Zero Emission Vehicle (ZEV) Demonstration Project

Phase I Report



Mendocino Council of Governments

Renewable Energy Revelopment Institute

Zero Emission Vehicle (ZEV) Demonstration Project - Phase I

1996/97 Overall Work Program - Work Element 15

Final Report

Prepared by

Renewable Energy Development Institute (REDI)
Consultant

Submitted to

Mendocino Council of Governments (MCOG)

October 15, 1997

Zero Emission Vehicle (ZEV) Demonstration Project - Phase I

1996/97 Overall Work Program - Work Element 15

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Submitted to

Mendocino Council of Governments (MCOG)

July 23, 1997

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Bibliography

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California Air Resources Board (CARB) Reports- *available on request*

- "Proposed Amendments to the Zero-Emission Vehicle Requirements for Passenger Cars and Light-Duty Trucks," 2/9/96
- "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," Amended 7/24/96

Zero Emission Vehicle (ZEV) Demonstration Project

Executive Summary

The ZEV Project is conducted by the Renewable Energy Development Institute (REDI), a charitable, nonprofit educational and scientific 501(c)(3) corporation in Willits, and the Mendocino Council of Governments (MCOG) is the lead agency.

This project is funded by MCOG, with in-kind contributions from REDI, Pacific Electric Vehicles, County of Mendocino Air Quality Management District, and Energy Conversion Devices, Inc.

Project Coordinator:	Janet Orth	MCOG / REDI	463-4470
Technical Consultant:	Bill Warf	Pacific Electric Vehicles, LLC	485-5799

Phase I, 1996/97: The purpose of this project is to conduct a feasibility study for the Zero Emission Vehicle (ZEV) Demonstration Project, Phase II. Phase One will focus on evaluating and comparing production ZEV's available on the consumer market, specifically for performance in the Mendocino County region. Study results are intended to provide a recommendation for Phase II.

Phase II, 1997/98: The second phase will test several commercial ZEVs entering the market, focusing on our rural setting. ZEVs, and possibly LEVs--Low Emission Vehicles--such as an electric/natural-gas hybrid if necessary to achieve goals, will be borrowed and/or leased and test driven in both regional commute and in-town modes. Goals of the project include:

- Participate in statewide clean-air strategies
- Evaluate practicality of ZEV/LEV use in rural transportation
- Collect data for future ZEV/LEV infrastructure planning
- Evaluate public response to ZEV/LEV Ride & Drive
- Demonstrate net metering by feeding photovoltaic remotely-generated electricity into the utility grid to offset ZEV energy use

- continued -

TASKS:
The following tasks were completed as a part of the Phase I project.

1. Develop route and scope of proposed Phase II

2. Evaluate commercial vehicles for use in Mendocino County

3. Research and evaluate infrastructure, chargers, and instrumentation

4. Develop documentation and reporting procedures

5. Conduct fundraising and research partnership opportunities

6. Provide outreach and education to the community

PRODUCTS:
The following work products have been produced and are incorporated in this report.

1. Recommendation on feasibility and application for Phase II

2. Identification of partners for a public-private partnership

3. Identification of funding for Phase II

- continued -

CONCLUSION:

Use of an electric vehicle (EV) for commuting and across-county travel is feasible in Mendocino County, especially utilizing advanced electric vehicles entering the market from General Motors, Honda, and Toyota. Other electric vehicles may have uses in towns and municipal fleets. It is to the County's advantage to begin to plan for and construct EV infrastructure, since it is likely that some EV's will be acquired and used in Mendocino County. The usefulness of EV's is enhanced by construction of charging stations throughout the county, such that more travel by EV's around the county is possible. Most EV's will require charging at both ends of a Willits to Ukiah or Fort Bragg to Willits commute to make the return trip. A few vehicles, such as the General Motors Impact, the Honda EV plus, and the Toyota RAV 4, are capable of the round trip, assuming little other travel is required in the same trip.

The 1996 National Electric Code includes a standard for Electric Vehicle Charging Stations, Article 625. In addition, Recommended Practices SAE J1772 and SAE J1773 provide guidelines. Since operators of EV's will need to charge it seems consistent with Public Saftey responsibilities to begin to plan for safe, code compliant charging infrastructure. In the absence of appropriate infrastructure, vehicles will likely be plugged in where ever a vehicle owner can find an outlet. This results in extensive use of extension cords or other temporary wiring provisions.

Use of an EV is significantly different from the use of a standard car, and routes chosen and speeds driven may differ from conventional internal combustion engined cars. For this reason we recommend that the project include operation of the project vehicle(s) by City and County personnel responsible for planning traffic, road use and maintenance, and charging infrastructure throughout the County. This diversifies the use of the vehicle(s) so that a broader understanding of how an EV might and might not be used in Mendocino County. Additionally, it provides these local government personnel with hands-on knowledge, which will be helpful in planning. Other planning considerations include the distribution of adequate power to areas where charging stations are or will be needed.

While Low Emission Vehicles (LEVs) or hybrid electric vehicles (HEVs), still prototypes, are showing promise in testing by original equipment manufacturers, especially Honda and Toyota, they are not yet readily available on the market. In addition, infrastructure planning issues are unknown. Consideration of vehicles for this project has been limited so far to EVs.

The balance of this report provides a description of the work accomplished for each of the tasks and work products. Since the MCOG board approved funding for Phase II contingent on guidance from a Technical Advisory Committee (TAC) subcommittee, plans for the Scope of Work and Schedule should be read as recommendations which need the concurrence of the project team to be assigned.

ADDENDUM

to

Zero Emission Vehicle (ZEV) Demonstration Project - Phase I

1996/97 Overall Work Program - Work Element 15

Draft Final Report of July 23, 1997

as part of the

Final Report

October 15, 1997

Zero Emission Vehicle (ZEV) Demonstration Project

Phase I

Addendum Summary

This addendum presents findings made after the Draft Final Report was submitted on July 23, 1997. These items were still pending at the time the report was due. The attachments are summarized below.

- Final quarterly report on October 15, 1997, with financial totals and a summary of in-kind contributions
- Letter from California Energy Commission announcing grant approval for Petroleum Violation Escrow Account funds
- Budget for ZEV Demonstration Project - Phase 2
- ZEV Technical Advisory Committee report to MCOG Board of Directors
- Timeline for Phase 2 project tasks
- Report by Stephen Heckeroth on performance of locally produced electric vehicles in Mendocino County
- Report on visit to Energy Conversion Devices, Inc. in Troy, Michigan, including tour of Ovonic Battery Company and GM/Ovonic facilities
- U.S. Department of Energy "Clean Cities" Program excerpts from "Guide to Alternative Fuel Vehicle Incentives & Laws" and "Clean Air Program - Summary Assessment of the Safety, Health, Environmental and System Risks of Alternative Fuel"

Date Submitted: October 15, 1997
Agency: MCOG Administration

1996/97 OVERALL WORK PROGRAM FINAL REPORT

WORK ELEMENT: **WE15 - Zero Emission Vehicle (ZEV) Demonstration Project - Phase I**

PURPOSE: To conduct a feasibility study for ZEV Demonstration Project, Phase II.

PROGRESS:

Task 1 - Route and scope	Complete
Task 2 - Evaluation of vehicles	Complete
Task 3 - Research and evaluate infrastructure, etc.	Complete
Task 4 - Reporting procedures	Completed plan
Task 5 - Fundraising, partners	Completed
Task 6 - Education, outreach	Completed plan

PRODUCT EXPECTED:

1. Recommendation on feasibility and application for Phase II
2. Identification of partners for Phase II
3. Identification of funding for Phase II

PROBLEMS: None

OUTLOOK / STATUS:

Remaining work was completed in August. The PVEA grant application was approved by the State Legislature and the parent bill signed by the Governor in October. Janet's trip to Troy, Michigan, in August, courtesy of Energy Conversion Devices, Inc., resulted in research findings and an oral agreement to explore funding and in-kind assistance; staff will be following up. The Ukiah City Council, at their July 16 meeting, donated $1,000 for a charging station. Further involvement of the County and Cities is assumed, based on approval of the project implementation plan refined by the TAC subcommittee. A project team of participants from each MCOG jurisdiction is being developed. PG&E funding is anticipated and is being pursued.

The Draft Final Report was completed July 23 (in time for the TAC meeting) and distributed. The Final Report is now complete. The project was successfully completed under budget. All direct costs were claimed, but less in-kind contributions of time were needed than originally estimated. Phase II is underway.

FUNDS CLAIMED:	MCOG / Fundor	Claimant / Match	Total
Total Project	$ 5,500	$ 11,500	$ 17,000
Claimed 4th Quarter	$ 2,055	$ 5,194	$ 7,249
Total Claimed	$ 5,500	$ 8,750	$ 14,250
Balance to be claimed	$ -0-	$ -0-	$ -0-

Funding sources include:	MCOG	Claimant
	Local Transportation Fund	Local match
	State Planning Assistance	25% OWP penalty
	Federal grants	Federal grants
	STP d(1) funds	Other

1996/97 OVERALL WORK PROGRAM FINAL REPORT

WE15 - Zero Emission Vehicle (ZEV) Demonstration Project - Phase I

SUMMARY OF IN-KIND CONTRIBUTIONS:

Mendocino Council of Governments - Staff time		3,364
Renewable Energy Development Institute - Directors' time, staff & overhead, materials		2,876
Pacific Electric Vehicles	- Donated time	1,435
Energy Conversion Devices, Inc.	- Donated travel	750
Air Quality Management District	- Staff time	175
Hiatt Consulting Services	- Staff time	150
	TOTAL	**8,750**

Prep. by J. Orth

RECEIVED DEC 1 - 1997

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

CALIFORNIA ENERGY COMMISSION
WILLIAM J. KEESE, CHAIRMAN
1516 NINTH STREET — MS 32
SACRAMENTO, CA 95814-5512
Telephone (916) 654-5000
Telefax (916) 654-4420

December 1, 1997

Ms. Janet Orth, Administrative Officer
Mendocino Council of Governments
215 West Standley Street, Suite 6
Ukiah, CA 95482

Dear Ms. Orth:

Congratulations on getting an appropriation of $20,000 from the Petroleum Violation Escrow Account (PVEA) for your energy-saving project, a zero-emission vehicle demonstration project. The appropriation is contained in Chapter 659, Statutes of 1997 (SB 368, Peace) which was signed recently by Governor Wilson and will be effective January 1, 1998. Your state legislator, Senator Mike Thompson, was instrumental in securing this appropriation for you.

Please keep in mind that all project proposals must be approved by the federal Department of Energy prior to commencement of your project. In addition, state law requires execution of an agreement between the California Energy Commission and the recipient of the appropriation before the funds can be released. The enclosures in this letter provide you with information on procedures and schedules in the hope of making the allocation process as smooth and efficient as possible.

Lisa Johnson and Susan Aronhalt of our Grants and Loans Office will be coordinating and processing the appropriations allocated by Chapter 659/97 through the Commission. Questions regarding administrative, eligibility and procedural issues should be directed to them by calling (916) 654-4276, or (916) 654-4204, respectively. Questions regarding policy issues and the PVEA legislative process should be addressed to Nick Bartsch in the Commission's Executive Office at (916) 654-4701.

Sincerely,

William J. Keese

WILLIAM J. KEESE
Chairman

Enclosures

cc: The Honorable Mike Thompson, Senator, 2nd District
Lisa Johnson, Grants and Loans Office, CEC
Ken Koyama, Technical Manager, CEC
Office of Governmental Affairs, CEC

Zero Emission Vehicle (ZEV)
Demonstration Project
Budget

Phase 2

Category	Description	MCOG	PVEA	TOTAL
Technical Support and Hardware				
Vehicles	leases, insurance, registration, taxes and transportation	0	10,000	10,000
Instrumentation	equipment rental, monitoring, labor	0	1,000	1,000
Charging Equipment	hardware and installation	0	6,000	6,000
Technical Consultant	maintenance, oversight, reporting, direct cost	4,000	3,000	7,000
Photovoltaic Charging	mounting, wiring, direct cost	1,000	0	1,000
	Total Technical Support and Hardware	**5,000**	**20,000**	**25,000**
Administration				
Outreach & Education	consultants, videotaping, printing, displays, etc.	4,000	0	4,000
Administration & Documentation	contractors, direct cost	6,000	0	6,000
	Total Administration	**10,000**	**0**	**10,000**
	Total Grants	**15,000**	**20,000**	**35,000**
	In-kind Contributions (est.)			**10,000**
	Total Project Budget			**45,000**

MENDOCINO COUNTY
Air Quality Management District

MEMORANDUM

DATE: September 26, 1997

TO: MCOG Board

FROM: Walt Allen, ZEV Advisory Committee Chair

SUBJECT: Summary of ZEV Advisory Committee Meetings

At the direction of the MCOG Board, an Advisory Committee was formed to review the Zero Emission Vehicle (ZEV) Project, and give direction on a number of topics about which the MCOG Board expressed concern. The committee members are Steve Turner, MTA; Rick Kennedy, City of Ukiah; and Walt Allen, Air Quality Management District. Janet Orth, REDI, and Bill Warf, Pacific Electric Vehicles, are the consultants.

The committee met twice in September and has reported the results to the MCOG Technical Advisory Committee (TAC). The committee discussed following areas of concern.

1. **Policy for Vehicle Use by Individuals and Agencies**. The study will solicit participation from four groups of trial users: decision-makers, planners, fleet providers, and engineers with responsibility for infrastructure development. TAC members were asked to provide names of possible ZEV users. The committee would approve a list of proposed users based on their ability to report their experience in various commutes under varied terrain. Users would test drive the ZEV for a one or two week period, and would provide a user's report after their test period ended. Members of the public would have a chance to see the vehicle and ride along with approved drivers at public "Drive and Ride" events. Legal Counsel will be consulted regarding the issue of Conflict of Interest.

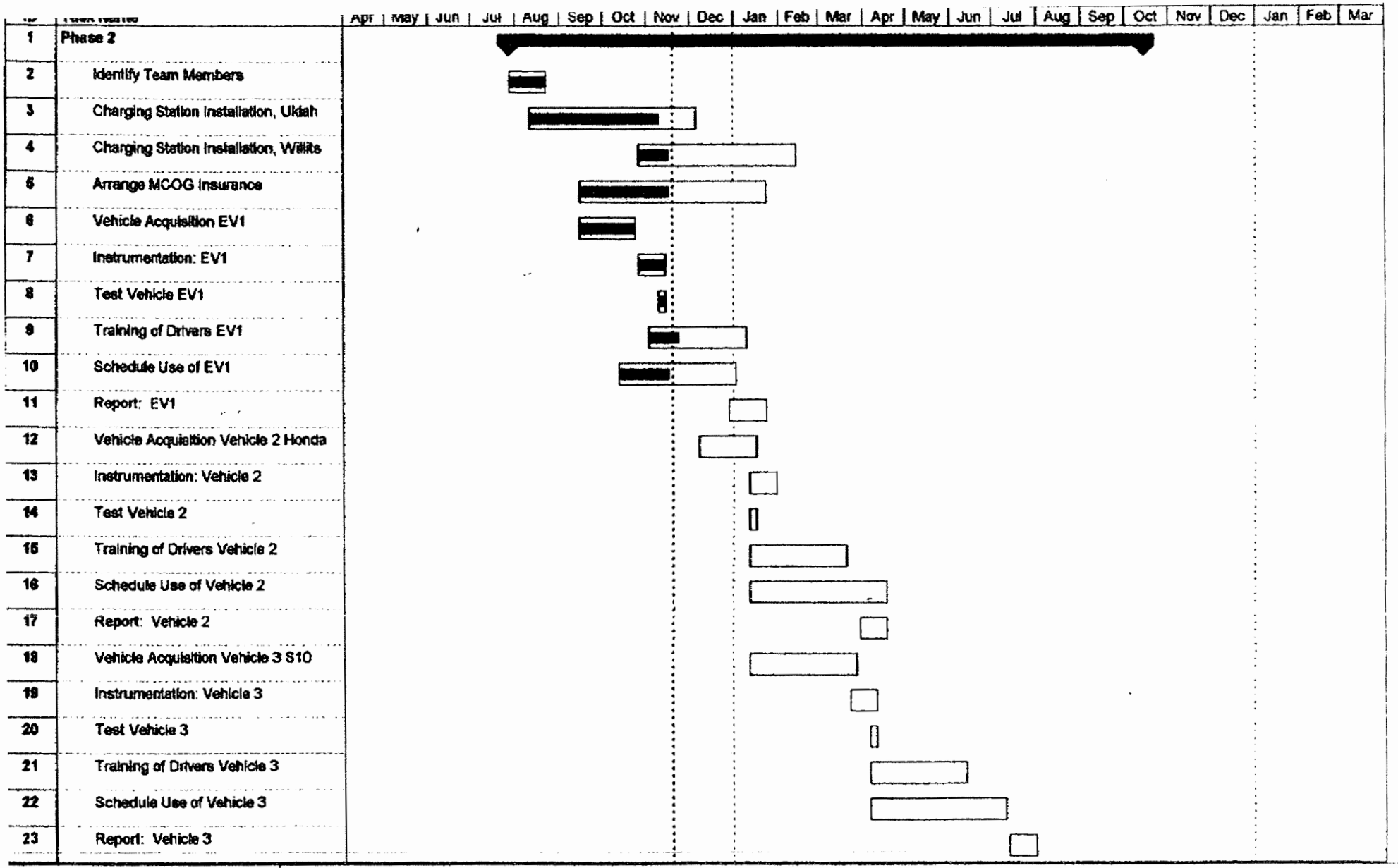
2. **Local Economic Development**. As with any new technology, the trial use of the ZEV will stimulate local business interest in this area. Contractors will be hired to install charging stations. Small businesses will spring up to provide service and maintenance to the increasing number of ZEV's. Following the front page article on electric vehicles in the Ukiah Daily Journal on September 11, a letter to the editor by Mark Winkler of Real Goods states that a growing electric vehicle industry could become an important tourist attraction in Mendocino County. Also, environmental technology companies could locate in Mendocino County, based on the expansion of other innovative programs.

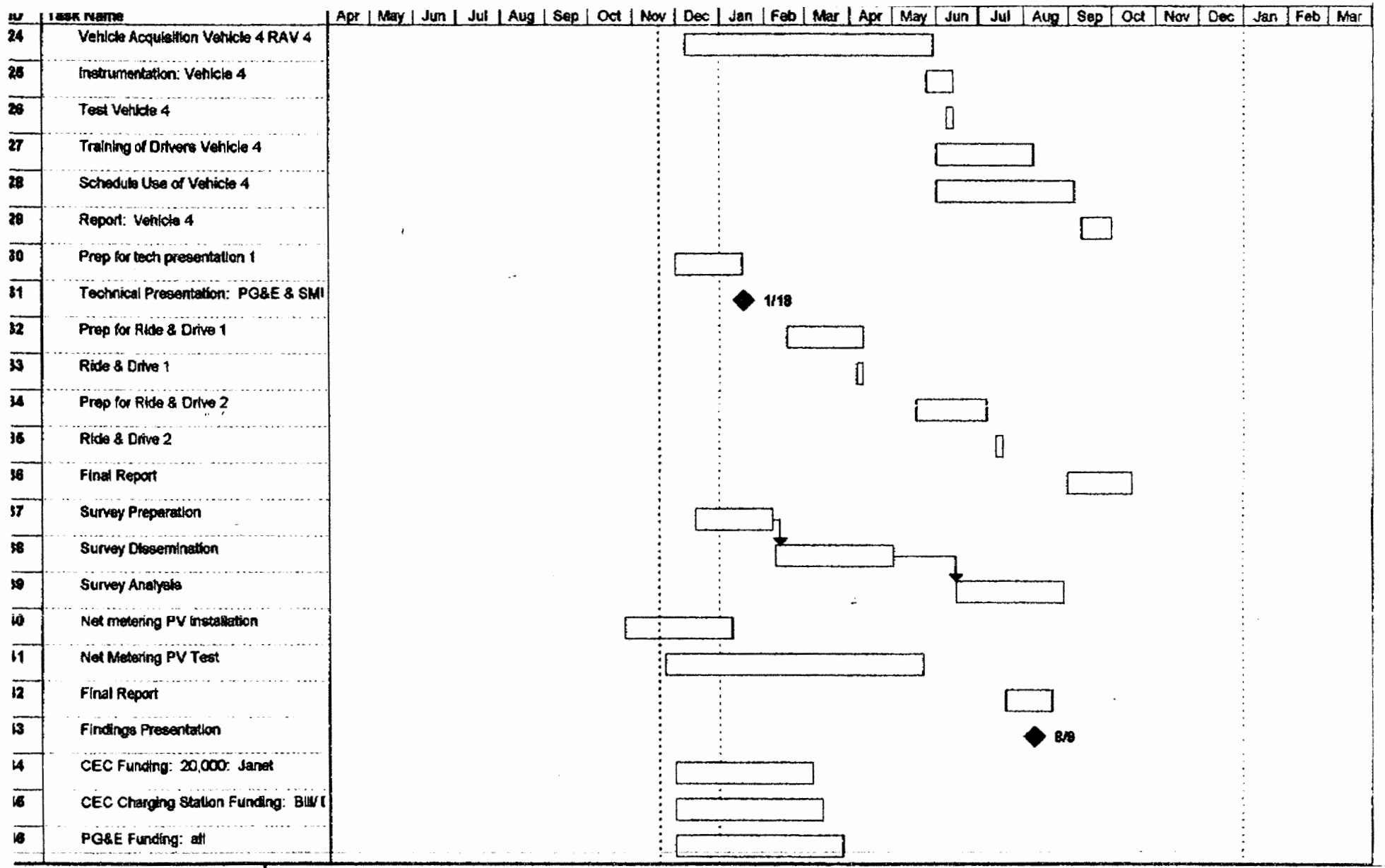
3. **Planning for Infrastructure**. An essential goal of the project is to put the ZEV's in the hands of people who need to plan for future electric vehicle use. By experiencing the need for charging stations, these users will be able to report back to the consultant, and the results can be included in the final project report. The consultant will also work with PG&E and the cities of Ukiah and Willits on the installation of public charging stations. The final report will include recommendations for infrastructure development.

4. **No Duplication of Other Studies**. By concentrating on local issues and local solutions, this report will be unique to this area. Additionally, the consultant will provide extensive publicity on this project, which will result in a local emphasis and interest. The consultant knows of no other ZEV project in a rural area. Already, other agencies and companies outside this area have expressed interest in this report.

The committee will continue to meet with the consultant throughout the project to provide assistance to the consultant and to insure that the project meets its goals. The consultant expects the first ZEV Project test vehicle to arrive in October.

WA/C:/PLANNING/MCOG/COG/ZEVSUM1


Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar
1 Phase 2
2 Identify Team Members
3 Charging Station Installation, Ukiah
4 Charging Station Installation, Willits
5 Arrange MCOG Insurance
6 Vehicle Acquisition EV1
7 Instrumentation: EV1
8 Test Vehicle EV1
9 Training of Drivers EV1
10 Schedule Use of EV1
11 Report: EV1
12 Vehicle Acquisition Vehicle 2 Honda
13 Instrumentation: Vehicle 2
14 Test Vehicle 2
15 Training of Drivers Vehicle 2
16 Schedule Use of Vehicle 2
17 Report: Vehicle 2
18 Vehicle Acquisition Vehicle 3 S10
19 Instrumentation: Vehicle 3
20 Test Vehicle 3
21 Training of Drivers Vehicle 3
22 Schedule Use of Vehicle 3
23 Report: Vehicle 3
Project:
Date: 11/19/97
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress



oject:
te: 11/19/97

TOTAL P.03

Report on Performance of Stephen Heckeroth's Electric Vehicles in Mendocino County

by
Stephen Heckeroth
Member, County of Mendocino Planning Commission
Owner, MendoMotive and Homestead Enterprises



Heading home on the Navarro Ridge in an electric Volkswagon Type 34 Karman Ghia



Charging at the County Administration Building during a Planning Commission meeting

The 1963 Electric Type 34 Karman Ghia

Introduction

The 1990 California Zero Emission Mandate fueled an electric vehicle Rennaisance. My company, MendoMotive, came into being as a result of the prospect of mandated electric car sales in 1998. The company converted one Pontiac Fiero, one Volkswagen Vanagon, one Volkswagen Type 34 Karman Ghia, and produced 4 electric Porsche Spyders, between 1992 and 1994. All the cars used off-the-shelf, inexpensive DC technology. Sales projections were good for 1995 but that year the auto industry and the oil companies spent $30 million to turn public opinion against electric vehicles and push back the Mandate to 2003. MendoMotive went out of business but the cars produced are still on the road. This report focuses on the Karman Ghia which is used daily by the Heckeroth family.

Car Specifications

The 1963 Type 34 Ghia is equipped with 24 6 Volt flooded, lead-acid golf cart batteries ($960); a 20 hp advanced DC motor ($1,200); a 144 V DC output, 110 AC input Zivan charger from Italy ($700); a 400 amp Zapi controller with regenerative braking from Italy ($1,200); an analog amp meter ($35); and a digital amp hour meter that acts as a gas gauge ($200).

Performance

The electric Ghia can produce 60 hp for acceleration and hill climbing which is more power than the original gas version. The battery pack is rated at 150 amp hours when used in a two-hour period. The range with the regenerative braking and careful driving is 75 miles. It takes 8 hours for a full recharge from any 20 amp 110V outlet. So the daily mile range can be increased to 150 miles by charging at the destination, i.e. work.

In the 6 years, the family has been driving the car, no battery replacement has been necessary and there has been no incident of inconvenience due to the electric conversion.

Solar Charging

The electricity for the Heckeroth homestead is generated by a 3 kW photovoltaic array mounted on the barn roof. It satisfies all the electrical needs for the home and a barn loft apartment throughout the year. During the summer there is enough excess power to charge the Ghia. In the winter, the car is charged currently off the utility grid. But with the installation of micro-hydro, all charging needs will be met from renewable sources throughout the year.

Driving experience

I lead full-day workshops on electric cars and solar design at the Real Goods Solar Living Center in Hopland. On those occasions I use the Ghia for the 150 mile round trip, and by charging at home from the photovoltaic array and then charging during the 8-hour workshop from the solar array at the Real Goods site, I am able to rely entirely on renewable, non-polluting energy for my transportation.

I am a member of the Mendocino County Planning Commission which meets twice a month in Ukiah. The 66-mile trip includes 6% grades and elevation changes from sea level to 3,000 feet. On the level stretches the car performs just like any gas car at 45 mph to 60 mph, even passing RVs and slower trucks. On hills, I drive conservatively, much like I would a loaded truck, at 15 mph to 35 mph. When I reach the top of the Hwy. 253 grade between Boonville and Ukiah, the batteries are very depleted but going down into the valley, the two-stage regenerative braking recharges the batteries enough to complete the trip.
Finding an outside plug at teh County offices was a challenge at first but now I have my own plug with a handy parking space. I look forward to the day when solar charging stations are available.

----- Steve Heckeroth

The Ghia is our car of choice for local trips. It allows us to run errands and go to job sites without producing air pollution or using non-renewable resources. We frequently take it to Fort Bragg (45 miles round trip) and Mendocino (30 miles round trip). During the tourist season because of the vintage of the electric car it often turns into a conversation piece with passers-by about the benefits of electric propulsion.
I have never gotten stuck anywhere because of low battery charge, and always stay with the traffic flow.

----- Christiane Heckeroth

Conclusion

Driving the electric Karman Ghia has never created a problem for anyone of us. Since the car will not allow frequent consecutive trips to town, we do a little bit more planning around our errands and appointments to reduce the amount of trips to town. This has proven to be a benefit rather than an impediment since it results in better time management. It also shows that an electric car can become the primary vehicle for households whose commuting distance is within its range.

ZEV Project - Phase I

Task 5 - Fundraising and Partnerships

Report on 8/7/97 Visit to Energy Conversion Devices, Inc. in Troy, Michigan
by Janet Orth

Background:

I was invited by Mr. Stanford Ovshinsky, President & CEO of Energy Conversion Devices, Inc. (ECD), to visit his factories in Troy, Michigan, just outside of Detroit, as his guest (the company paid for my travel and lodging). I went primarily for purposes of research on the ZEV Project, to see their advanced battery production for electric cars, scooters and motorized bicycles.

ECD, formed by Ovshinsky and his wife in 1960, has numerous subsidiary companies and joint ventures around the world, and holds over 1,000 patents. Mr. Ovshinsky invented the technology that he now is applying to a variety of products, based on molecular "amorphous semi-conductor devices."

One significant product is "the green battery" for electric vehicles, so named for its nontoxicity, recylability, long life, and environmentally benign green-colored metal alloy powder. This battery is also significant for the greatly increased mileage between charges that it brings to electric cars. It already has a 40% market share of small batteries for computers, cameras, etc. ECD received the first grant from the U.S. Advanced Battery Consortium, at $30 million over the past several years, to develop this technology.

This battery technology, made of nickel metal hydride (NiMH - hydrogen energy stored in metal), is still very expensive but is making the transition to higher production, and is ahead of most other advanced battery technologies for electric cars. Eventually it will become more affordable; meanwhile it is subsidized in EV's by the manufacturers. ECD has licensed the technology to Honda, and Matsushita is producing it for the Honda EV Plus and Toyota RAV4, with Japan helping subsidize the cars' cost. Installed in Solectria EV's, Ovonic's batteries have taken top honors at every American Tour de Sol electric vehicle championship for nine years running, reaching a range of 373 miles on a single charge. They are claiming 100 miles or so on a charge in the production vehicles made for the mass consumer market.

ECD's other amorphous semi-conductor products include thin-film solar-electric roof tiles and high-capacity rewritable computer memory storage disks. During my visit, I was introduced to all the major aspects of their diverse business ventures.

Highlights:

- I received personal guided tours through four plants:

  - United Solar Systems Corp. (Uni-Solar), which manufactures thin-film solar collectors,

  - ECD's Manufacturing Technology Division, which designs and engineers the machines to enable manufacturing of their concepts, in other words, technology transfer,

  - Ovonic Battery Company, an ECD subsidiary, which is developing the NiMH "green battery" at an essentially handmade level, where I drove a Solectria EV, and

  - GM/Ovonic, a joint venture with General Motors, which is ramping up the battery manufacturing process to mass production levels, with stringent quality controls for uniform performance.

- I had a lunch meeting in ECD's conference room with:

  - Mr. Ovshinsky
  - His wife Iris Ovshinsky, Ph.D. scientist
  - Former General Motors Chairman Robert Stempel, now ECD's Chairman of the Board
  - and Stephen Hudgens, Ph.D., ECD's Vice President of Research & Development.

- Mr. Hudgens escorted me throughout the day and engaged me in discussions before and after the tours. The day concluded with a presentation of ECD's work in information technology (computer storage devices) and further discussion with Mr. Hudgens. I came home with various ECD product literature and press kits.

- I later had dinner with Mr. & Mrs. Ovshinsky, and we discussed long-term fundraising possibilities through their network of associates.

Discussion and Outcome:

- *Clean Cities Program* - Mr. Stempel suggested that our ZEV Report include research already done by this U.S. Department of Energy (DOE) program on safety standards and emergency reponse training for electric vehicle use.

- *California's ZEV Mandate* - At the recent California Air Resources Board (CARB) hearing, ECD gave "ride & drives" in electric cars with Ovonic batteries for legislators in the Capitol, to make the point that California's ZEV Mandate is technically feasible. At the same hearing, the major auto manufacturers' executives testified against feasibility. ECD maintains that California has the ideal conditions for use of zero-emission vehicles.

- *MCOG's ZEV Project* - My lunch hosts at ECD were very impressed with the ZEV Draft Final Report, which I brought along. They had not seen anything similar to date, and asked to keep my copy. They were somewhat familiar with the work of the Renewable Energy Development Institute (REDI), the ZEV Project administrator, and were quite interested in all I had to say. They believe REDI is going in the right direction in working with MCOG on transportation planning and infrastructure for the new generation of vehicles. They asked me how they could help.

  I persisted in my original request that ECD help to secure a GM EV1 car outfitted with Ovonic batteries, for loan or lease by our ZEV Project. My reasoning is that this car is state-of-the-art, but so far has been offered only with the old lead-acid battery technology, thereby limiting its performance. With an Ovonic battery pack, which GM plans to install in EV1s within a few months, performance should be more than equal to the demands of Mendocino County's rugged terrain. While the EV1 is a production-line vehicle, GM's marketing is limited to Saturn dealerships in selected cities, making it unavailable for our demonstration. Through GM/Ovonic, however, we might have access to this initially exclusive car for planning purposes. An agreement could set up Saturn of Santa Rosa as the delivery point and service provider.

  The ECD executives' reply was that they are attempting to secure from GM several of the EV1s for their company's use, which could occur in the next few months. Mr. Ovshinsky promised to try to get one released for us at the same time. He asked me to make the request in writing, which I have done.

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Clean Cities

Guide to Alternative Fuel Vehicle Incentives & Laws

2nd Edition November 1996

Alternative Fuel Information

U.S. Department of Energy



Taking an alternative route

ALTERNATIVE FUEL VEHICLE INCENTIVES AND LAWS

Why alternative fuels?

Nowhere else in the world is the value of the automobile and the importance of transportation more recognized than it is right here in the United States. The transportation sector has an enormous impact on our economy, our nation's energy security, and our environment. Every year we increase our dependence on imported oil - - which increases the trade deficit, costs us jobs, and undermines our national security. Moreover, emissions from vehicles are the single largest contributor to air pollution in many cities - - making our air unhealthy to breathe and increasing our health care costs. We can change this situation. Expanding utilization of alternative fuels offers solutions to many of these problems. The plan to find these solutions is Clean Cities.

What is Clean Cities?

Clean Cities is a *locally-based* government/industry partnership, coordinated by the U.S. Department of Energy (DOE) to expand the use of alternatives to gasoline and diesel fuel. By combining local decision-making with voluntary action by *partners*, the "grass-roots" approach of Clean Cities departs from traditional "top-down" federal programs. It creates an effective plan, carried out at the local level, for creating a sustainable, nationwide alternative fuels market.

How does Clean Cities work?

Clean Cities builds on local initiative, provides options to local problems, and creates partnerships as the mechanism to develop solutions. Clean Cities works directly with local businesses and governments to shepherd them through the goal-setting, coalition-building, and commitments process necessary to establish the foundations for a viable alternative fuels market. Then, by sharing local innovation along the Clean Cities network "mayor-to-mayor," by relating local problems to state and federal objectives, and by providing continuous feedback to the 2,000 industry and government stakeholders, Clean Cities can continually pioneer innovations and aspire to effect national as well as local achievements. DOE will be working with Clean Cities coalitions nationwide to:

- **Create new jobs and commercial opportunities** - Alternative fuels and alternative fuel vehicles (AFVs) can benefit the economy in many ways. Converting conventional vehicles to AFVs, developing new technologies and products, utilizing domestically-produced alternative fuels, increasing crop (feedstock) production, and expanding alternative fuel infrastructure create commercial opportunities, new jobs, and businesses nationwide.

- **Facilitate alternative fuel vehicle production and conversion** - By pledging AFV acquisitions through the year 2005, the 2,000 registered Clean Cities stakeholders have shown that significant demand exists for these vehicles. Clean Cities will work to transform these pledges into validated vehicle acquisition and conversion plans useful to manufacturers challenged to develop market-driven production lines.

- **Advance Clean Air objectives** - The Clean Cities Program will advance the objectives of the Clean Air Act and seek to integrate its 1990 Amendments into each Clean City coalition's decision-making process.

- **Increase public awareness** - Clean Cities will pursue an active public education campaign to ensure that citizens are aware of the benefits of using alternative fuels over gasoline and diesel.

- **Provide greater fuel choices** - The variety of fuel choices has enabled Clean Cities to choose the alternative fuels that best serve their local community and economy. This choice gives the community an opportunity to utilize the fuels which provide them with the best fuel performance, reduced emissions, and financial incentives.

- **Develop "Clean Corridors"** - Clean Cities recognizes the need for "clean corridors" and will build links between existing Clean Cities to ensure that refueling facilities will be available for regional transit.

How does Clean Cities work? (cont.)

- **Expand refueling infrastructure** - Concurrent with Clean Cities expansion of the AFV market, the program will build on fuel supplier commitments to provide the refueling infrastructure critical for service and maintenance of AFVs. In addition, the program will seek to make available existing private refueling stations for wider use.

- **Support regulated fleets** - Through the Clean Cities Program, DOE will be able to provide local assistance to Federal and state requirements for AFV acquisitions and conversions.

Where do I get more information?

The Clean Cities Hotline (toll-free (800) CCITIES) provides answers to questions on funding, alternative fuel and AFV questions, program planning, and other program issues. The Hotline also makes available several resources for Clean Cities use, including the following publications:

- *The Road to Clean Cities* provides cities with step-by-step instructions on how to become a Clean City.

- *Clean Cities Troubleshooting Guide* offers helpful suggestions on solving the challenges Clean Cities may face.

- Clean Cities newsletter, *The Drive*, provides cities with quarterly updates on the Clean Cities Program.

DOE has also appointed Clean Cities Program managers at each of the DOE Regional Support Offices to assist local Clean Cities with their alternative fuels market development. In addition, the vast network of local Clean Cities coordinators is available to share information and provide assistance. The names and phone numbers of the Clean Cities coordinators and the Clean Cities Program managers at the DOE Regional Support Offices are listed in this document, under the appropriate state's Points of Contact section.

To obtain more information, contact the Clean Cities Hotline at (800) CCITIES, or write to: U.S. Department of Energy, EE-34, Clean Cities Program, 1000 Independence Avenue SW, Washington, DC 20585. Visit the Clean Cities Home Page on the Internet. The Clean Cities Home Page can be accessed at:

- http://www.ccities.doe.gov

Clean Cities

Throughout this guide, states with one or more designated Clean Cities are indicated by this Clean Cities symbol.

Cities that have coalitions working toward designation are listed under the appropriate state as Future Clean Cities.

CALIFORNIA ALTERNATIVE FUEL VEHICLE INCENTIVES AND LAWS

California is the proud home of eleven Clean Cities:

Coachella Valley	San Diego
Lancaster	San Francisco
Long Beach	San Joaquin Valley
Oakland	South Bay (San Jose)
Los Angeles	Southern California Association
Sacramento	of Governments (SCAG)

Overview

California has a wide variety of incentives for alternative fuel vehicles (AFVs). The California Energy Commission (CEC) offers incentives of $1,000 for certified low emission vehicles (LEVs), and $1,500 for certified ultra-low emission vehicles (ULEVs). Air Pollution Control Districts in California that have not attained State and Federal air quality standards may collect an annual surcharge of up to $4 per vehicle as part of the California Department of Motor Vehicles registration fee. These funds are used for projects related to reducing pollution from motor vehicles, including AFV programs and incentives.

Highlights

- $ The CEC has incentives of $1,000 for natural gas vehicles (NGVs) that have been certified LEVs; $1,500 for certified ULEVs.
- $ Up to $5,000 for the incremental cost of a zero emission vehicle (ZEV) for fleets located in designated Clean Cities.
- $ $5,000 incentive for purchase of a qualified electric vehicle (EV) from the South Coast Air Quality Management District (SCAQMD) and from the San Diego Air Pollution Control District.
- $ $200 - $800 incentives from the Sacramento Metropolitan Air Quality Management District for AFVs operating 75% of the time in the Sacramento air district.
- $ $1,000 incentive from the San Diego Air Pollution Control District for dedicated NGVs or certified LEV conversions through December 1996.

State Incentives

$ The CEC offers a $1,000 incentive for NGVs that have been certified as LEVs, while a $1,500 incentive is available for certified ULEVs. Incentives are not offered to utilities and Federal government agencies. The incentives are in the form of cash rebates which are distributed by 3 of the California utilities: Southern California Gas Company, Pacific Gas and Electric, and San Diego Gas & Electric. Contact Susan Patterson at (916) 654-4992 for more information about the cash incentives. You can also contact the CEC Transportation Technology and Fuels Office at (916) 654-4634.

$ The CEC, through a pilot grant from the U.S. Department of Energy, will fund a portion of the incremental cost of 40 ZEVs for fleets located in designated Clean Cities. A maximum of $5,000 will be available per vehicle. Contact Susan Patterson at (916) 654-4992 for additional information.

$ The Quick-Charge program of the SCAQMD offers a $5,000 incentive for the purchase of pre-qualified EVs in the 1996 and 1997 model years. The rebate applies only to EVs sold and operated in the SCAQMD. The program has $6 million available on a first-come first-served basis. Charging facilities are currently being implemented under the Community Corridor Program, which is funded at $1.8 million. For additional information, contact Ray Gorski at (909) 396-2479.

State Incentives (cont.)

- The SCAQMD also administers the Air Quality Investment Program (AQIP) that funds proposals for improving air quality, including AFV projects. The program is administered quarterly. Contact Connie Day at (909) 396-3055 for more information on the current request for proposals (RFP).

- The Sacramento Metropolitan Air Quality Management District offers $200 of M85 (85% methanol) free to public and private owners of flexible fuel vehicles (FFVs) that operate 75% of the time in the Sacramento air district. The Sacramento air district offers incentives of $200 - $800 for certified LEV alternative fuel light- and medium-duty vehicles operating 75% of the time in Sacramento County. The amount of the incentive is based on the exhaust emission category of the vehicle. A total of $100,000 is available on a first-come first-served basis. The program will end when the funding is depleted. Money is also available for incentives for heavy-duty LEVs. Call Tim Taylor at (916) 386-7042 for more information.

- The San Diego Air Pollution Control District (APCD) offers a $1,000 incentive for factory-produced dedicated NGVs or certified LEV conversions through December 1996. A total of $500,000 is available on a first-come first-served basis. The program is administered by San Diego Gas & Electric. For more information, call Kim Cresencia at (619) 654-1107.

- The San Diego APCD offers a $5,000 incentive for the purchase of a qualified EV. A total of $100,000 is available on a first-come, first-served basis. For more information, contact Morris Dye at (619) 654-3303.

Air Pollution Control Districts (APCDs) in California that have not attained State and Federal air quality standards may collect an annual surcharge of up to $4 per vehicle as part of the California Department of Motor Vehicles registration fee. These funds are used for projects related to reducing pollution from motor vehicles. Each APCD runs its own program and has a different funding level. Total funding for the entire state is around $8 million per year. Funds are available to local governments, government agencies, private industry, and research institutions, with a preference for partnerships and coalitions. Most APCDs have formal Request for Proposals (RFPs) at specific times during the year.

Contact your local APCD to request information about its specific program. Ask the APCD to put your name on its mailing list to receive meeting notices, program announcements, and RFPs.

Air Pollution Control District	Contact Person	Phone Number
Bay Area Air Quality Management District	Mark Kragen	(415) 749-4643
Imperial County APCD	Miguel Monroy	(619) 339-4314
Kern County APCD	Tom Paxson	(805) 861-2593
Mojave Desert Air Quality Management District	Eldon Heaston	(619) 245-1661
Sacramento AQMD	Tim Taylor	(916) 386-7042
San Diego APCD	Morris Dye	(619) 654-3303
San Joaquin Valley Unified APCD	Jeff Findley/John Villeneuve	(209) 497-1075
San Luis Obispo County APCD	Larry Allen	(805) 781-4247
Santa Barbara County APCD	Mahesh Talwar	(805) 961-8922
South Coast Air Quality Management District	Cindy Sullivan	(909) 396-3249
Ventura County APCD	Scott Johnson	(805) 645-1491
	Barbara Page	(805) 645-1415
Yolo-Solano AQMD	Andrew F. Nantz	(916) 757-3670

Utilities/Private Incentives

Los Angeles Department of Water and Power (LADWP) offers an EV discount of 2.5¢/kilowatt hour (kWh) of electricity. The discount is available for a maximum of 500 kWh per month limited to the Base Period Rate (off-peak hours). LADWP has proposed additional incentives for installing EV charging equipment. LADWP also provides EV infrastructure services to help customers determine applications for EVs in fleet operations, EV maintenance services, and training. For additional information, call LADWP's Electric Transportation Hotline at (800) 552-2334.

Pacific Gas and Electric (PG&E) has an extensive program to educate its customers on the safe and efficient use of natural gas and electricity as vehicle fuels. For information on NGV Programs, contact Joe Garcia at (415) 973-4162. Contact Kent Harris at (415) 973-6981 for more information on EV programs. PG&E also offers a publication listing NGV refueling sites entitled, "Quick Reference Guide for Fueling Stations." Call PG&E's alternative fuels hotline at (800) 684-4648 for a copy of the publication for additional information on alternative fuels.

San Diego Gas and Electric administers the NGV incentive program for the San Diego APCD and offers a special discounted rate of electricity used to charge EVs. For more information contact Risa Barron at (619) 654-1108.

Sacramento Municipal Utility District (SMUD) has a discounted off-peak rate of 4.187¢/kilowatt hour (kWh) for electricity used to charge an EV for residential customers. The SMUD also has lower off-peak electricity rates for EV charging for commercial customers. Contact Mike Wirsch at (916) 452-3211 for more information.

Southern California Edison has a special time of use rate for customers who install a meter to charge EVs during off-peak hours. Two residential time of use rates and one commercial time of use rate are available. For additional information, contact Coleen Tessema at (818) 302-8715.

Southern California Gas Company offers assistance to fleet operators wishing to purchase and/or convert to NGVs. Southern California Gas Company produces a directory of financial assistance available in California in the "Clean Fuel Vehicle Funding Opportunities" document. A copy of the publication, or the latest financial assistance information, can be obtained by calling the NGV Hotline at (800) GAS-2000, or contact Rick Price at (213) 244-3679.

Laws & Regulations

Purchases of compressed natural gas (CNG) and liquefied petroleum gas (LPG) as vehicle fuels are taxed by an annual flat sticker tax.

Excise taxes on alcohol fuels, ethanol (E85) and methanol (M85), are reduced to one-half the rate imposed on gasoline, because of their lower BTU content. Legislation adopted in 1993 eliminated the expiration date for this incentive. Neat (100%) alcohol fuels are exempt from fuel taxes. The tax for gasoline is 17¢/gallon.

In 1991, California adopted vehicle and fuels requirements, as well as a "reactivity protocol" for various clean fuels. The plan, amended in March 1996, establishes exhaust emission standards in four progressively more stringent categories:

- Transitional Low-Emission Vehicles (TLEVs)
- Low-Emission Vehicles (LEVs)
- Ultra-Low-Emission Vehicles (ULEVs)
- Zero-Emission Vehicles (ZEVs).

The California Air Resources Board (CARB) originally required that, beginning in 1998, 2% of all vehicles sold by major automakers must be ZEVs. By 2003, 10% of sales must be ZEVs. On March 23, 1996, CARB suspended the 2% requirement for the years 1998-2002.

State law authorizes local governments to assess emission fees to fund vehicle demonstration programs.

Laws & Regulations (cont.)

1990 legislation allows districts in nonattainment areas to require public and private fleet operators to purchase LEVs and operate them on clean fuels. All passenger vehicles for hire in nonattainment areas are required to use alternative fuels. The state is required to purchase 25% AFVs as it replaces fleet vehicles.

1991 legislation provides that ownership or operation of a facility selling retail natural gas for motor fuel use to the public is not to be construed as a public utility.

The California Public Utilities Commission is charged with encouraging the state's utilities to develop substantial market penetration of CNG and electric fueled vehicles.

Under law, the Public Utilities Commission may establish special incentive tariffs for refueling electric or CNG vehicles.

A law requests that CARB establish a 40¢/gallon production incentive for liquid fuel fermented in California from biomass resources. However, no funds have ever been appropriated for this incentive.

The CEC has developed the Calfuels Plan, a consumer recharging and refueling infrastructure master plan. As part of this plan, CEC has released a resource guide for AFV infrastructure. Contact Heather Raitt at (916) 654-4735 for a copy.

An Executive Order (W-100-94) increases the percentage of AFVs in state fleets to match those in Federal fleets. The schedule is as follows:

1996	25%
1997	33%
1998	50%
1999	75%

The Executive Order also calls for at least 10% of state fleet purchases to include ULEVs and ZEVs in 1996 and beyond.

Alternative fuel buses will be used as feeder buses between rail passenger services and airports whenever possible.

Fleets of 15 or more vehicles under a single owner in the SCAQMD are required to purchase or replace vehicles with ones that operate on clean-burning fuel. Vehicles must be original equipment manufacturer (OEM) vehicles only, not conversions.

Points of Contact

Coachella Valley Clean Cities Coordinator
Tracy Daly (619) 343-3456
Sun Line Transit Agency extension 112

Lancaster Clean Cities Coordinator
Brian Hawley (805) 723-6000
City of Lancaster

Long Beach Clean Cities Coordinator
Paul Smock (310) 570-2052
City of Long Beach Gas Co.

Los Angeles Clean Cities Coordinator
Leilani Johnson (213) 580-1028
City of Los Angeles

Oakland Clean Cities Coordinator
George N. Oakes (510) 615-5480
City of Oakland

San Diego Clean Cities Coordinator
Kim Cresencia (619) 654-1107
San Diego Gas & Electric Co.

Sacramento Clean Cities Coordinator
Bill Fairbairn (916) 643-5443
McClellan Air Force Base

San Francisco Clean Cities Coordinator
Rick Ruvolo (415) 554-6184
City and County of San Francisco

San Joaquin Valley Clean Cities Coordinator
Joseph Oldham (209) 297-4000
Clovis Unified School District extension 2856

South Bay (San Jose) Clean Cities Coordinator
Rita Norton (408) 277-5533
City of San Jose

Points of Contact (cont.)

Southern California Association of Governments Clean Cities Coordinator
David Preece (213) 236-1948
Southern California Association of Governments

Future Clean Cities

Redwood Empire Clean Cities Coalition (Santa Rosa/Napa Valley)
Chuck Hammond (707) 543-3903
County of Santa Rosa

Riverside Clean Cities Coalition
Jody Orttung (909) 686-4711
City of Riverside

Santa Barbara Clean Cities Coalition
Mike Grimes (805) 564-5568
City of Santa Barbara

Santa Monica Clean Cities Coalition
John Ingersoll (818) 565-5512
Helios International

California Energy Commission (CEC) (916) 654-4634
Susan Patterson (916) 654-4992

South Coast Air Quality Management District (SCAQMD)
Ray Gorski (909) 396-2479
Connie Day (909) 396-3055

Sacramento Metropolitan Air Quality Management District
Tim Taylor (916) 386-7042

Los Angeles Department of Power and Water
Christy Zidonis (213) 367-0292

Pacific Gas and Electric
Alternative Fuels Hotline (800) 684-4648
Joe Garcia (NGV programs) (415) 973-4162
Kent Harris (EV programs) (415) 973-6981

Sacramento Municipal Utility District
Mike Wirsch (916) 452-3211

San Diego Air Pollution Control District
Morris Dye (619) 654-3303

San Diego Gas & Electric
Risa Barron (619) 654-1108

Southern California Edison
Coleen Tessema (818) 302-8715

Edison EV
Enid P. Joffe (213) 452-4627

Southern California Gas Company
NGV Hotline (800) GAS-2000
Rick Price (213) 244-3679
Wayne Tanaka (NGV Sales Mgr.) (310) 781-7202

Metropolitan Planning Organizations

Southern California Association of Governments
Jim Gosnell (213) 236-1800

San Diego Association of Governments
Steve Sachs (619) 595-5346

Santa Barbara County Association of Governments
Michael G. Powers (805) 568-2546

Tulare County Association of Governments
Jim Larsen (209) 733-6291

Council of Fresno County Governments
Clark Thompson (209) 233-4148

Association of Monterey Bay Area Governments
Nicolas Papadakis (408) 883-3750

Monterey Bay Air District
Mark Miller (408) 647-9411

Metro Transportation Commission
Dave Murray (510) 464-7766

San Joaquin County Council of Governments
Barton R. Meays (209) 468-3913

Stansislaus Area Association of Governments
Vince Angelino (209) 558-7830

Sacramento Area Council of Governments
Gary Keill (916) 457-2264

Points of Contact (cont.)

California State Transportation Contact
Garland Hagen (916) 654-2983

California State Energy Office
Mike McCormack (916) 654-4652

U.S. Department of Energy
Seattle Regional Support Office
San Francisco Duty Station
Clara Chun (510) 637-1943

U.S. Department of Transportation Contacts

Federal Highway Administration
Region 9
Bob O'Loughlin (415) 744-3823

Federal Transit Administration
Region 9
Donna Turchie (415) 744-3133

General Services Administration
Regional Fleet Manager
Region 9
Nathaniel Reed or (415) 522-2880
Greg Herren

U.S. Environmental Protection Agency
Regional Pollution Prevention Coordinators
Region 9
Eileen Sheehan (415) 744-2190
Bill Wilson (415) 744-2192

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Federal Transit
Administration

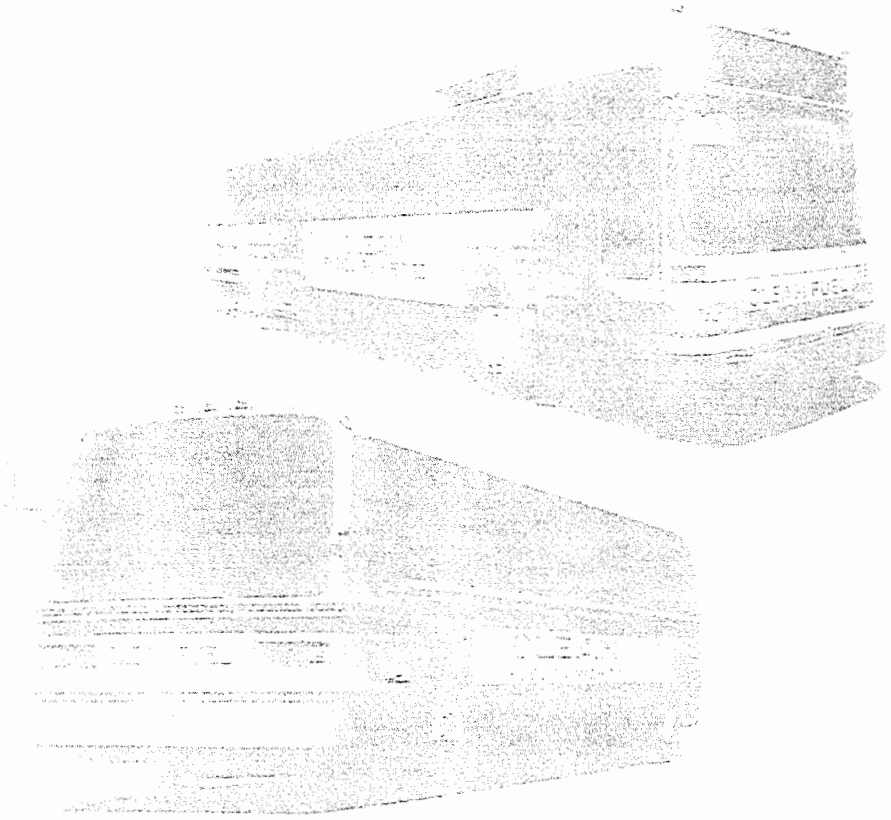
U.S. Department
of Energy

Clean Air Program

Summary Assessment of the Safety, Health, Environmental and System Risks of Alternative Fuel

U. S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
Cambridge, MA 02142-1093

August 1995
Final Report



FEDERAL TRANSIT ADMINISTRATION

PREFACE

National goals for both energy security and clean air have resulted in heightened interest in the use of alternative motor fuels (AMFs) in the transportation market. The growth of interest in alternative fuels has expanded not only the numbers of alternative fuel vehicles, but also the list of viable alternative transportation fuels.

Thus, an increasing number of transit fleets and other fleet owners are operating vehicles on alternative fuels — often with a minimum of technical guidance related to the possible safety or operational impacts on traditional fleet operations, including fueling, inspecting, and cleaning vehicles, as well as performing the light and heavy maintenance activities necessary to keep the fleet in operation.

Moreover, the buildings or facilities used for storing, loading, and maintaining alternative fuel vehicles form an important portion of a fleet operation. Here, the experience with fire and building codes is not yet complete. This situation requires additional care on the part of the owners of these facilities to recognize all hazards associated with the use of alternative fuel vehicles and to ensure that these hazards are properly addressed in the design and operation of the facility.

Experience has shown that not all local community and regulatory groups view the use of alternative fuels as a purely positive option. Transit properties and others who propose the use of alternative fuels need to deal not only with the perceptions of fire and building code officials who grant approvals, but also with the perceptions and concerns of community and neighborhood organizations. The concerns of these groups are not limited to fleet operations, but may also include the production of the alternative fuel and the transportation of the fuel to the point of use.

In view of the diversity of these safety concerns, as well as the number of possible hazards, a comprehensive and systematic program is needed to recognize and organize the existing knowledge about the health, safety, and environmental hazards of alternative fuels and to identify where additional study is needed. The objective of this report is assist the Volpe Center, FTA and DOE in providing information on these issues to the transit and fleet operator community while avoiding a commitment to or bias against any given fuel or point of view.

This report presents the results of a research effort undertaken for the Volpe National Transportation Systems Center. This work was funded jointly by the U.S. Department of Transportation, Federal Transit Administration Office of Engineering and the U.S. Department of Energy, Alternative Fuels Utilization and Analysis Division. The interest, insight and advice of David Knapton of the Volpe National Transportation Systems Center, John Russell of the U.S. Department of Energy, and Tony Yen and Steven Sill of the Federal Transit Administration are gratefully acknowledged.

3.3.8 Electricity

3.3.8.1 General Description

Electricity can be considered as an AMF based on the use of electrically powered fleet vehicles using batteries as the energy storage medium. Most fleet applications currently considered involve vehicle tours that are relatively short and low speed, e.g., shuttle service, due to the limited range (less than 100 miles) and power of battery electric-powered vehicles. Typical battery recharging times are on the order of 6 to 8 hours requiring that fleet vehicles be recharged overnight. The current research focus for electric propulsion vehicles is in the area of battery development where the goal is to develop batteries that have low initial cost, high specific energy (Wh/kg), and high power density.

The bulk transport of electricity via the electric power distribution system is a fundamental part of the nation's infrastructure. The hazards associated with high voltage power lines, substation transformers, and local power distribution systems are well known. The National Electrical Code developed under the auspices of the NFPA covers the safety and protection measures associated with the provision of electrical service to the facilities.

3.3.8.2 Safety Issues

All of the safety issues associated with electricity are directly related to the transmission of electric power to the recharging station at the fleet facility. There is no storage issue since the electrical energy is stored in the on-board batteries.

The major safety concern is the exposure of personnel to electrical hazards as they work with the recharging system and connecting the vehicles to that system. This is not expected to be a serious safety hazard because the normal design practices for setting up the connections involve safeguards to ensure that personnel are protected from direct exposure to electrical hazards.

One of the safety advantages of electricity compared to the other AMFs is that all facility personnel are generally familiar with the hazards associated with electrical power. Therefore,

personnel working with the recharging system can be expected to be aware of the dangers and follow the proper safety procedures.

3.3.8.3 Health Issues

There are no specific health hazards associated with the transmission and use of electricity at a fleet facility.

3.3.8.4 Environmental Issues

There are no specific environmental hazards associated with the transmission and use of electricity at a fleet facility.

TABLE 4-7(H). HYDROGEN -- ELECTRICAL ENERGY

Hazard -- Event	Background	Consequences	Knowledge
None – no significant hazards identified.	Hydrogen fuel does not involve stored electrical energy and does not present a significant electrical hazard.	–	–

TABLE 4-8(A). ELECTRICITY -- FLAMMABILITY

Hazard -- Event	Background	Consequences	Knowledge
Fire – due to electrical short or overload.	Currently, most fires on heavy duty fleet vehicles originate as electrical fires. Electric vehicles will have a much greater power capability and hence a greater potential hazard.	A fire can result in damage to or loss of the vehicle as well as injury to the occupants.	Recently (June 1994) two Ford Ecostar electric vehicles experienced electrical fires during battery charging.
Fire – due to electrical component failure.	Currently, most fires on heavy duty fleet vehicles originate as electrical fires. Electric vehicles will have a much greater power capability and hence a greater potential hazard.	A fire can result in damage to or loss of the vehicle as well as injury to the occupants.	Several experimental electric vehicles have suffered electrical fires, including most recently the Ford Ecostar.
Fire – due to contact with hot electrolyte.	Some battery systems use very hot electrolytes. Since the autoignition temperature of hydrocarbons can be as low as 220°C, contact with heat from the battery could lead to a vehicle fire.	A fire can result in damage to or loss of the vehicle as well as injury to the occupants.	Both the electrolyte temperature and the ignition temperatures of other materials are reasonably well-known. The major uncertainty is the ability to isolate the high temperature in all types of normal operation and during traffic accidents.

TABLE 4-8(B). ELECTRICITY -- CORROSIVITY

Hazard – Event	Background	Consequences	Knowledge
Corrosion – from battery electrolyte.	Most battery systems proposed for electric vehicles have electrolytes which are corrosive. Leakage of this electrolyte can cause damage to and/or failure of other vehicle components. A recent example from a non-electric vehicle is the failure of CNG fuel tanks from spilled electrolyte from batteries carried to start other vehicles.	The consequences can be either minor or major depending on the vehicle component affected and the importance of that component to maintaining safe operation of the vehicle.	Little data are available on the degree to which this will be a problem in actual electric vehicles.
Corrosion – from electrolysis.	Leakage current may cause electrolysis of metal vehicle components. While such electrolysis could take place with current battery-powered accessory circuits, the larger currents and higher voltages used for electric propulsion could increase the danger of electrolytic corrosion.	The consequences can be either minor or major depending on the vehicle component affected and the importance of that component to maintaining safe operation of the vehicle.	Little data are available on the degree to which this will be a problem in actual electric vehicles.

TABLE 4-8(C). ELECTRICITY -- TOXICITY

Hazard -- Event	Background	Consequences	Knowledge
Health hazard -- from contact with battery electrolyte.	Many candidate battery electrolytes are corrosive and toxic. They are potential hazardous via skin contact or inhalation of fumes or vapors.	The toxic consequences depends on the composition of the electrolyte.	The degree of knowledge depends on the material composition(s) involved.

TABLE 4-8(D). ELECTRICITY -- HIGH PRESSURE

Hazard -- Event	Background	Consequences	Knowledge
None -- no significant hazards identified.	The use of electricity does not involve high pressures and hence there is not a significant high pressure hazard associated with the use of electricity.	--	--

TABLE 4-8(E). ELECTRICITY -- HIGH TEMPERATURE

Hazard -- Event	Background	Consequences	Knowledge
Burns – from contact with battery.	Some proposed battery systems operate at high temperatures. Contact with such temperatures could occur during vehicle repair and cause unexpected burns.	Any burn is a potentially serious injury.	The degree of hazard depends on the type of battery system used and on the design configuration of the vehicle.
Burns – from contact with leaking battery electrolyte after component failure.	Some proposed battery systems operate at high temperatures. Contact with such temperatures could cause burns.	Any burn is a potentially serious injury.	The degree of hazard depends on the type of battery system used and on the design configuration of the vehicle.
Burns – from contact with leaking battery electrolyte after traffic accident.	Some proposed battery systems operate at high temperatures. A damaged battery pack could leak electrolyte at high temperature. Contact with such temperatures could cause burns.	Any burn is a potentially serious injury.	The degree of hazard depends on the type of battery system used and on the design configuration of the vehicle.

TABLE 4-8(F). ELECTRICITY -- CRYOGENIC TEMPERATURE

Hazard -- Event	Background	Consequences	Knowledge
None -- no significant hazards identified.	The use of electricity does not involve cryogenic temperatures and hence there is not a significant cryogenic temperature hazard.	--	--

TABLE 4-8(G). ELECTRICITY -- MECHANICAL ENERGY

Hazard -- Event	Background	Consequences	Knowledge
Lifting-falling hazard -- from changing battery packs.	Electric vehicle battery packs are not expected to last the life of the vehicle and will need to be replaced. Such battery packs are heavy components and will require special handling.	Given the weight of battery packs, a falling battery pack could cause serious trauma.	Although engines and transmissions are heavy components which are routinely replaced, experience with such techniques may not provide much information on battery packs which are several times as heavy and which require different handling techniques.

TABLE 4-8(H). ELECTRICITY -- ELECTRICAL ENERGY

Hazard-- Event	Background	Consequences	Knowledge
Shock hazard -- from battery charger connection.	Electric vehicles are likely to employ much higher voltages than used for vehicle accessory circuits, as many as several hundred volts. Battery charger connections are subject to severe handling and abuse. Connections may need to be made to vehicles which are wet with road salt or during heavy rains.	Major electric shocks can cause death or injury. Even minor electric shocks can cause injury by causing involuntary movement.	The hazards associated with electric shock are well-known, but there is relatively little experience with the hazard from electric vehicles in everyday use.
Shock hazard -- from on-board electric supply during vehicle repair.	Electric vehicles are likely to employ much higher voltages than used for vehicle accessory circuits, as many as several hundred volts. Mechanics and others who repair vehicles will need to follow strict procedures to avoid electric shocks.	Major electric shocks can cause death or injury. Even minor electric shocks can cause injury by causing involuntary movement.	The hazards associated with electric shock are well-known: voltages less than 24 volts are not considered to present a shock hazard, while voltages greater than 50 volts are considered potentially lethal.[34] There is relatively little experience with the hazard from electric vehicles in everyday use.
Shock hazard -- from on-board electric supply due to component failure.	Electric vehicles are likely to employ much higher voltages than used for vehicle accessory circuits, as many as several hundred volts. A component failure could expose the occupants to these voltages.	Major electric shocks can cause death or injury. Even minor electric shocks can cause injury by causing involuntary movement.	The hazards associated with electric shock are well-known, but there is relatively little experience with the hazard from electric vehicles in everyday use.
Shock hazard -- from on-board electric supply after traffic accident.	Electric vehicles are likely to employ much higher voltages than used for vehicle accessory circuits, as many as several hundred volts. A damaged electrical system component could expose the occupants to these voltages.	Major electric shocks can cause death or injury. Even minor electric shocks can cause injury by causing involuntary movement.	The hazards associated with electric shock are well-known, but there is relatively little experience with the hazard from electric vehicles in everyday use.

TABLE 4-8(H). ELECTRICITY -- ELECTRICAL ENERGY (cont.)

Hazard-- Event	Background	Consequences	Knowledge
Electromagnetic field damage – from electric traction equipment.	Cargo carried on-board vehicles commonly includes magnetic data processing media as well as a variety of electronic devices which may be subject to interference from electromagnetic fields arising from electric traction equipment. Because of the relatively large power involved in electric traction as well as the complex waveforms generated by traction control modules, such interference may be much more severe than from traditional vehicle electrical systems.	Damage to electronic media or interference with the operation of electronic devices.	While the principles of EMI control are well-known, it is difficult to predict whether a given device in a real-world situation will be affected by EMI.
Electric and magnetic field health effects -- from electric traction equipment.	Several types of health effects have been imputed to human exposure to electric and/or magnetic fields. The main concern is possible elevated rates of cancer, though various other physiological changes are also suspected to be caused by electric and/or magnetic fields.	The suggested health effects of exposure to electromagnetic radiation are serious, especially cancers, such as leukemia. However, the cause and effect and dose response relationships are far from proven.	Much additional information is needed confirm or deny the various hypotheses on health effects of electromagnetic fields. The physical principles involved are well-described in Reference [35]. A summary of the issues is given in Reference [36]. Current epidemiologic results are reviewed in Reference [37]. A report on the most recent results is given in Reference [38].

Electricity:

"An Illustrated Guide to Electrical Safety," William S. Watkins, Editor, American Society of Safety Engineers publication, 1983. [While not specifically directed towards electric vehicles, this publication contains a good summary of the principles of electrical safety as well as of relevant OSHA regulations.]

"National Electric Code," National Fire Protection Association, NFPA-70, 1993.

"Overview of Epidemiologic Research on Electric and Magnetic Fields and Cancer," David A. Savitz, American Industrial Hygiene Association Journal, Vol. 54, 1993, pp. 197-204.

TASK 1 - Develop Route and Scope of Proposed Phase II

Discussions with members of MCOG s Technical Advisory Committee (TAC) and Board of Directors and project participants have concluded that all MCOG member jurisdictions should be included in the ZEV Project, i.e. the County of Mendocino and the four cities, Ukiah, Fort Bragg, Willits, and Point Arena. MCOG is a regional council, therefore, the project will be regional in scope.

- The project will include both commute and in-town modes, to reflect local driving patterns. The route driven will include a Brooktrails to Ukiah Commute. Additional routes will be determined after the project team is formed.

- The project will focus on the rural aspects of Mendocino County, with its mountainous terrain and distance between destinations, to specifically address the rural application of the new clean-air vehicle technologies available on the market.

- The project will emphasize endurance tests of ZEVs and/or LEVs, e.g. over the Ridgewood grade on Highway 101, up Sherwood Road in Brooktrails, and between inland and the coast.

- As much as possible, the project will not duplicate studies already done elsewhere, and focus on the local needs of Mendocino County.

- The project will consider paratransit services, such as Dial-A-Ride, that might be practical ZEV uses in intermodal transit niches.

Scope of Work for Phase II

TASKS: The following tasks are envisioned for Phase II.

1. Install vehicle charging/fueling stations
   - in Willits
   - in Ukiah
2. Acquire vehicle/s (lease and/or borrow)
   - arrange insurance, cellular phone
3. Set up instrumentation for data collection
   - instrument vehicle with ac w-h meter to allow collection of energy use data
4. Test vehicles
   - initial vehicle test
5. Train/orient drivers in MCOG member governments
   - identify team members
   - develop training program
   - develop maintenance procedures and responsibilities
   - train operators
6. Schedule shared vehicle use
   - plan vehicle use by team members and others
   - deploy vehicle according to plan
   - collect data including driver experiences
7. Conduct Ride & Drives
   - collect data including driver experiences
8. Install photovoltaic net-metering demonstration
9. Document and present findings

(Above tasks correspond with 1997/98 WE #13 and Draft Project Plan for Phase II.)

PRODUCTS: The following products are envisioned for Phase II.

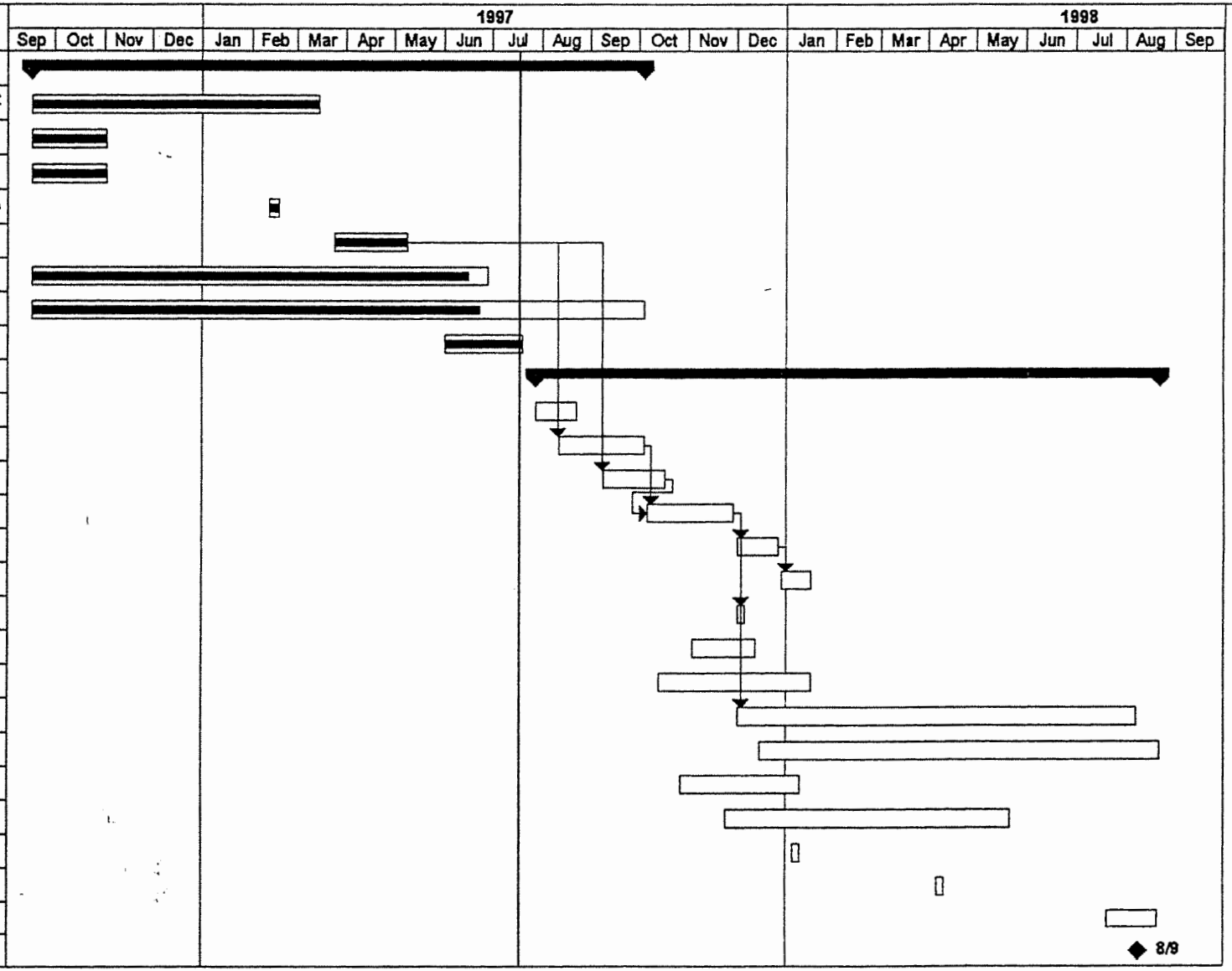
1. Report on rural ZEV/LEV trial performances with terrain/climate effects and driver experience/evaluations
2. Forecast of power/fueling requirements with summary of standards and safety issues
3. Data for ZEV/LEV air quality and transportation elements to County General Plan
4. Photovoltaic net metering demonstration/report

(Above products correspond with 1997/98 Work Element #13.)

Attachments

- Draft Project Plan for Phase II - *Gantt chart timeline*
- Map of Electric Vehicle Charging Stations in Mendocino County
- Summary of Route Characterization for ZEV Project

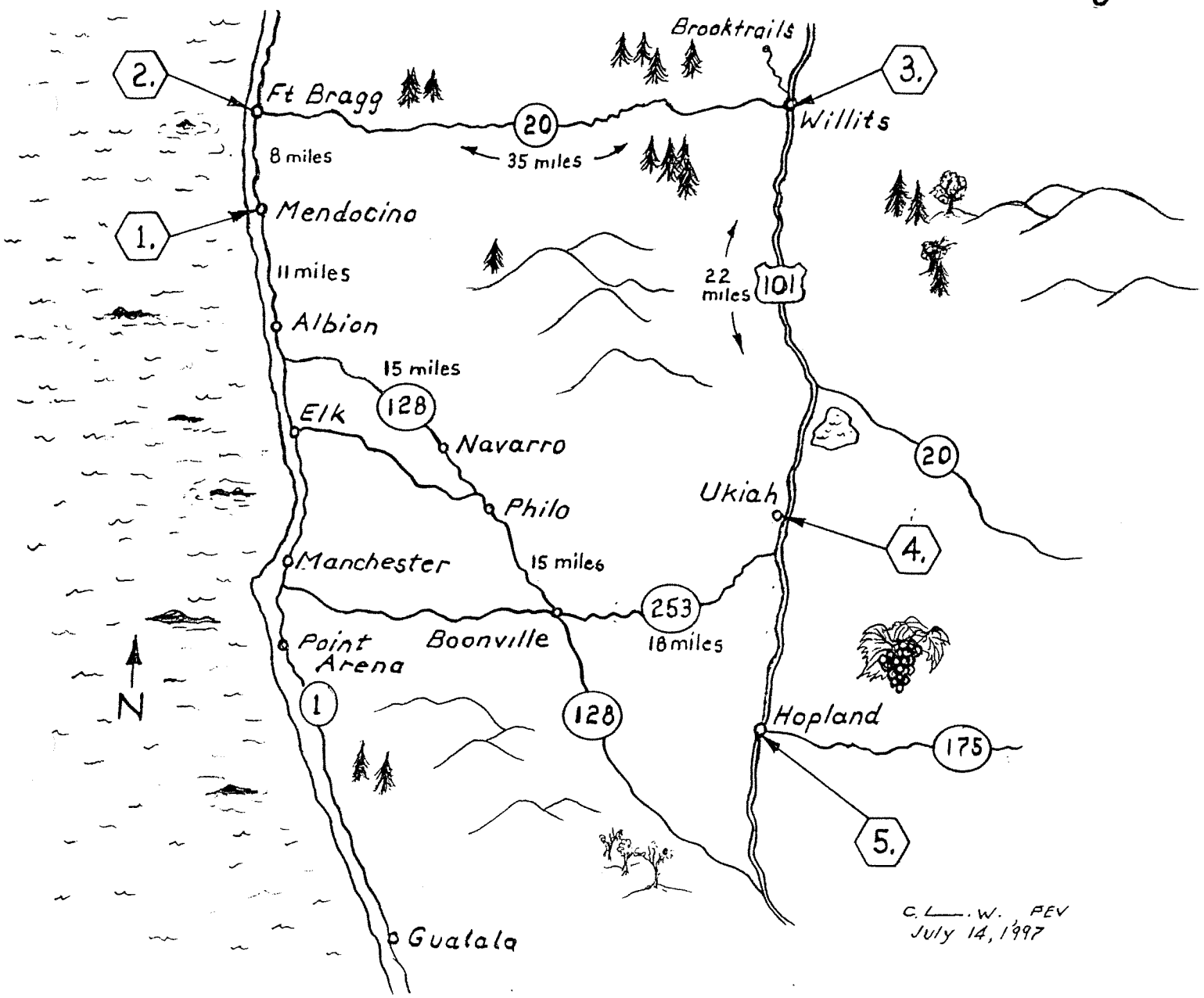
ID	Task Name
1	Phase 1
2	Analyse Charging Station requirement
3	Identify/Recommend Vehicles
4	Identify Instrumentation
5	Characterize Energy, Trip to Brooktra
6	Plan Charging Station Installations
7	Build Project Team
8	Fundraising
9	Detail Phase 2 Plan
10	Phase 2
11	Identify Team Members
12	Charging Station Installation, Ukiah
13	Charging Station Installation, Willits
14	Vehicle Acquisition
15	Arrange Insurance, Cellular Phone
16	Instrumentation
17	Test Vehicle
18	Training of Drivers/Operators
19	Schedule Use of Vehicle(s)
20	Vehicle Deployment
21	Collect Data
22	Net metering PV installation
23	Net Metering PV Test
24	Ride & Drive 1
25	Ride & Drive 2
26	Final Report
27	Findings Presentation



Project: Redi-MCOG ZEV Project
Date: 7/18/97

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

E.V. Charging Stations in Mendocino County



1. Mendocino Environmental Center - 10500 Lansing Street. Check inside before plugging, donations to pay for power requested.
2. Fort Bragg, at Laurel & 1.
   (1) 14-50 R 240 V 50 A, (4) 15 A 120 V, (1) 30 A 120 V,
   (1) 6-20 R 240 V 20 A "1893" is combination,
   no motorhomes please.
3. Proposed site in Willits at Community Center Park.
4. Proposed site in Ukiah, downtown parking area.
5. Real Goods, south of Hopland on highway 101
   (4) 14-50 R, (8) 5-20 R 120 V, 20 A w/ GFI,
   240 V, 50 A

   SOLAR & WIND Power Supply, open during business hours, please inquire before plugging in.

Report: Summary of Route Characterization for ZEV Project

Prepared by: William R. Warf, PE

Prepared for: REDI/MCOG, March 1, 1997

Background:
A project is underway to study the feasibility of using a zero emission vehicle for commuter use in Mendocino County. One proposed test is a commute from Brooktrails to Ukiah and the return commute home. A light weight prototype electric vehicle owned by SMUD (Sacramento Municipal Utility District) was driven over much of this route to determine the approximate energy use and other project needs. The prototype was the Horlacher Sport built by Horlacher AG of Switzerland.

Results: Energy use for a 44.5 mile round trip was 5.675 kW-h DC, and 8.903 kW-h AC. This results in an average energy use of 200 AC W-h/mile and 127.45 DC W-h/mile. The trip was cut short in Willits, where we had lunch. If there had been a public charging station in Willits to partly recharge the batteries, we could have completed the commute to Brooktrails and back to Ukiah, however because this is a customer owned vehicle we did not want to over-discharge the batteries. The DC energy contained in the battery pack is only about 8 DC kW-hours at 80% DOD. If a charging station were available, about 2 DC kW-h could have been replenished in the one hour we took for lunch, allowing approximately another 15 miles of driving to before a safe discharge limit was reached.

Energy use climbing the Ridgewood grade averaged 233 DC W-h/mile, while coming down the hill using regenerative braking used only 18 DC W-h/mile.

Notes:
An advanced EV from GM, Honda, or Toyota could be expected to use about twice the energy of the light weight prototype, because they weigh roughly twice as much. They also have larger DC energy storage in the battery pack. Analysis performed shows that these vehicles are capable of the round trip from Brooktrails to Ukiah and back. If the vehicles are to be driven during the day, a charging station is needed in Ukiah.

Attachment: Sport.XLS spread sheet showing energy used driving the Sport during the month of February, 1997.

	A	B	C	D	E	F	G	H	I	J	K	L
1	2/2/97	Badicheq	Voltage	Brusa A-h	Odometer	AC W-h	Notes:	Trip Lengt	calib. f	Trip act.	Trip act.	AC Energy
2	2/2/97	68	150	100.42	38962.6	345718	Initial	km	km	km	miles	
3	2/2/97	60	150	108.23	38974.5	345718	trip to house, 10.6 km	11.9	0.890756	10.6	6.58	0
4	2/2/97	70	162	99.99	38974.5	347280	charged at house	0	0.89	0	0.00	1562
5	2/2/97	18; E6	139	144.42	39041.7	347280	home, walmt, tomki, home E6	67.2	0.89	59.808	37.11	0
6	2/3/97	61	163	92.48	39041.7	357366	flashing, full,PUo	0	0.89	0	0.00	10086
7	2/3/97	56		98.24	39052.4	357366		10.7	0.89	9.523	5.91	0
8	2/3/97	34	149	120.7	39096.3	358443		43.9	0.89	39.071	24.24	1077
9	2/5/97	68	152	92.45	39096.4	364144		0.1	0.89	0.089	0.06	5701
10	2/6/97	66	160	0.01	39112.8	367971	tires changed, toe improved	16.4	0.89	14.596	9.06	3827
11	2/6/97			10.55	39133.1	367971	To Retech	20.3	0.92	18.676	11.59	0
12	2/6/97			24.7	39159.9	367971	back to shop, 26.89 mi trip	26.8	0.92	24.656	15.30	0
13	2/8/97	68	152	1.23	39160.1	374216		0.2	0.92	0.184	0.11	6245
14	2/8/97	30	150	37.04	39228.1	374216	38 mile trip, river road	68	0.92	62.56	38.82	0
15	2/11/97	68	152	0.81	39228.1	384776		0	0.92	0	0.00	10560
16	2/11/97	41	150	26.41	39273.8	384776	in Willits	45.7	0.92	42.044	26.09	0
17	2/11/97	26	148	39.41	39306.1	384776	end 44 mile trip	32.3	0.92	29.716	18.44	0
18	2/12/97	66	165	0	39306.1	393679		0	0.92	0	0.00	8903
19	2/12/97	31	149	31.94	39359.5	393679	to Retech+Max's ride	53.4	0.92	49.128	30.48	0
20	2/12/97	56	158	11.48	39359.6	397365	shop, interrupted charge	0.1	0.92	0.092	0.06	3686
21	2/12/97			16.4	39371.1	397365	home	11.5	0.921739	10.6	6.58	0
22	2/12/97	53		15.16	39371.1	397861	home interrupted charge	0	0.92	0	0.00	496
23		41	150	26.81	39395.8	397861	at shop	24.7	0.92	22.724	14.10	0
24		31	150	35.88	39411.4	397861	at shop, Garys Ride	15.6	0.92	14.352	8.91	0
25							returned to SMUD			408.42	253.42	
26								Trip Lengt	calib. f	Trip act.	Trip act.	AC Energy
27	This is a breakdown of the trip to Willits by segment. Readings taken while driving							km	km	km	miles	
28	2/11/97	68	152	0.81	39228.1	384776			0.92	0	0.00	
29				4.67	39235.3		at Janet's Office	7.2	0.92	6.624	4.11	
30				12	39249.3		bottom of Hill	14	0.92	12.88	7.99	
31				24.85	39263.2		top of Hill	13.9	0.92	12.788	7.93	
32	2/11/97	41	150	26.41	39273.8	384776	in Willits	10.6	0.92	9.752	6.05	
33				34.24	39284.1		top hill	10.3	0.92	9.476	5.88	
34				35.15	39296.7		bottom of hill	12.6	0.92	11.592	7.19	
35	2/11/97	26	148	39.41	39306.1	384776	end 44 mile trip	9.4	0.92	8.648	5.37	
36	2/12/97	66	165	0	39306.1	393679		0	0.92	0	0.00	8903
37		Badicheq	Voltage	Brusa A-h	Odometer	AC W-h	Totals			71.76	44.53	
38						8903						

	M	N	O	P	Q	R	S	T	U	V	W	X
1	AC W-h/mi	DC energy	DC W-h/mile			Trip act.	2/2/97	Badicheq	Voltage	Brusa A-h	Odometer	AC W-h
2				amp-h/mi.		miles	2/2/97	68.00	150.00	100.42	38962.60	345718
3	0	1124.64	170.99	1.187417		6.58	2/2/97	60.00	150.00	108.23	38974.50	345718
4	237.4835			0		0.00	2/2/97	70.00	162.00	99.99	38974.50	347280
5		6397.92	172.40	1.197224	19.42 W-h/kg	37.11	2/2/97	18; E6	139.00	144.42	39041.70	347280
6	271.7803			0		0.00	2/3/97	61.00	163.00	92.48	39041.70	357366
7		829.44	140.37	0.974781		5.91	2/3/97	56.00	0.00	98.24	39052.40	357366
8		3234.24	133.41	0.926432		24.24	2/3/97	34.00	149.00	120.70	39096.30	358443
9				0		0.06	2/5/97	68.00	152.00	92.45	39096.40	364144
10	317.9376			0		9.06	2/6/97	66.00	160.00	0.01	39112.80	367971
11	0	1517.76	130.97	0.909526		11.59	2/6/97	0.00	0.00	10.55	39133.10	367971
12	0	2037.6	133.18	0.924894		15.30	2/6/97	0.00	0.00	24.70	39159.90	367971
13	232.264			0		0.11	2/8/97	68.00	152.00	1.23	39160.10	374216
14	0	5156.64	132.84	0.922499		38.82	2/8/97	30.00	150.00	37.04	39228.10	374216
15	271.2376			0		0.00	2/11/97	68.00	152.00	0.81	39228.10	384776
16		3686.4	141.30	0.981283		26.09	2/11/97	41.00	150.00	26.41	39273.80	384776
17	0	1872	101.53	0.705036		18.44	2/11/97	26.00	148.00	39.41	39306.10	384776
18	199.9457			0		0.00	2/12/97	66.00	165.00	0.00	39306.10	393679
19		4599.36	150.88	1.047765		30.48	2/12/97	31.00	149.00	31.94	39359.50	393679
20	120.9162			0		0.06	2/12/97	56.00	158.00	11.48	39359.60	397365
21	0	708.48	107.72	0.748027		6.58	2/12/97	0.00	0.00	16.40	39371.10	397365
22	75.41088					0.00	2/12/97	53.00	0.00	15.16	39371.10	397861
23		1677.6	118.98	0.826227		14.10		41.00	150.00	26.81	39395.80	397861
24		1306.08	146.66	1.018481		8.91		31.00	150.00	35.88	39411.40	397861
25						253.42						
26	AC W-h/mi	DC energy	DC W-h/mile			Trip act.						
27		W-h		amp-h/mi.		miles						
28		116.64		0		0.00	2/11/97	68.00	152.00	0.81	39228.10	384776
29		555.84	135.23	0.939129		4.11	2/11/97	0.00	0.00	4.67	39235.30	0
30		1055.52	132.07	0.917163		7.99	2/11/97	0.00	0.00	12.00	39249.30	0
31		1850.4	233.20	1.619417		7.93	2/11/97	0.00	0.00	24.85	39263.20	0
32		224.64	37.12	0.257804		6.05	2/11/97	41.00	150.00	26.41	39273.80	384776
33		1127.52	191.76	1.331665		5.88	2/11/97	0.00	0.00	34.24	39284.10	0
34		131.04	18.22	0.126515		7.19	2/11/97	0.00	0.00	35.15	39296.70	0
35		613.44	114.32	0.793875		5.37	2/11/97	26.00	148.00	39.41	39306.10	384776
36	199.9457		127.45	0.885079		0.00	2/11/97	66.00	165.00	0.00	39306.10	393679
37		5675.04				44.53	2/11/97	Badicheq	Voltage	Brusa A-h	Odometer	AC W-h
38												

	Y
1	Notes:
2	Initial
3	trip to house, 10.6 km
4	charged at house
5	home, walmt, tomki, home E6
6	flashing, full,PUc
7	1/0/00
8	1/0/00
9	1/0/00
10	tires changed, toe improved
11	To Retech
12	back to shop, 26.89 mi trip
13	1/0/00
14	38 mile trip, river road
15	1/0/00
16	in Willits
17	end 44 mile trip
18	1/0/00
19	to Retech+Max's ride
20	shop, interrupted charge
21	home
22	home interrupted charge
23	at shop
24	at shop, Garys Ride
25	returned to SMUD
26	
27	
28	
29	at Janet's Office
30	bottom of Hill
31	top of Hill
32	in Willits
33	top hill
34	bottom of hill
35	end 44 mile trip
36	1/0/00
37	Totals
38	

Help revamp The Willits News — fill out survey on back page

— see page 14

The Willits News

Volume 94 — Number 16 Wednesday, February 26, 1997

Electric cars on the run

Local woman — Janet Orth — gets her own project on the road



Janet Orth and Bill Warf arrived back in Willits on Feb. 11 in a Swiss-made electric car owned by the Sacramento Municipal Utility District. Orth, an employee of the Mendocino Council of Governments (MCOG), and Warf, founder and general manager of Pacific Electric Vehicles in Ukiah, made the 44.5 mile round-trip from Ukiah to Willits to "measure the amount of energy" it took — which ended up being 8.9 kilowatts.

"At 14 cents a kilowatt from PG&E, that's $1.25," said Warf, who noted that "the hill took a lot of energy" and also that how many miles the car can go depends "on the terrain and how fast the car is going."

The car Orth and Warf drove, pictured above, weighs 1,465 pounds, which includes 726 pounds of batteries, and can usually go "60 miles on a charge," according to Warf. It's quiet, has a lot of leg room, three dials on the dash and three pedals on the floor. The dials are a voltage meter, ammeter and speedometer, and the pedals are an accelerator, decelerator and a brake pedal.

The trip was made in connection with a "proposed project to acquire and put an electric vehicle in use in this county," according to Warf. The project is a joint venture of MCOG and the Renewable Energy Development Institute (REDI), with Warf acting as consultant to REDI, and is currently in a fund-raising feasibility study phase.

— photo and story by Joanne Moore

Local news in brief

thanks all those who helped make the "Heartwood Night on the Town" such a success.

Missing Humboldt

Giant asphalt spill closes Highway 101

A big rig traveling too fast on a turn lost control and spilled more than 3,000 gallons of

TASK 2 - Evaluate Commercial Vehicles

We researched vehicles which may be commercially available for a one-year project commencing on July 1, 1997. An evaluation and ranking of nine commercially available vehicles was prepared based on the assumption that they must be capable of the commute from Brooktrails to Ukiah. Cost information and product literature was obtained. The full report is provided in Appendix B.

The evaluation in this report assumes the vehicle(s) acquired for the project would be driven on a daily basis from Ukiah to approximately 2000' elevation in Brook trails. In addition, the vehicles would be used during the day by local agency personnel for demonstrations and short errands. Demonstrations and loans of the vehicle to fleet operators and other agencies in the four Cities associated with MCOG is also assumed, as this maximizes the benefit of the project by maximizing the exposure of County and City personnel to a state of the art EV.

Technical Study - Prepared by Pacific Electric Vehicles 10/28/96

Nine EV's were evaluated for commuter use as described in paragraph 2.0. Five of the nine vehicles are probably capable of the commute (EV1, EV1 Ni-M-H, RAV4, Honda EV, and Pivco CityBee). Two of these capable vehicles would require charging at both ends of the commute if speeds of 55 mph average are to be maintained. Because of the elevation change, only Ni-M- Hydride equipped EV1, Honda EV, or a RAV4 is likely to be capable of the 52-mile round trip at normal driving speeds, without recharging. Recharge capability is required in Ukiah if local loans and demonstrations are needed. Recharge services need to be established at demonstration sites in each of the Cities.

The other four vehicles evaluated are capable of the trip from Ukiah to Willits at freeway speed, but would probably require recharge in Willits before proceeding very far into Brooktrails.

3.1 Availability:

Originally we thought we would lease an EV1, a Honda, or a Toyota EV for the project, for a one-year term. In initial discussions with these manufacturers, only Toyota indicated they would entertain allowing us to use a vehicle. Both GM(Saturn) and Honda have carefully chosen market areas, and appear to be focused on providing only enough vehicles to satisfy their Memorandum of Agreement with CARB. Saturn and Honda personnel are quite negative about our chances of obtaining a vehicle here. GM (but not Saturn) might be persuaded to allow us to use an EV1, if we have a well crafted demonstration proposal. Toyota indicated a preliminary willingness to allow us to use a

vehicle for a several month period, however they have not considered a lease so far, and are more focused on selling their RAV4's to fleets. I think they would consider leasing the vehicle to us if we have a well crafted demonstration proposal. In summary, we will have to compete for one of the advanced EV's.

With this in mind I broadened the scope of our search to include TDM's Ranger, GM's S10 Electric pick-up, Solectria products, and the Pivco CityBee. Of these, only the CityBee is likely to be able to reliably make the one way commute to Janet's house at something close to normal highway speed. The CityBee is supposed to be available in Federal Motor Vehicle Safety Standards (FMVSS) compliant form in October, 1997. Bill Meurer of Green Motorworks is the importer, and he indicated he thought we might rent one for $500 per month. Solectria does not offer a lease, and the availability of leases for the others is so far not known.

Please see the attached spreadsheet for the comparative ranking of the vehicles. I did a calculation to see what percentage of the battery pack energy would be used to commute to Janet's, and recommend this number as the ranking.

3.2 Recommendation:
With the above availability in mind, I think we should assume we can persuade the major manufacturers GM and Toyota to allow us to use one of their vehicles for a shorter term from one week to 3 months without charge to us. We can probably borrow EV's and/or hybrids from PG&E, SMUD, and possibly BART for short terms also. Their willingness to loan us the vehicle will depend on our having the *supporting infrastructure in place*, and having a large public/agency exposure for the demonstration planned out.

Please see the attached spreadsheet for the comparative ranking of the vehicles. I did a calculation to see what percentage of the battery pack energy would be used to commute to Brooktrails, and used this number as the ranking.

Attachments

- Spreadsheet comparing vehicles researched
  - includes pricing and availability, batteries and options
- Product literature
- Technical Report, 10/28/96 by W. R. Warf, PE, Pacific Electric Vehicles
  - see Appendix B
- Report on visit to ECD/Ovonics battery plant *(pending Final Report)*

Characteristic	EV1	EV1	RAV4	Honda EV	Force	GMS10	RangerEV	City-Bee
manufacturer	Saturn	GM	Toyota	mini-van	Solectria	GM	TDM/Ford	Pivco
type	car	car	sport ute	car	car	pick-up	pick-up	small car
availability	1Q97(1)	note (3)	3Q97 (4)	2Q97 (2)	4 months	1Q97	?	Oct-97
battery	VRLA	NiM-H	NiM-H	NiM-H	lead acid	VRLA	VRLA	NiCd
batt. pack voltage	312	312	288	288	156	312	312	144
batt. Capacity(kW-h)	12.96	30	30	30	9	16.2	16.2	12
passengers	2	2	4	4	4	2	2	2
GVWR (kg)	1550	1550	?	?	1272.73	2341.00		?
Curb Wt. (kg)	1350	1350	1468.181818	1630	1200	1955		750
Payload (kg)	200	200	?	?	72.73	386		?
Driving Mass (kg)	1500	1500	1618.181818	1780	1350	2104.55	150.00	900.00
Charger	ind. (off board)	ind. (off board)	cond. on board	cond. on board	cond. on board	ind. (off board)	off board	cond/on board
Service Req'm't	220/40A	220/40A	220/40A	110/220 30Acond.	220/20A	220/40A		220/20A
Charging Time (hours)	5.3	5.3	6	8	6	5		7
Charging Speed (miles/h)	13.21	13.21	19.67	12.50	7.50	12.00	#DIV/0!	5.71
FMVSS	yes	?	yes	yes	yes	yes		no
Motor	async AC, 102 kW	async AC, 102 kW	syncAC, 45kW	syncAC, 45kW	async AC, 42 kW	asynch AC, 85 kW		async AC 35 kW
Top Speed (mph)	80	80	79	80 mph	70	70		55
Mfg range @45	135	135	?	?	49	60		65
Mfg Fuds range (mi)	70	70	118	100	45	40		40
Cd*A	0.428	0.428	1.067	0.998	0.763	1.369		0.878
Energy to Janet's (kW-h) (5	8.21	8.21	13.96	14.26	10.85	18.04		9.54
elevatn change only (kW-h	3.08	3.08	3.33	3.66	2.77	4.33		1.85
Trip Capable	one way	yes	yes	yes	no	no		one way
% batt cap used	63%	27%	47%	48%	121%	111%		79%
Price:	$33,995	$60k?	$42,000	?	$35k	$33,500		
Special Charger, indoor	$2,000	$2,000	no	no	no	$2,000	yes	no
Special Charger, outdoor	$3,200	$3,200	no	no	no	$3,200		no
Lease Lump sum	$26,328		no			may lease		$500/month
Lease Term	3yr, 30,000 ,mi.		no			min order 10 units		
Capitalized cost	$33,995							
Heater/AC	heat pump		heat pump			fuel fired heater		
Notes:								
1. Saturn marketing only in South CA. and Arizona. Approx $400 per month with charger								
2. Honda vehicles are all committed, approx 300 units. , Honda states not available to us, Approx $399 per month.								
3. Prototype possibly availablefrom GM Advanced Technology Vehicles, Especially with Ovonic's help.								
4. Toyota demonstrator availalble sooner. (for weeks to a few months) No lease yet.								
5. 55 mph on grade								

TOYOTA



The popular RAV4 will soon be available to fleet users as an electric vehicle. The front-drive, four-door Toyotas will be among the first mass-produced vehicles to use advanced nickel-metal hydride batteries — twice the power of lead-acid batteries. With a combined per-charge range of 118 miles and an electronically controlled top speed of 79 mph, the RAV4-EV is a serious player in the race for zero emissions.

GENERAL

- Front engine, front-wheel drive, 4-passenger, 4-door vehicle

DIMENSIONS AND WEIGHTS

• Exterior		• Interior, front/rear	
Overall length	162.0 in.	Head room	40.3 in. 39.0 in.
Overall width	66.7 in.	Shoulder room	53.1 in. 53.1 in.
Overall height	63.6 in.	Hip room	55.9 in. 56.0 in.
Wheelbase	94.9 in.	Leg room	39.5 in. 33.9 in.
• Curb Weight	3,230 lbs.	• Cargo Volume (behind rear seats)	31.4 cu. ft.

STANDARD FEATURES

- Dual air bag Supplemental Restraint System (SRS)
- Fully reclining front and rear seats
- Low-energy heat pump-type CFC-free air conditioning available
- Power windows and door locks available
- Deluxe AM/FM stereo with Cassette available
- Heated seats (driver and front-passenger)
- Heated windshield
- Rear window defogger and wiper
- Dual black outside mirrors
- Rear door-mounted spare tire
- 195/80R16 low rolling resistance steel-belted radial tires (unique to EV)



RAV4-EV

RAV4-EV

In the RAV4-EV, a lightweight and responsive permanent-magnet motor powers the front wheels through a single-speed transaxle. This maintenence-free air-cooled motor is "fueled" by 24 12-volt (288 volts) nickel-metal hydride batteries located under the vehicle's floor.

The on-board charger lets you recharge the batteries using 220-volt household current. And thanks to a built-in timer, you can charge conveniently during off-peak hours when electricity is cheapest. A battery ECU (electronic control unit) monitors and controls the charging rate. An EV ECU controls the motor's output in response to acceleration and braking.

The low rolling resistance tires exclusively developed for EVs, along with the regenerative brake system, convert the kinetic energy of braking into electrical energy, thus increasing the vehicle's single-charge driving range.

POWERTRAIN

- Motor
  45-kW @ 2,600-2,800 rpm permanent-magnet
- Transaxle
  single-speed, front-wheel drive

BATTERIES

• Type	Sealed nickel-metal hydride, 24 12-volt units. One 12-volt lead-acid auxiliary battery
• Charger	On-board, 220-volt/40-amp with timer and automatic-off functions
• Recharge time	6-8 hours

PERFORMANCE

• City/highway/combined range	130/106/118 miles per charge
• Acceleration, 0-60 mph	17.5 seconds
• Top speed	79 mph (electronically limited)

SUSPENSION

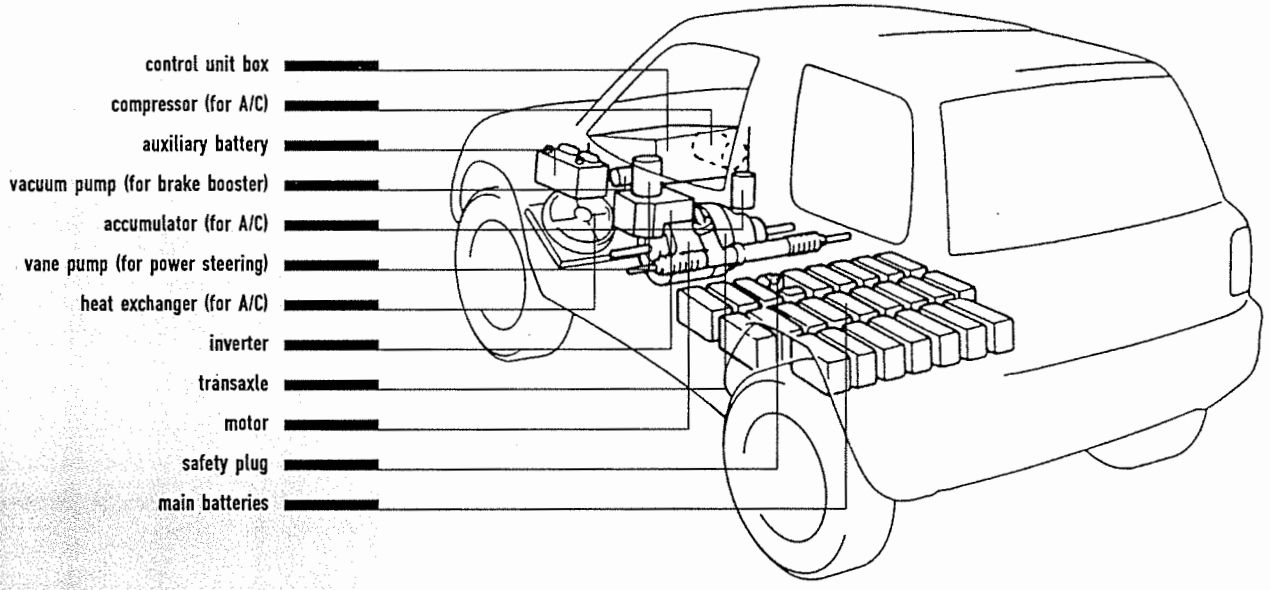
- Independent MacPherson strut front/double-wishbone coil-spring rear

STEERING

- Vehicle-speed sensing electro-hydraulic power steering

BRAKES

- Power-assisted front disc/rear drum brakes with regenerative function



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TOYOTA

TOYOTA

RAV4 EV

The popular RAV4 will soon be available to fleet users as an electric vehicle. The innovative, four-door Toyotas will be among the first mass-produced vehicles to use a state-of-the-art nickel-metal hydride batteries with twice the power of lead-acid batteries. With a combined per charge range of [illegible] miles and an electronically controlled top speed of 79 mph, the RAV4-EV is a serious player in the race for zero emissions.

STANDARD FEATURES

- Front wheel drive, 5-passenger, 4-door wagon
- Dual air bag Supplemental Restraint System (SRS)*
- Fully reclining front and rear seats
- Low-energy heat pump type CFC-free air conditioning
- Power windows, door locks and mirrors
- Deluxe AM/FM stereo with cassette
- * Heated seats (driver and front passenger)
- * Heated and tinted windshield
- Rear window defogger and wiper
- * Control panel with pre-heat and pre-cool cabin function
- Concealed spare tire
- 195/80R15 low rolling resistance steel-belted radial tires
- 50/50 split fold-down (and up) rear seats
- Cold Weather Package available

*Driver and front passenger air bags standard. Driver and front passenger air bags and seatbelt pre-tensioners are only available with the optional Cold Weather Package.



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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In the RAV4-EV, a lightweight and responsive permanent-magnet motor powers the front wheels through a single-speed transaxle. This maintenance-free air-cooled motor is "fueled" by 24 12-volt (288 volts) nickel-metal hydride batteries located under the vehicle's floor.

The on-board charger lets you recharge the batteries using 220-volt household current. With the built-in timer, you can charge conveniently during off-peak hours when electricity is cheapest. ECUs (electronic control units) monitor the charging rate, as well as control the motor output in response to acceleration and braking.

The low rolling resistance tires exclusively developed for EVs, along with the regenerative brake system, convert the kinetic energy of braking into electrical energy, thus increasing the vehicle's single-charge driving range.

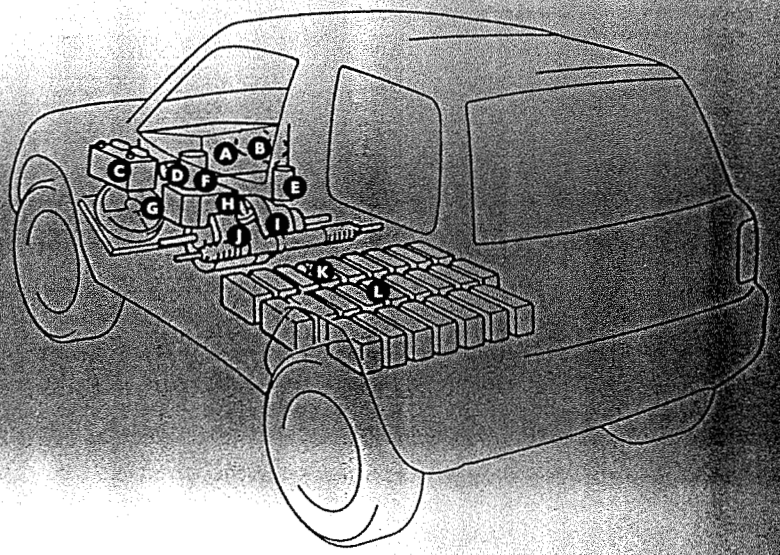






POWERTRAIN	Motor	50-kW, 67 hp @ 2,600-2,800 rpm permanent-magnet
	Transaxle	Single-speed, front-wheel drive
BATTERIES	Type	Sealed nickel-metal hydride, 24 12-volt units; one 12-volt lead-acid auxiliary battery
	Charger	On-board, 220-volt/40-amp conductive with timer
	Recharge time	6-8 hours
PERFORMANCE	City/highway/ combined range	130/106/118 miles per charge**
	Acceleration, 0-60 mph	17 seconds
	Top speed	79 mph (electronically limited)
SUSPENSION	Independent MacPherson strut front/ double-wishbone coil-spring rear	
STEERING	Vehicle speed-sensing electro-hydraulic power steering	
BRAKES	Power-assisted front disc/rear drum ABS brakes with regenerative function	

**Actual range may vary based on driving habits.



- A control unit box
- B compressor (for A/C)
- C auxiliary battery
- D hydraulic brake accumulator
- E accumulator (for A/C)
- F vane pump (for power steering)
- G heat exchanger (for A/C)
- H inverter
- I transaxle
- J motor
- K safety plug
- L main batteries

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TOYOTA

NEWS FROM TOYOTA

PUBLIC AFFAIRS, TOYOTA MOTOR SALES, U.S.A., INC.

FOR RELEASE AFTER 11:00 A.M. (PST), APRIL 10, 1996

TMS-28-96

TOYOTA ANNOUNCES PLAN TO MARKET ELECTRIC-POWERED RAV4 IN 1998

LOS ANGELES, April 10, 1996 -- Toyota Motor Sales, USA (TMS), Inc., today announced plans to market approximately 320 electric-powered RAV4 sport utility vehicles to fleet buyers beginning in 1998.

"The RAV4-EV is at the very top of the electric vehicle development scale in terms of technical advancements and real-world practicality," said George Borst, TMS group vice president, corporate and strategic planning. "It's quiet and smooth, accelerates well, and steers, brakes and handles like a conventional sedan. It offers range, performance, drivability and convenience unsurpassed in the EV arena today."

Toyota's RAV4-EV has been comprehensively tested, and is equipped with an advanced nickel-metal hydride (NiMH) battery pack. Providing performance unavailable from common lead-acid batteries, the Matsushita NiMH battery allows the RAV4-EV to travel at speeds up to 79 MPH and provides the vehicle with a combined city/highway range of 120 miles per charge.

The RAV4-EV's 24 sealed batteries are arranged in a flat configuration and mounted under the floor for a low center of gravity and maximum passenger space. The permanent magnet motor is transversely mounted under the hood.

The RAV4-EV utilizes a 220-volt, 40-amp conductive charging system and carries its charger on-board, eliminating the need for additional equipment. The charger incorporates a timer function allowing the vehicle to be charged during off-peak hours when electricity is least expensive, and automatically turns off when charging is completed.

Toyota announced the first stage of its zero-emission vehicle (ZEV) program on January 22 when it began an in-depth on-the-road monitor test program. The seven-vehicle program, scheduled to last approximately two years, places RAV4-EVs with utility companies in California and New York, and with Toyota test facilities. Because of the varied environments, weather and driving conditions these areas provide, Toyota's

engineers will be able to gather a significant amount of vehicle performance data in a short time.

Toyota's current monitor partners are Southern California Edison, Sacramento Municipal Utility District, Pacific Gas & Electric and Los Angeles Department of Water and Power in California. In New York, Consolidated Edison will be testing Toyota's technology.

The second stage of Toyota's EV program will see RAV4-EVs made available for direct purchase by fleet users. "In these early days of concentrated, large-scale EV use, a single fleet operator can provide the infrastructure support and cooperation needed to refine the end product. By closely monitoring each individual user within these larger fleets, Toyota will develop a useful and reliable customer satisfaction data base," said Borst. "With the information gained from this fleet use, we will be able to bring our EV program closer to the level that Toyota owners have come to expect from our products."

In what could be described as the ultimate test of a vehicle -- racing -- the RAV4-EV has excelled. Winning the 1995 Scandinavian Electric Car Rally, the RAV4-EV beat 26 other vehicles representing ten nations. Featured in the event were vehicles from Toyota, Ford, GM, Renault and Volvo, making this the first truly international electric vehicle rally.

In 2003, the Memorandum of Agreement between the California Air Resources Board and automakers calls for ZEVs to represent ten percent of total California sales. "The MOA is a significant cooperative effort designed to benefit consumers, regulators, manufacturers and -- most importantly -- the environment. What we have now is a logical, more realistic path to achieving a common goal. A path that should allow battery technology sufficient time to catch up. I strongly believe that given the additional time, there is greater potential to build a product that the market will embrace," said Borst. "Although I can't tell you for sure what product we will sell in 2003, I CAN tell you that the vehicle we sell will be the right product, at the right time, at the right price and with Toyota quality, dependability and reliability."

TOYOTA RAV4-EV SPECIFICATIONS:

Length:	156 in.
Width:	67 in.
Height:	66 in.
Weight	3,373 lb.
Seating Capacity:	4
Motor:	Permanent Magnet
Transmission:	Single Speed
Braking:	Front Disc/Rear Drum (Hydraulic) with Integrated Regenerative System
Battery:	Nickel-Metal Hydride
Approx. Battery Life:	6-8 years
Maximum Speed:	79 MPH (Electronically limited)
Maximum Range:	130 miles (City) 106 miles (Highway) 118 Miles (City/Highway combined)

Contact: Toyota Motor Sales, USA, Inc.
John Hanson/Jeremy Barnes (310) 618-4718/7728



Honda EV (Electric Vehicle) The Honda EV is a four-passenger automobile powered by nickel-metal hydride (Ni-MH) batteries, the first production electric vehicle to use this advanced battery technology. Designed to perform well in both normal urban traffic and freeway driving conditions, the Honda EV has a range of 125 miles.

HONDA

NEWS

American Honda
Motor Co., Inc.

FOR MORE INFORMATION CONTACT:
Kurt Antonius (310) 783-3170
Chris Marshall (310) 783-3164

For Immediate Release:

AMERICAN HONDA UNVEILS ELECTRIC VEHICLE

TORRANCE, Calif., — American Honda Motor Co., Inc. unveiled the Honda EV, a purpose-built electric vehicle, which operates on advanced nickel-metal hydride batteries (Ni-MH).

American Honda plans to lease the Honda EV to both fleets and individual consumers in California, beginning in the spring of 1997. Honda plans to lease approximately 300 electric vehicles over the next few years through select Honda dealers initially within Southern California and Sacramento.

Honda will offer a "turn-key" lease program that will cover such major items as maintenance, insurance, roadside assistance and battery replacement.

"The Honda EV offers one of the highest levels of electric vehicle practicality and refinement in the world," said Mr. Watanabe, president of Honda R&D, North America. "The announcement of the Honda EV is another step in Honda's ongoing commitment to preserving and improving the environment and to developing clean vehicles using various energy sources that meet consumers' needs."

The Honda EV (Electric Vehicle) is a four-passenger automobile powered by nickel-metal hydride batteries, the first production electric vehicle to take advantage of this advanced battery technology, which greatly improves range.

The Honda EV is not a conversion of an existing automobile, and over 95 percent is composed of all-new components.

- more -

With a goal of obtaining a balance between driveability and range, the Honda EV was designed to perform well in both urban traffic and freeway driving conditions. Based on the standard FUDS (Federal Urban Driving Schedule), a government test designed to simulate city driving, the Honda EV has a range of 125 miles. It accelerates from 0 to 60 mph in 18.7 seconds, and has a top speed of over 80 mph.

In addition to meeting all Federal Motor Vehicle Safety Standards (FMVSS), the Honda EV is equipped with numerous standard features that include regenerative braking and anti-lock brakes, dual airbags, heat-pump type climate control system, multi-function remote keyless entry, CD-audio system, power windows, doorlocks and mirrors, electric power steering and high performance, energy-efficient projector type headlamps.

For recharging, the Honda EV is equipped with a compact on-board charger, capable of recharging at 110 or 220 volts.

By introducing the EV in spring 1997, Honda is addressing the memorandum of agreement with the California Air Resources Board (CARB) a year early. This agreement establishes a technology development partnership between the Board and Honda, to put advanced technology battery vehicles on California roads beginning in 1998. CARB has established partnerships with seven auto manufacturers.

# # #

Photography is also available through the Wieck Photo Database at (214) 392-0888

HONDA NEWS

American Honda
Motor Co., Inc.

HONDA EV (ELECTRIC VEHICLE) FACT SHEET

	FEATURE/EQUIPMENT		SPECIFICATION
VEHICLE SIZE	Overall Length (mm)		4,045
	Overall Width (mm)		1,750
	Overall Height (mm)		1,630
	Wheel Base (mm)		2,530
	Track Front/Rear (mm)		1,500/1,490
	Curb Weight (kg)		1,630
	Drive Train		Front Wheel Drive
	Number of Occupants		4
POWER PLANT	Voltage (V)		288
	Motor	Type	DC Brushless
		Power (Continuous)	49Kw @ 8,750 rpm
		Torque	275Nm @ 1,700 rpm
	Battery	Type (12V)	12V sealed Ni MH
		Modules	24
	Charger	Input Voltage Output	AC 110/220V 1.1Kw/4.2Kw
		Type	On-Board (Conductive)
		Recharge Time (20 to 100% state of charge)	8 Hours (220V)
	Transmission		Single-speed
VEHICLE SYSTEMS	Suspension	Front/Rear	Strut/Torsion beam
	Steering		EPS Rack and Pinion
	Air Bags		Driver and Passenger Side
	Tire	Size (Front and Rear)	195/65, R-14 (EV tire)
		Pressure (kPa)	300 (44 psi)
	Brake Assist		Power Vacuum
	Regenerative Braking		Equipped
	Anti-Lock Braking System (ABS)		Equipped
	Air Conditioning (Heat pump type)		Equipped
	Audio System (AM/FM/CD)		Equipped
PERFORMANCE	Drive Range (FUDS mode) - miles		125 (100% depth of discharge)
			100 (80% depth of discharge)
	0 - 60 MPH Acceleration (Sec)		18.7
	Maximum Speed (MPH)		Over 80

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HONDA NEWS

American Honda
Motor Co., Inc.

1996 HONDA CIVIC MODELS
FIRST TO RECEIVE LEV CERTIFICATION

TORRANCE, Calif., — Several models of the all-new 1996 Honda Civic have received "Low Emission Vehicle" (LEV) certification from the California Air Resources Board and the Environmental Protection Agency, the first mass-produced, gasoline-powered vehicles to achieve this stringent California emission standard, American Honda Motor Co., Inc., announced in August, 1995.

The LEV-certified Civics reduce emission levels by more than 50 percent from 1995 model year California standards. By the year 2000, fleet average emissions of all auto makers selling cars in California must meet LEV levels.

The new 1.6-liter, 16-valve, SOHC engine, built at Honda's Anna Engine Plant in Ohio, provides improved performance and excellent fuel economy. The Civic LEV is produced at the East Liberty, Ohio, Auto Plant and Alliston Auto Plant in Ontario, Canada. The models receiving LEV certification include all Civic DX and LX Sedans, DX and CX Hatchbacks and DX Coupes sold in California.

The Civic LEV engine uses a combination of more accurate electronic control of the air/fuel ratio, a close-coupled, fast warm-up catalyst (without the use of an electric heater) and a new "tumble port" cylinder head design.

Compared to the engine it replaces, the LEV engine boasts an increase of four horsepower to 106-horsepower and increases torque to 103 lb.-ft. at 4600 rpm from 98 lb.-ft. at 5000 rpm. LEV-certified cars equipped with a 5-speed manual transmission earned an EPA city/highway rating of 33/40 mpg and 31/38 mpg when equipped with an automatic transmission.

# # #

Photography is available from the Wieck Photo Database at (214) 392-0888.

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SPECIFICATIONS AND DIMENSIONS/ FEATURES AND STANDARD EQUIPMENT

Civic (LEV) Low Emissions Vehicles

Engine	Civic DX Sedan	Civic LX Sedan	Civic CX Hatchback	Civic DX Hatchback
Type: Aluminum-Alloy In-Line 4, Transverse-Mounted LEV	■	■	■	■
Displacement (cc)	1590	1590	1590	1590
Horsepower @ rpm (SAE net)	106 @ 6200	106 @ 6200	106@ 6200	106@ 6200
Torque (lb.-ft. @ rpm)	103 @ 4600	103 @ 4600	103 @ 4600	103 @ 4600
Compression Ratio	9.4:1	9.4:1	9.4:1	9.4:1
Valve Train: SOHC 16-Valve	■	■	■	■
Fuel System: Multi-Point Programmed Fuel Injection	■	■	■	■
Ignition System: Electronic	■	■	■	■
Drivetrain				
Type: Front-Wheel Drive	■	■	■	■
Manual Transmission: 5-Speed	■	■	■	■
Automatic Transmission: 4-Speed (available)	■	■	■	■
Final Drive Ratio (MT/AT)	4.06/4.36	4.06/4.36	3.72/4.36	3.72/4.36
Body/Suspension/Chassis				
Body Type: Unit Body	■	■	■	■
Suspension: 4-Wheel Double Wishbone	■	■	■	■
Front Stabilizer Bar (mm)	NA	22.0	NA	NA
Steering Type: Power Rack-and-Pinion	■	■	Power w/AT	Power w/AT
Turning Diameter, Curb-to-Curb (ft.)	32.8	32.8	32.8	32.8
Power-Assisted Front Disc/Rear Drum Brakes	■	■	■	■
Anti-Lock Braking System (ABS)	NA	Available	NA	NA
Wheels	13" w/Center Caps	14" w/Full Covers	13" w/Center Caps	13" w/Center Caps
Tires: All-Season	P175/70 R13	P185/65 R14	P175/70 R13	P175/70 R13
Exterior Dimensions				
Wheelbase (in.)	103.2	103.2	103.2	103.2
Length (in.)	175.1	175.1	164.5	164.5
Height (in.)	54.7	54.7	54.1	54.1
Width (in.)	67.1	67.1	67.1	67.1
Track (in., front/rear)	58.1/58.1	58.1/58.1	58.1/58.1	58.1/58.1
Curb Weight (lbs., MT/AT)	2319/2370	2387/2438	2238/2304	2253/2319
Interior Dimensions				
Headroom (in., front/rear)	39.8/37.6	39.8/37.6	38.8/37.2	38.8/37.2
Legroom (in., front/rear)	42.7/34.1	42.7/34.1	42.7/34.1	42.7/34.1
Shoulder Room (in., front/rear)	52.4/51.8	52.4/51.8	52.4/51.8	52.4/51.8
Hiproom (in., front/rear)	50.0/49.3	50.0/49.3	50.0/49.3	50.0/49.3
Usable Cargo Volume (cu. ft.)	11.9	11.9	13.4	13.4
Interior Passenger Volume (cu. ft.)	89.8	89.8	86.1	86.1
Capacities				
Engine Oil with Filter (qt.)	3.5	3.5	3.5	3.5
Fuel (gal.)	11.9	11.9	11.9	11.9
Cooling System (qt., MT/AT)	4.4/4.3	4.4/4.3	4.4/4.3	4.4/4.3

NA=Not Applicable

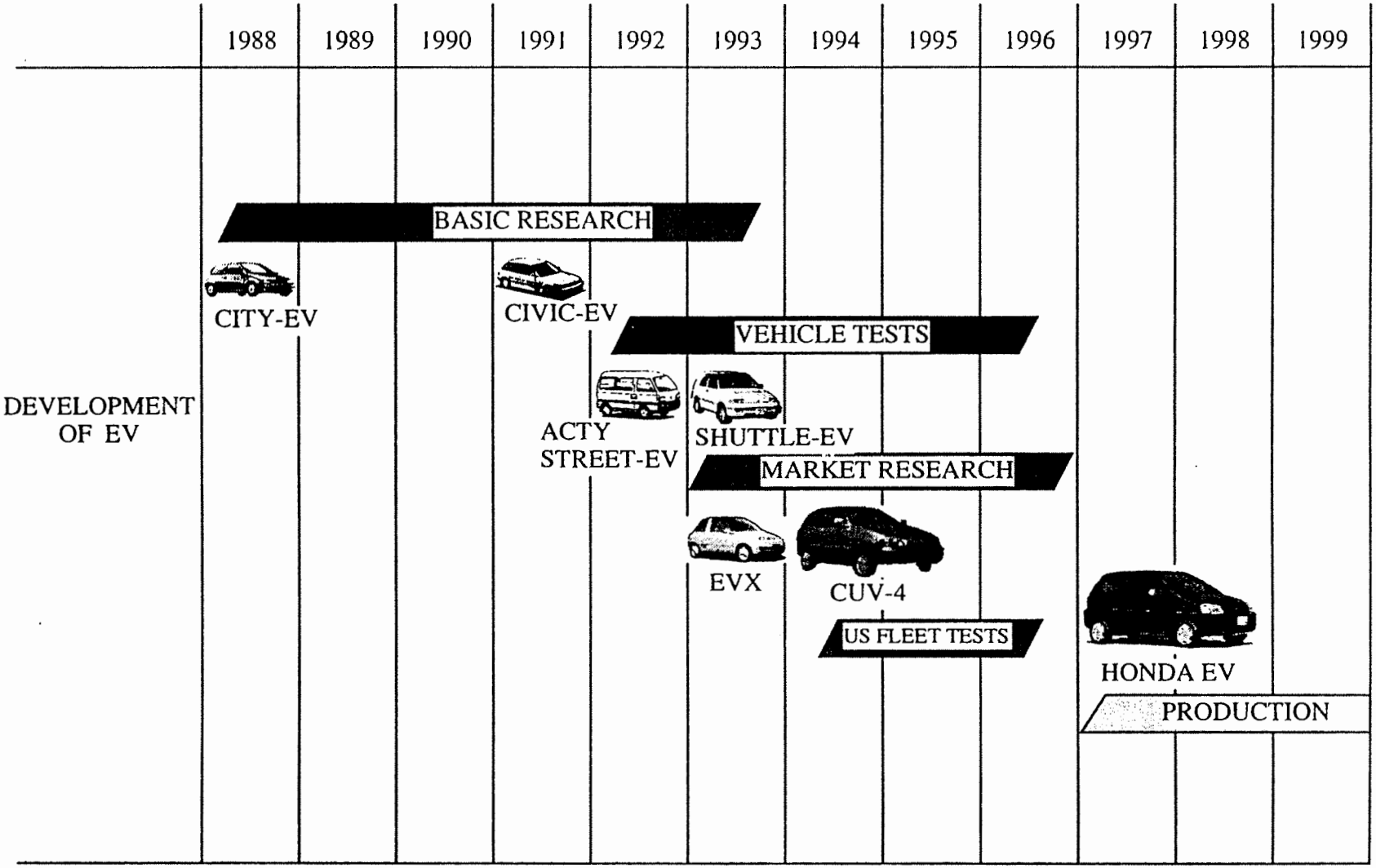
SPECIFICATIONS AND DIMENSIONS/ FEATURES AND STANDARD EQUIPMENT

Civic (LEV) Low Emissions Vehicles

Exterior Features	Civic DX Sedan	Civic LX Sedan	Civic CX Hatchback	Civic DX Hatchback
Power Moonroof with Tilt Feature				
Rear Window Wiper/Washer				■
Impact-Absorbing Body-Colored Bumpers	■	■	■	■
Body Side Moulding	■	■	■	■
Dual Manual Remote-Operated Mirrors	■		■	■
Dual Power Mirrors		■		
Chrome Side Window Trim		■		
Interior Features				
Dual Airbags (SRS)	■	■	■	■
Air Conditioning	Option	Option	Option	Option
AM/FM High-Power Stereo with Clock	4x20-Watt	4x20-Watt	Option	Option
Remote Entry System		Option		
Power Windows and Door Locks		■		
Cruise Control		■		
Tachometer		■		
Trip Odometer	■	■	■	■
Adjustable Steering Column	■	■		■
Removable Cargo Area Cover			Option	■
Front Center Armrest with Storage Compartment	Option	■		
Beverage Holder	■	■	■	■
2-Speed/Intermittent Windshield Wipers	■	■	■	■
Front 3-Point Seat Belts	■	■	■	■
Adjustable Front Seat Belt Anchors	■	■		
Rear 3-Point Seat Belts with Center Lap Belt	■	■	■	■
Reclining Front Seatbacks	■	■	■	■
Fold-Down Rear Seatback	60/40 w/Lock	60/40 w/Lock	50/50	50/50
Remote Fuel Filler Door Release	■	■	■	■
Remote Trunk/Hatch Release	w/Lock	w/Lock	■	■
Maintenance Interval Indicator	■	■	■	■
Low-Fuel Warning Light	■	■		■
Low-Oil Warning Light	■	■	■	■
Headlights-On Reminder	■	■	■	■
Trunk/Hatch Open Warning Light	■	■	■	■
Rear Window Defroster with Timer	■	■	■	■
Cargo Area Light		■		
Seatback Pocket		■		■
Auto-Locking Seat Belt Retractors	■	■	■	■
Dual Vanity Mirrors	■	■	■	■
Child-Proof Rear Door Locks	■	■		
EPA Mileage Estimates*				
City/Highway (5-Speed Manual)	33/38	33/38	33/38	33/38
City/Highway (4-Speed Automatic)	29/36	29/36	29/36	29/36

**Mileage figures shown for comparison only. Actual mileage may vary.*

HISTORY OF HONDA EV DEVELOPMENT



HONDA *EV*

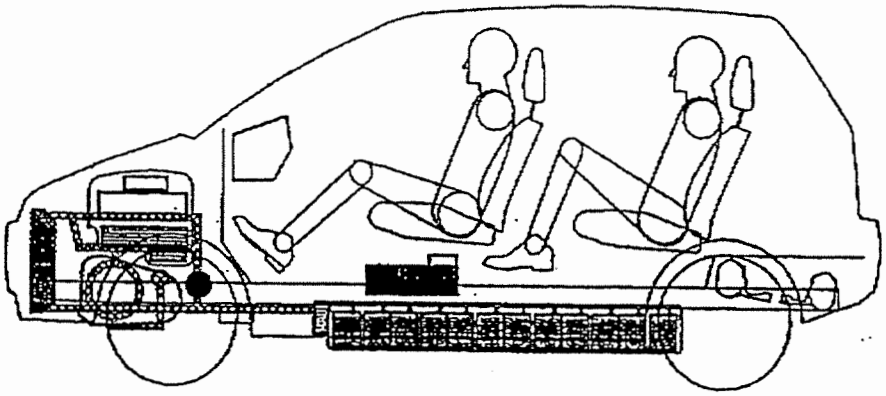
Features

- Regenerative Braking
- Anti-Lock Brakes System (ABS)
- Dual Airbags (driver and passenger)
- EPS Rack and Pinion Steering
- Two-way Remote Communicator
  (Security On/Off; Battery Status; Pre-Heat/Pre-Cool)
- Power Windows, Doorlocks and Mirrors
- AM/FM/CD Audio System

Specifications

- 24 X 12V Nickel Metal Hydride (NiMH) Batteries
- 49kW DC Brushless Motor
- On-board 220V/30Ah Charger (conductive type)
- 8 hour Recharge time (20% to 100% state of charge)
- Meets all applicable Federal Motor Vehicle Safety Specifications
- Single Speed Transmission

System Layout



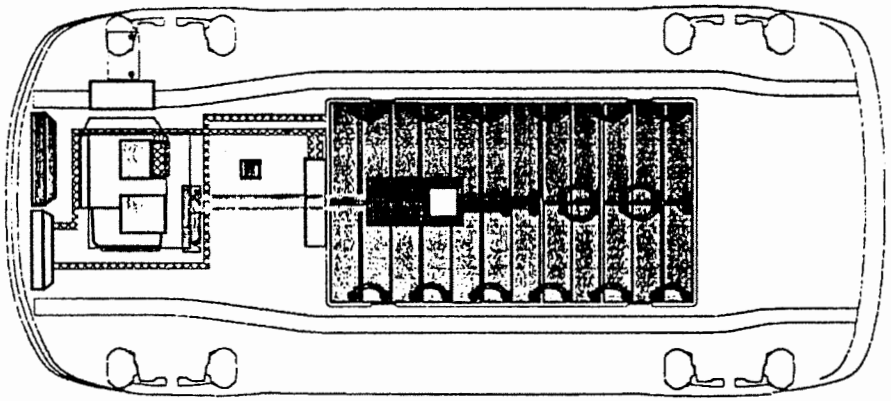
Performance

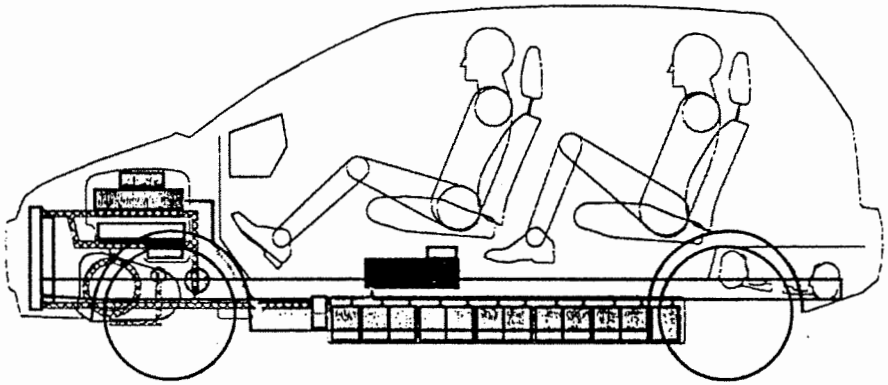
Driving Range	125 miles (FUDS to 100% depth of discharge) 100 miles (FUDS to 80% depth of discharge)
Top Speed	80 mph+
0 to 60 MPH	18.7 seconds

BASIC LAYOUT

4 PASSENGER VEHICLE

* PASSENGER SPACE SEPARATE FROM THE POWER DRIVETRAIN.
* LOW CENTER OF GRAVITY. (BATTERY-PACK IS MOUNTED UNDENEATH THE VEHICLE).
* HIGH & FLAT FLOOR.
* ONE CONSOLIDATED PACKAGE FOR ALL ELECTRICAL PARTS.
* FRONT - WHEEL DRIVE.

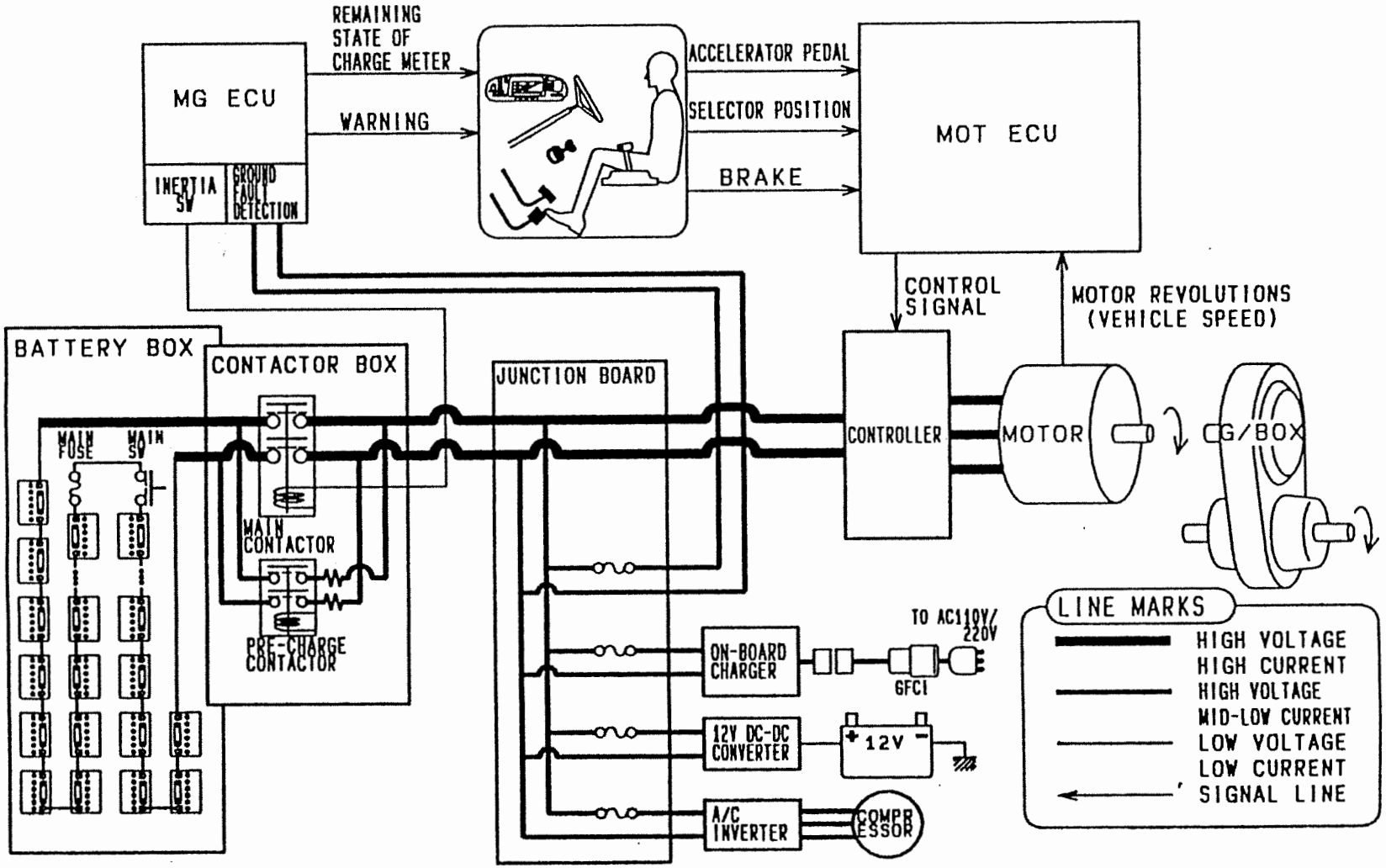




SYSTEM

Running - Turning - Stopping ➡ **Totally electrically controlled**

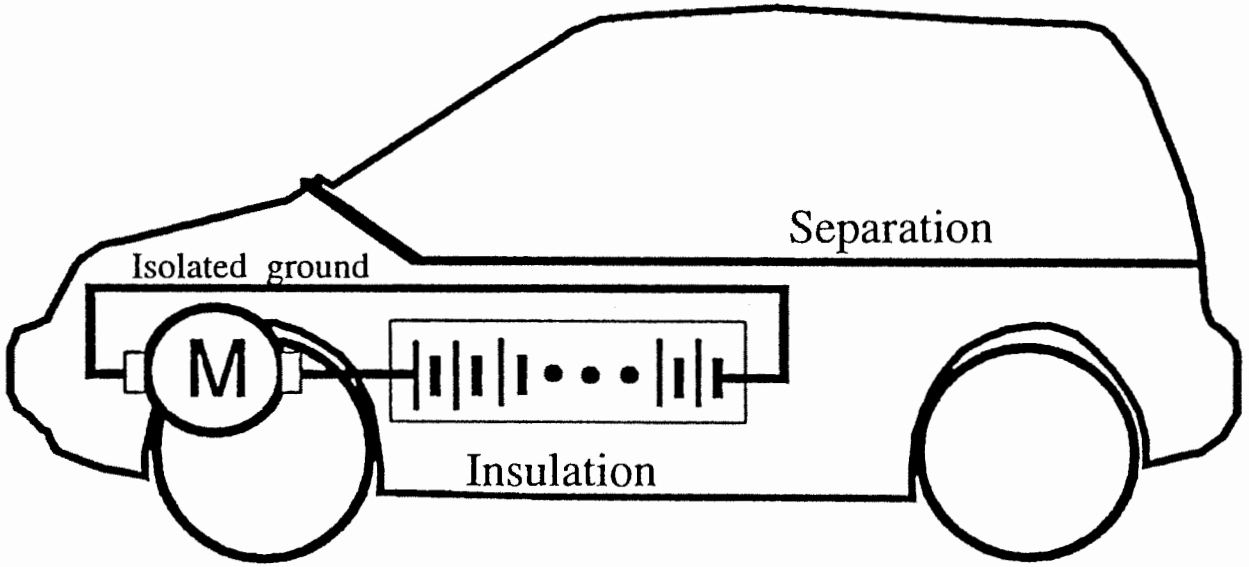
For passenger's safety ➡ **Insulating structure isolates high voltage circuits**



SAFETY CONCEPT

Crash Safety

Crash performance is equivalent to conventional vehicle



Intelligent Crash/Fault Detection

Collision ⇨ Automatic shut off

Electrical faults ⇨ Warning

Triple Protection System

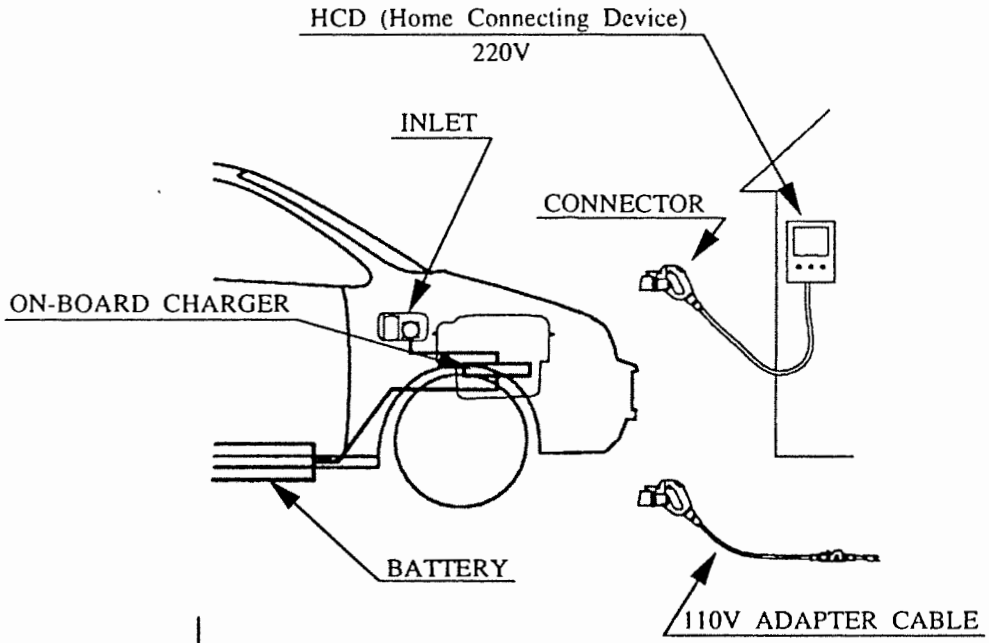
Separation

Insulation

Isolated ground

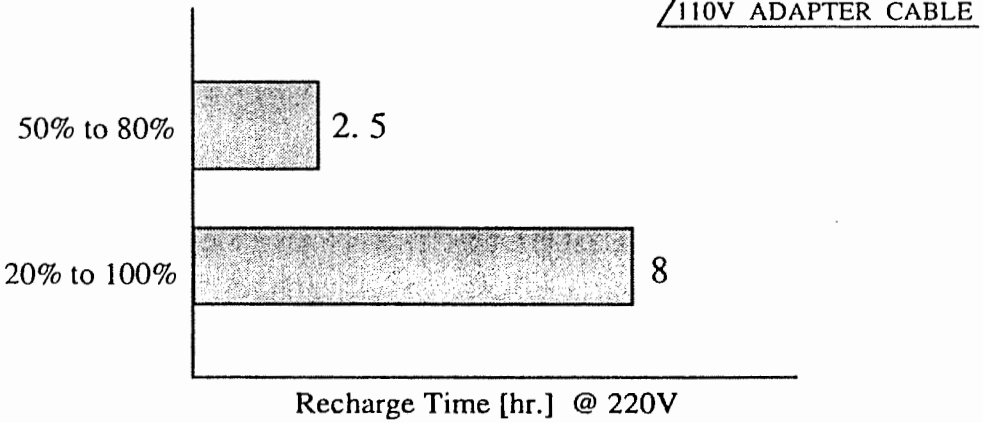
RECHARGE SYSTEM

* Convenient charge system.
* Intelligent on-board charger.



ON-BOARD CHARGER SPECIFICATIONS

ITEM	SPECIFICATIONS
INPUT VOLTAGE	220V / 110V
OUTPUT	4.2Kw / 1.1Kw
CONTROL MODE	Fixed Voltage / Fixed Current



HONDA DESIGNED POWER DRIVETRAIN

MOTOR

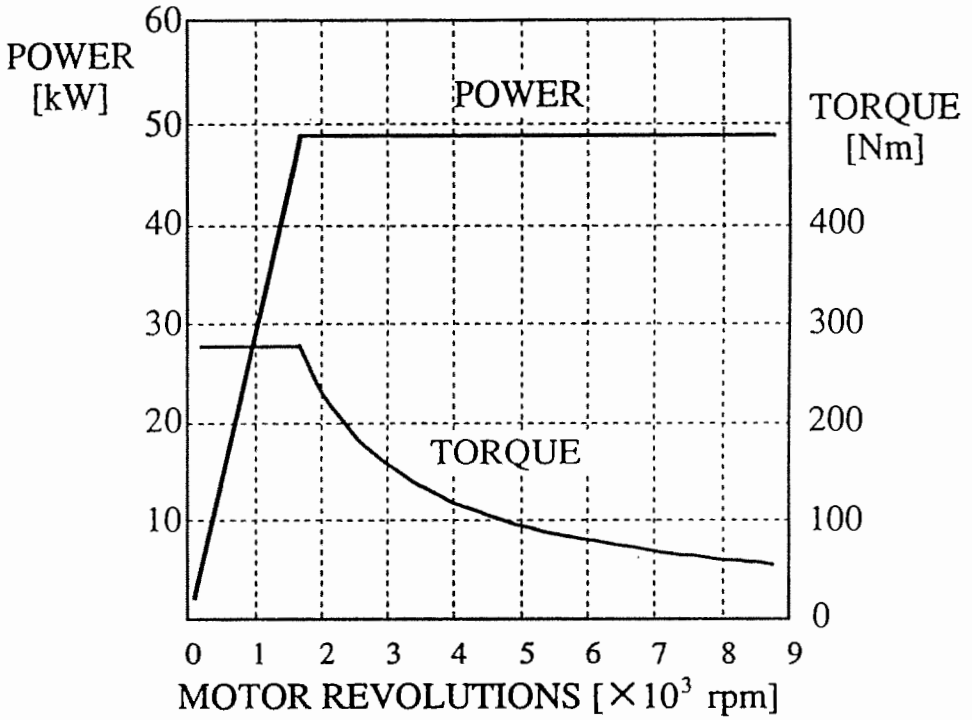
* High efficiency DC-brushless motor.
* Permanent magnet.
* Liquid cooled (Continuous peak power available).

POWER CONTROL UNIT

* Pulse width moduration (IGBT) controller.
* Fully integrated systems.
  (Motor ECU, Management ECU, Charger, etc)
* Liquid cooled.

TRANSMISSION

* Single speed reduction gear.
* Parking lock system.
* High efficiency (> 96%).



Power (max.)	49 Kw / 8750rpm
Torque (max.)	275Nm / 1700rpm
Weight (Kg)	Motor : 44 Transmission : 24 Controller : 18
Maximum Efficiency (%)	96 (Motor & controller)

HONDA NEWS

American Honda
Motor Co., Inc.

HONDA FIRST TO HAVE GASOLINE ENGINE VERIFIED AT ULEV EXHAUST LEVELS

TORRANCE, Calif., — Honda is the first manufacturer to develop a production-based gasoline engine that has been tested and verified by the California Air Resources Board (CARB) as meeting Ultra Low Emission Vehicle (ULEV) exhaust levels, American Honda Motor Co., Inc., announced in January, 1995.

The engine reduces emissions by over 80 percent compared to current manufacturers fleet average requirement. By the year 2000, it will be necessary for auto manufacturers selling cars in California to have vehicles meeting ULEV levels in their fleets.

"Honda has exceeded our expectations by achieving ultra-low emissions before our requirements apply," said Tom Cackette, CARB deputy chief executive officer. "The Accord is the cleanest such pre-production automobile we have ever tested."

The 2.2-liter, 4-cylinder Honda ULEV engine is undergoing testing in an Accord prototype and features technological improvements in Honda's patented VTEC engine design, a fast warm-up catalytic converter and significant advancements in precise computer control. The engine will produce about the same horsepower and torque as the current model, and provide the same or slightly better fuel economy.

Honda expects to begin selling vehicles equipped with the ULEV engine in California in late 1997 as a '98 model, more than two years before manufacturers will need to offer ULEVs in their fleets.

The CARB tests were conducted using California Phase II reformulated gasoline.

# # #

Photography is available from the Wieck Photo Database at (214) 392-0888.

1919 Torrance Boulevard • Torrance, California 90501-2746 • Telephone (310) 783-3170 • Fax (310) 783-3622

HONDA NEWS

American Honda
Motor Co., Inc.

ULEV PROTOTYPE
FACT SHEET

SYSTEM	FEATURE	ULEV PROTOTYPE	ACCORD EX
ENGINE	Type	Alluminum Alloy VTEC	Alluminum Alloy VTEC
	Displacement (cc)	2156	2156
	Bore & Stroke (mm)	85.0 x 95.0	85.0 x 95.0
	Horsepower @ RPM	137 @ 5,500	145 @ 5,500
	Torque (lb-ft @ RPM)	138 @ 4,500	147 @ 4,500
	Compression Ratio	9.4:1	8.8:1
	Valve Train	SOHC 16-valve	SOHC 16-valve
DRIVETRAIN	Type	Front-wheel Drive	Front-wheel Drive
	Transmission	4-Speed, Automatic	4-Speed, Automatic
WEIGHT	Curb Weight (lbs)	3,090	3,075
CATALYTIC CONVERTER	Exhaust Manifold Type	4-1 Tournament	4-2-1 Dual
	Catalyst Type	Close-coupled + Underfloor 2 Bed	Underfloor
	Catalyst Size	Close-Coupled: 1.0 liter Underfloor: 1.7 liter 400 Cell	Underfloor: 1.72 liter 300 Cell
	Catalyst Metal Loading Mass	Pt:Pd:Rh = 3:10:1	Pt:Pd:Rh = 3:5:1
ELECTRONICS	A/F Control System	LAF + MID O2 Feed Back	O2 Feed Back
	O2 Sensor	Heated O2 after C.C. CAT.	Heated O2 Sensor before U.F. CAT.
	LAF Sensor	LAF before C.C. CAT.	-
	EGR System	Electronic EGR VLV	Pneumatic with Life Sensor

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HONDA

NEWS

American Honda
Motor Co., Inc.

HONDA CIVIC NATURAL GAS VEHICLE

TORRANCE, Calif. — Honda will start mass production of a natural gas-powered Civic beginning with the 1998 model year, American Honda Motor Co., Inc., announced in October, 1995.

Based on the gasoline-powered Civic, the Civic Natural Gas Vehicle (NGV) will run exclusively on natural gas, and have a "real world" driving range of 200-250 miles, about 70 percent of the gasoline model. It will be manufactured in North America.

The Civic NGV will have the same exterior and interior design and features of its popular gasoline-powered counterpart. In addition, it will meet California's stringent ULEV (Ultra Low Emission Vehicle) standards.

"Honda is committed to developing future technologies that preserve the environment and use available resources," said Robert Bienenfeld, Honda's Alternative Fuel Task Force Manager. "Natural gas is an ideal alternative fuel because it's abundant, it's domestically produced and it's extremely clean-burning."

The Civic NGV is primarily intended for the fleet market, including government and natural gas utility fleets, which are covered by the 1992 Energy Policy Act requiring alternative fuel vehicles purchases.

Honda's first natural gas vehicle was an Accord concept vehicle introduced in 1993. In 1995, Honda produced a fleet of Civic Sedan natural gas prototypes for evaluation by various fleet and utility companies across the country, including Pacific Gas and Electric Company, Southern California Gas Company, Atlanta Gas Light Company, Washington Gas Light Company (D.C.), Brooklyn Union Gas Company and Columbia Gas Distribution Companies (Ohio, Pa., Ky., Md. and Va.).

# # #

Photography is available from the Wieck Photo Database at (214) 392-0888

HONDA NEWS

American Honda
Motor Co., Inc.

HONDA CIVIC SEDAN
NATURAL GAS VEHICLE
FACT SHEET

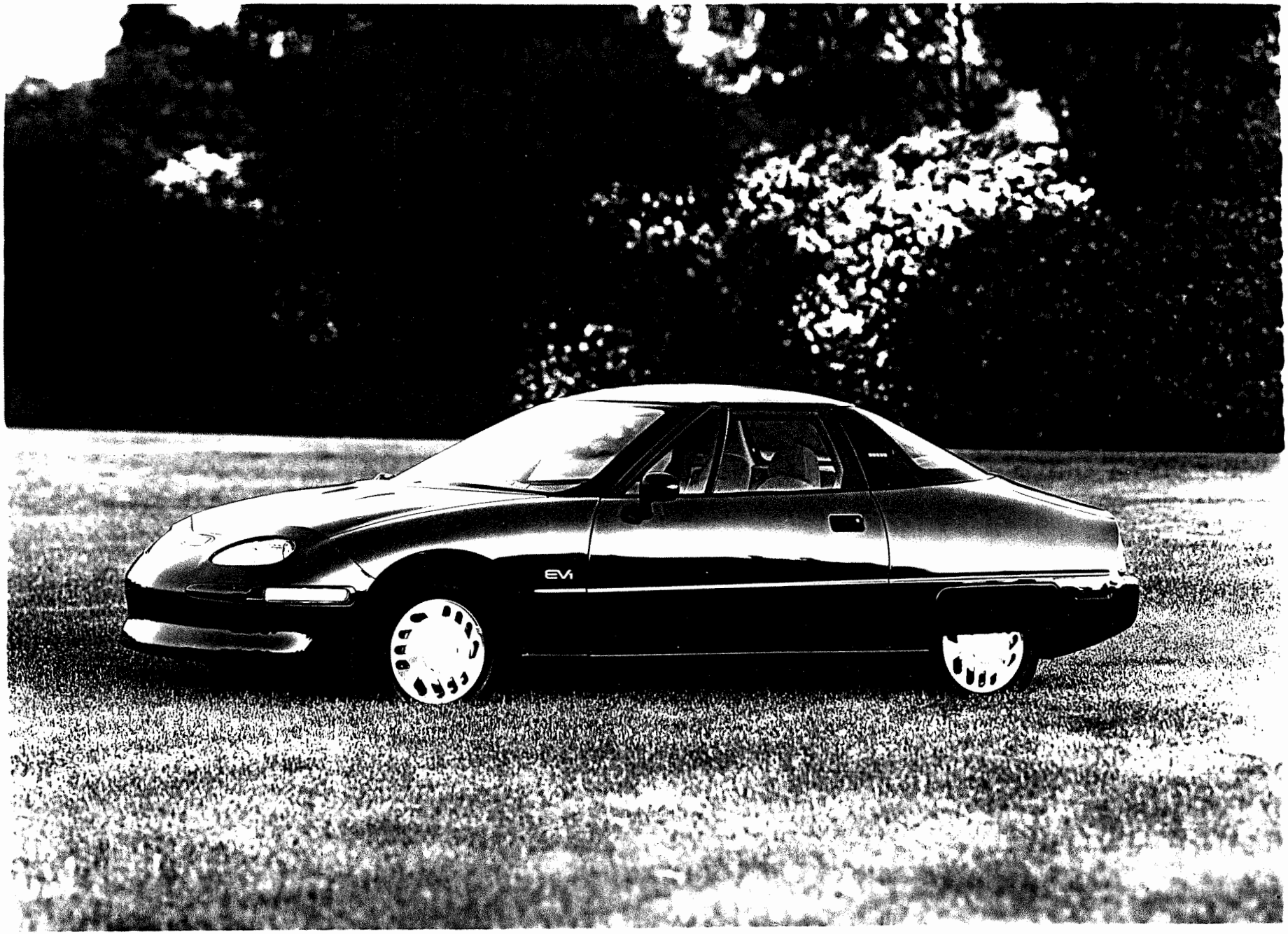
SYSTEM	FEATURE	CIVIC DX-NGV
FUEL	Fuel Type (Octane Ratings)	Compressed Natural Gas (130 Octane)
	Gallons (Gasoline equivalent)	7.4
	Fuel Pressure	3,000 psi
FUEL ECONOMY	Combined City/Highway	36.6
	Range to Empty	271*
ENGINE	Type	Alluminum Alloy In-Line 4
	Displacement (cc)	1493
	Horsepower @ RPM	110 @ 6,800
	Torque (lb-ft @ RPM)	88.5 @ 5,500
	Compression Ratio	12.5:1
	Valve Train	SOHC 16-valve
	Fuel Injection	Multi-Port Injection
	3 Way Catalyst	CNG Type
DRIVETRAIN	Type	Front-wheel Drive
	Transmission	4-Speed, Automatic
	Final Drive Ratio	4.33
TIRES	Size	P185/60, R-14
WEIGHT	Curb Weight (lbs)	2,635
EMISSIONS TARGET	Vehicle Category (CARB)	ULEV
	Hydrocarbons (grams/mile)	0.04
	Carbon Monoxide (grams/mile)	1.7
	Nitrous Oxides (grams/mile)	0.2

* "Real World" range is approximately 200+ city and 225+ highway.

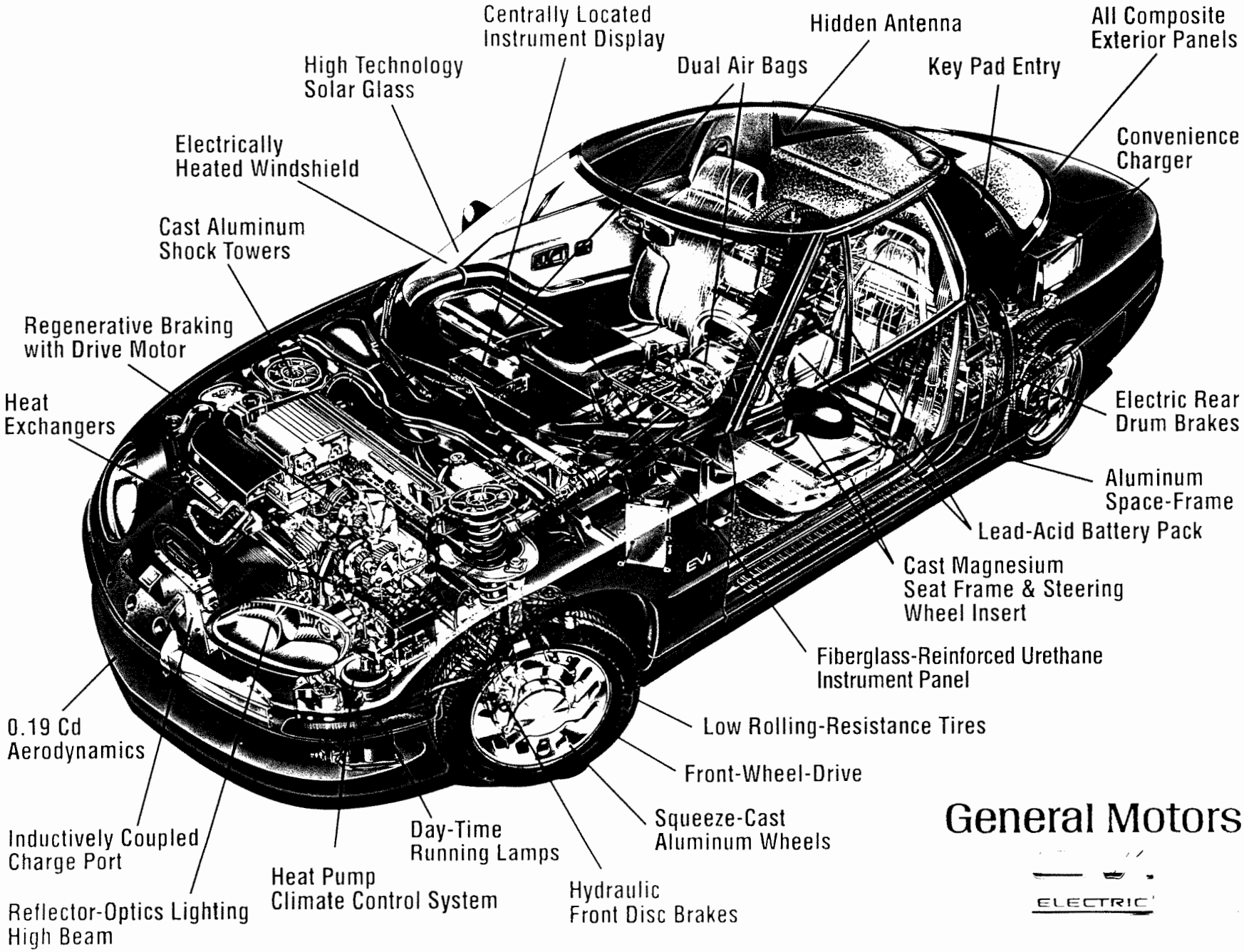
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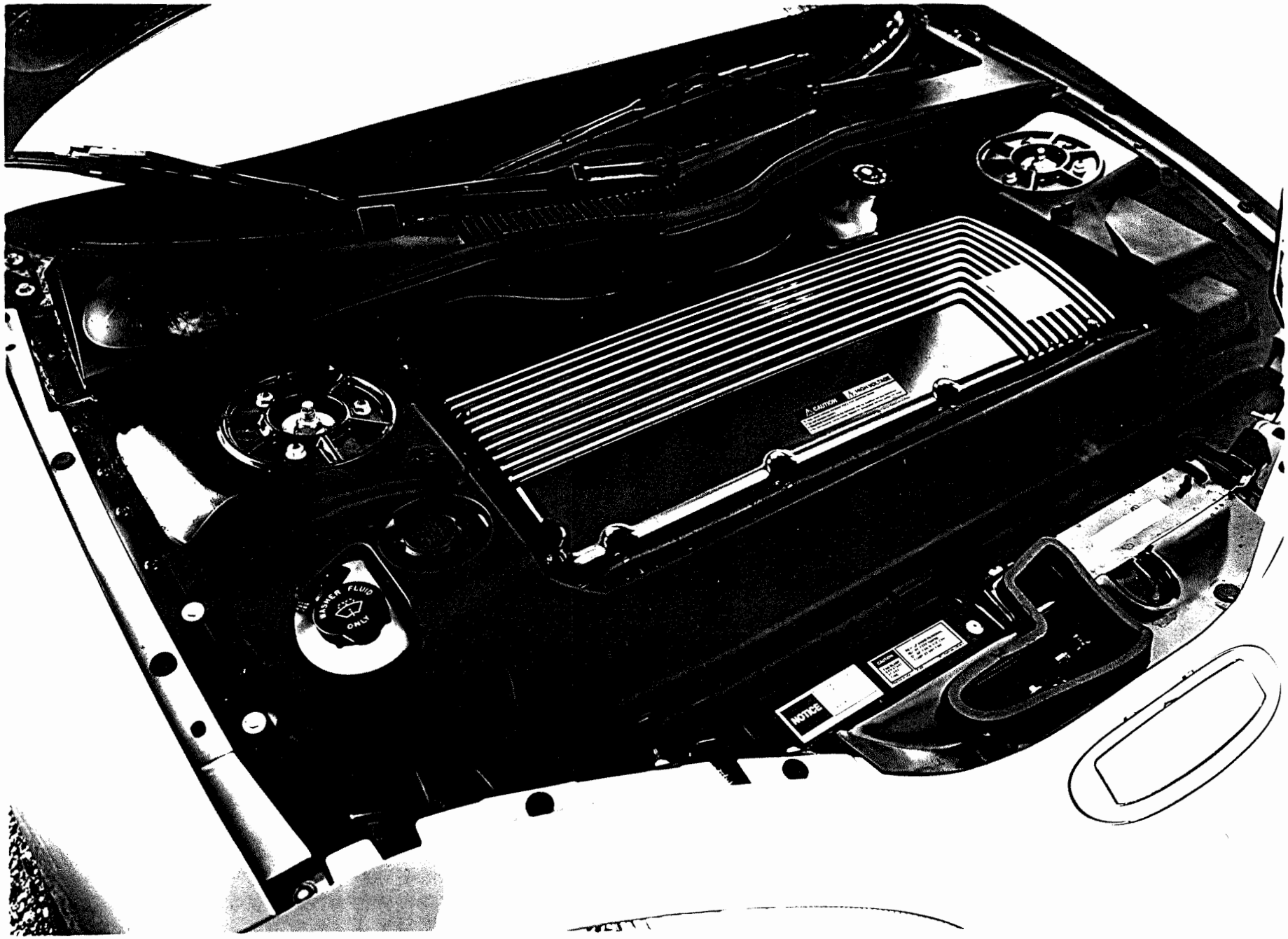
GENERAL MOTORS EV1



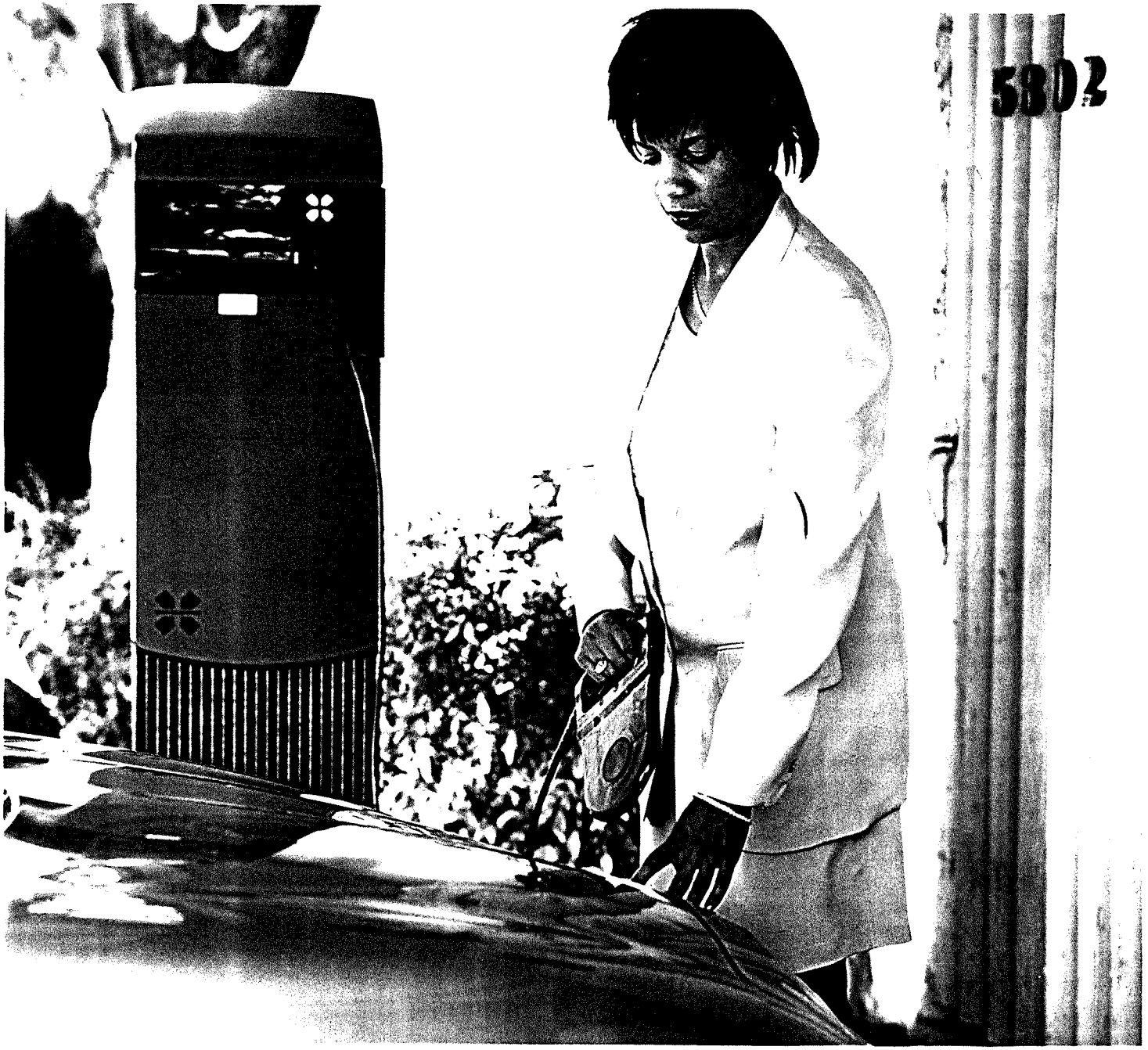
GENERAL MOTORS EV1



EV1 CALLOUTS



EV1 UNDERHOOD



EV1 PUBLIC CHARGING





EV1 INTERIOR

SATURN

ADVANCED TECHNOLOGY VEHICLES

August 22, 1996

To Our Media Friends:

Saturn and General Motors Advanced Technology Vehicles are tremendously excited about presenting to you the 1997 EV1 -- the first specifically designed electric passenger vehicle in modern times.

We feel the product is a symbol of GM's commitment to technological and environmental leadership. It also represents the first product in a portfolio of high-technology products GM will be bringing to market in the years ahead.

The EV1 represents the design, engineering and manufacturing work of many partnerships within the Corporation. As never before, the total resources of GM were brought to bear in developing this revolutionary car.

There are innovations in technology, design, processing and materials in the EV1 that create an entirely new class of automotive transportation -- a product which is focused on energy efficiency and environmental compatibility.

We hope this press kit can begin to capture the broad reach of this new product, and help provide an insight into GM's leadership role as an innovative technology company.

Please note that all information found in the "Marketing" section carries an embargo date of August 26, 1996. All other information is available for immediate release.

As always, feel free to call on us for further assistance.

Bob Tripolsky
Saturn Communications

(810) 528-6122

Dick Thompson
GMATV Communications

(810) 680-5537

GM ELECTRIC VEHICLE MEDIA CONTACTS

GM UNIT	*CONTACT*	*PHONE / FAX*
General Motors Corporation		
State & Federal Regulations :	Bill Noack	(202) 775-5008 / (202) 775-5095
	Tom Pyden	(202) 775-5015 / (202) 775-5095
	Sharon Sarris	(805) 373-9572 / (805) 373-9648
Environmental & Energy :	Betsy Hemming	(313) 556-6990 / (313) 556-2644
GM Advanced Technology Vehicles		
Vehicle Engineering & Manufacturing :	Dick Thompson	(810) 680-5537 / (810) 680-5131
Saturn Corporation		
EV1 Sales, Service & Marketing :	Jim Farmer	(810) 524-5721 / (810) 528-6174
	Bob Tripolsky	(810) 528-6122 / (810) 528-6174
	Necole Merritt	(805) 373-9748 / (805) 373-9648

(med-cont)
05/20/96

ADVANCED TECHNOLOGY VEHICLES

1997 GM EV1 Features

STANDARD FEATURES

26 - 53 ampere-hour Valve Regulated Lead-Acid (VRLA) Modules in Series (312 volts)
Ambient, Forced-Air Battery Thermal System
1.2 kW Convenience Charger
3-Phase, AC Induction Motor
Dual Reduction, Fixed Ratio Single-Speed Transaxle
Rigid, Welded and Bonded Aluminum Alloy Spaceframe
Electro-Hydraulic Braking System w/ Blended Regenerative Braking
Double Wishbone Front Suspension
Variable-Assist Electro-Hydraulic Rack and Pinion Steering
Low Rolling Resistance Tires - 175/65R14 Michelin Proxima Tires
"Squeeze Cast" Aluminum Alloy Wheels
AC Electric Motor-Driven Heat Pump Climate Control System w/ Preconditioning
AM/FM Stereo w/ Compact Disc/Cassette Player and 4 speakers
Electronic Keypad Entry/Vehicle-Activation System
Pedestrian Alert Horn
Power Windows, Door Locks and Outside Mirrors
Solar Reflective/Absorptive Glass w/Electriclear™ Windshield Defogger/Deicer
Side Window Defogging Vents
Rear Window Defrost
Cruise Control
Reverse Alert
Remote Trunk Release
Reclining Bucket Seats w/Scotchgard™ Seats

SAFETY FEATURES

Inductively Coupled Charging System
Sealed Valve-Regulated Lead-Acid (VRLA) Indoor Charging
High-Voltage Isolation Assurance
High-Voltage Service Disconnect
Self-Sealing, Puncture Resistant Tires w/Check Pressure System
Anti-Lock Braking System (ABS)
Driver and Passenger Front Airbags
Traction Control
Daytime Running Lamps

###

(features 06/03/96)

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Propulsion:	
Motor	
Type	3- phase AC induction
Transaxle	
Type	Single-speed with dual reduction
Overall Ratio	10.946:1
Motor and Transaxle Lubrication	Oil: Electric pump
Power Electronics	
Type	IGBT (Insulated Gate Bipolar Transistors)
Battery	
Type	VRLA (Valve Regulated, Lead-Acid)
Number of Modules	26
Nominal Voltage	312
Rated Maximum Capacity (@ 25 A)	53 A-hr
Chargers:	
Type of Coupling to Vehicle	Inductive, per SAE J-1773
Standard Module	220-240 volts
Rated Power	6600 watts
Convenience Module	110-120 volts
Rated Power	1200 watts
Thermal Systems:	
Drive Unit , Power Electronics and Charge Port	Liquid: Electric pump / sealed system
Battery Pack	Forced air

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Braking System:	
Type	Computer-controlled Electro-Hydraulic Blended friction and regenerative with ABS Power-assisted
Front Friction Brakes	Solid discs with floating-piston calipers Hydraulically applied
Front Regenerative Braking	Blended, with ABS
Rear Brakes	Metal-matrix drums Electrically applied
Park Brake	Electrically applied Automatic "PARK" apply / release and manual push-button
Steering System:	
Type	Speed-sensitive, variable-effort Electro-Hydraulic (Electric motor driven hydraulic pump)
Ratio	16.54:1
Turn Diameter (Curb/Curb)	9.9 m (32.5 ft)
Lock-to-Lock Turns	3.1

Preliminary = 06/13/96

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Electronics:	
Type	Serial data linked microprocessors Junction-block wiring harness system
Controllers	BPM (Battery Pack Module) PCM (Propulsion Control Module) DSCM (Display, Steering, and Chime Module) BTCM (Brake and Traction Control Module) CCU (Console Control Unit) HTCM (HVAC and Thermal Contol Module) SDM (Sensor and Diagnostic Module)
Lighting:	
Exterior	Projection lamp low beam Reflector optics high beam Daytime running lamps
Interior	Courtesy lamps in mirror and behind seats with theatre dimming

Preliminary = 06/13/96

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Body:	
Structure	Welded and bonded aluminum alloy spaceframe
Spaceframe mass	132 kg
Exterior Panels	Dent / corrosion-resistant composites Sheet Molding Compound (SMC) and Reinforced Reaction Injection Molding (RRIM)
Chassis:	
Layout	Transverse drive unit/ front wheel drive
Suspension: Front	Short-long arm with coil spring-over-shock absorber Forged aluminum arms and squeeze-cast aluminum knuckle Stabilizer bar
Rear	Multi-link and Panhard rod located aluminum beam Coil spring and shock absorber mounted separately
Tires	Self-sealing, puncture resistant with check tire pressure system 175 / 65 R 14 345 kPa (50 psi) No spare tire
Wheels	Squeeze-cast aluminum 14 x 4.5

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Interior:	
Seating	3-D knit seat fabric with Scotchgard fabric protector Cast magnesium seat cushion frame
Climate System	Heat pump system, with pre-conditioning: provides both heating and air conditioning R-134a refrigerant
Controls	Electronic keylepad entry / vehicle-activation system Electric power windows, door locks and outside mirrors PRND shift control Coasting regenerative braking level Cruise control Remote trunk release
Instrumentation	Centrally-located vacuum fluorescent display Range remaining Battery state-of-charge Speedometer PRND indicator LED telltale lamps
Audio system	AM-FM, CD and cassette tape 4 - speaker system
Restraint systems	Dual air bags 3 - point lap/shoulder belts

Preliminary = 06/13/96

Vehicle Specifications
1997 EV1

	General Motors EV1 Coupe
Dimensions:	
Mass	
Curb	1350 kg. (2970 lb.)
GVM	1550 kg. (3410 lb.)
Test Weight Class	3250 lb.
Exterior	
Wheelbase	2512 mm (98.9 in.)
Overall Length	4309 mm (169.7 in.)
Overall Width	1766 mm (69.5 in.)
Overall Height (@ design)	1281 m m (50.5 in.)
Track	
Front	1470 mm (57.9 in.)
Rear	1244 mm (49.0 in.)
Aerodynamic Drag Coefficient	0.19
Frontal Area	1.89 sq. m (20.3 sq. ft.)
Interior	
Accomodations	2 - passenger
EPA Passenger Volume	50.4 cu. ft. (1.78 cu. m)
Headroom	954 mm (37.6 in.)
Shoulder Room	1381 mm (54.4 in.)
Hip Room	570 mm (22.5 in.) (X 2)
Leg Room	1083 mm (42.6 in.)
EPA Cargo Volume	9.7 cu. ft. (275 l.)

Vehicle Specifications

Preliminary = 06/13/96

1997 EV1

	General Motors EV1 Coupe
Performance:	
Propulsion Power	102 kW (137 hp) @ 7000 - 14000 rpm
Axle Torque	1640 Nm (1209 lb-ft) @ 0 - 7000 rpm
Energy Consumption (from battery)	
City	tbd
Highway	tbd
Energy Consumption (into charger)	
City	tbd
Highway	tbd
Estimated Range (to 15% SOC)	
City	70 miles
Highway	90 miles
0 - 60 mph Acceleration	less than 9 seconds
Top Speed (Electronically regulated)	80 mph
Stopping Distance: 60 - 0 mph Light Load	49 m (160 ft.)

TDA Ranger EV



Transportation Design and Manufacturing Inc. (TDM), a Michigan based design and manufacturing firm, is an established modifier of Ford products. The company, which employs more than 2,200 people worldwide, is experienced in developing and manufacturing alternative fuel systems and components, including converting F-Series pickup trucks into natural gas vehicles.

The Ford Qualified Vehicle Modifier (QVM) electric Ranger program is a unique, innovative effort to bring electric vehicles (EV) to market more quickly and cost effectively. The vehicle will be built by TDM from a Ranger "glider" -- a vehicle that comes off the factory line without an engine, drivetrain or fuel system. Ford implemented this program as part of its EV research and development programs. It will allow Ford to expand its knowledge-base about marketing and selling EVs by putting a small number of vehicles into customer hands today.

TDM Ranger EV

Vehicle

Model Year	1996
Body Style	Regular cab pickup
Wheelbase	Long wheelbase
Payload (base vehicle)	510 lbs. (includes 2 pass.)
Dimensions	Similar to 1996 Ranger
Exterior Paint	Oxford white (other colors special order)

Powertrain

Motor	100hp (peak) high-efficiency, 3-phase AC
Transaxle	Single-speed, RWD

Standard Features

Dual Air Bags	Occupancy protection
Microprocessor Control Units	
-Battery Controller	Monitors functions of the battery
-Motor Inverter	Converts high voltage DC to 3-phase AC
-Communications Center	Operates instruments and climate control
Heater	Electric resistive heating element
DC/DC Converter	Electronic "alternator"
Brakes	2 wheel ABS and regenerating braking
Battery Thermal Management	Maintains battery temperatures
Other	Full vehicle safety compliance (FMVSS)

Options

A/C	Electrically driven high-efficiency compressor. Non-flouro-carbon refrigerant
Power Steering	Electro hydraulic

Battery

Type	Sealed lead-acid
Voltage	26x12v modules 312v system
Battery Capacity	26kWh (21 kWh @ 80% discharge)
Optional Charger	Off-board 240v/30A conductive charging

Performance Targets

0-50 mph	13.5 seconds
Rated Top Speed	70 mph (governed)
Customer Range @32'F w/Heater	30 miles
Range -- FUDS Cycle @72'F	55 miles without AC or heater usage

Pricing

Base VehicleMSRP	$33,990
Option Package * Air Conditioning & Electohydraulic Power Steering	$ 2,999

* with subsequent reduction in payload capacity, range, and performance

Warranty

Vehicle	3 years/36,000 miles same as 1996 gasoline-powered, inclusive of integral parts
Batteries	1 year, prorated

TDM Electric Vehicle Marketing Center

Telephone	313-458-9100
Fax	313-458-9118
Online	http://www.tdm.team.com

Product Availability

Production vehicles available to customers in 1996 through selected TDM dealers.

Information contained in this Specifications Sheet was correct when approved for public release. TDM reserves the right to change or to discontinue specifications or designs at any time without notice or obligation. All taxes, title, and destination charges extra. Final FMVSS and QVM certification forthcoming © 1996 TDM 7/23/96.

TDM™ Ford

Electric Vehicle Data Sheet

VEHICLE

Model Year	1997
Body Style	Regular Cab Pick-Up
Wheelbase	Long wheelbase
Payload (base vehicle)	510 lbs. (includes 2 pass.)
Dimensions	Similar to 1997 Ranger
Exterior Paint	Oxford White (other colors special order)

POWERTRAIN

Motor	100hp (peak) high-efficiency, 3-phase AC
Transaxle	Single-speed, RWD

STANDARD FEATURES

Dual Air Bags	Occupancy protection
Microprocessor Control Units:	
Battery Controller	Monitors functions of the battery
Motor Inverter	Converts high voltage DC to 3-phase AC
Communications Center	Operates instruments and climate control
Heater	Electric resistance
Regenerative Braking	Energy recovered to increase range
DC/DC Converter	Electronic "alternator"
2-Wheel ABS	Straighter stopping and steering control under most conditions
Battery Thermal Management	Maintains battery temperatures
FMVSS	Full vehicle safety compliance

BATTERY

Type	Sealed lead-acid
Voltage	26x12v modules 312v System
Battery Capacity	26kWh (21kWh @ 80% discharge)
Charger	240v/30A conductive charging

PERFORMANCE TARGETS

0-50 mph	13.5 seconds
Rated Top Speed	70 mph (governed)
Customer Range @32° F w/Heater	30 miles
Range - FUDS Cycle @72° F	55 miles without AC or heater usage

PRICING

Base Vehicle MSRP	$33,990.00
Option Package* Air conditioning & Electrohydraulic Power Steering	$2,999.00

* with subsequent reduction in payload capacity, range and performance

INCENTIVES AND ORDERING

Contact your TDM representative for pricing, incentive discounts and ordering information.

WARRANTY

Vehicle	3 years/36,000 miles same as 1997 gasoline-powered inclusive of integral parts
Batteries	1 year, non-prorated

TDM ELECTRIC VEHICLE MARKETING CENTER

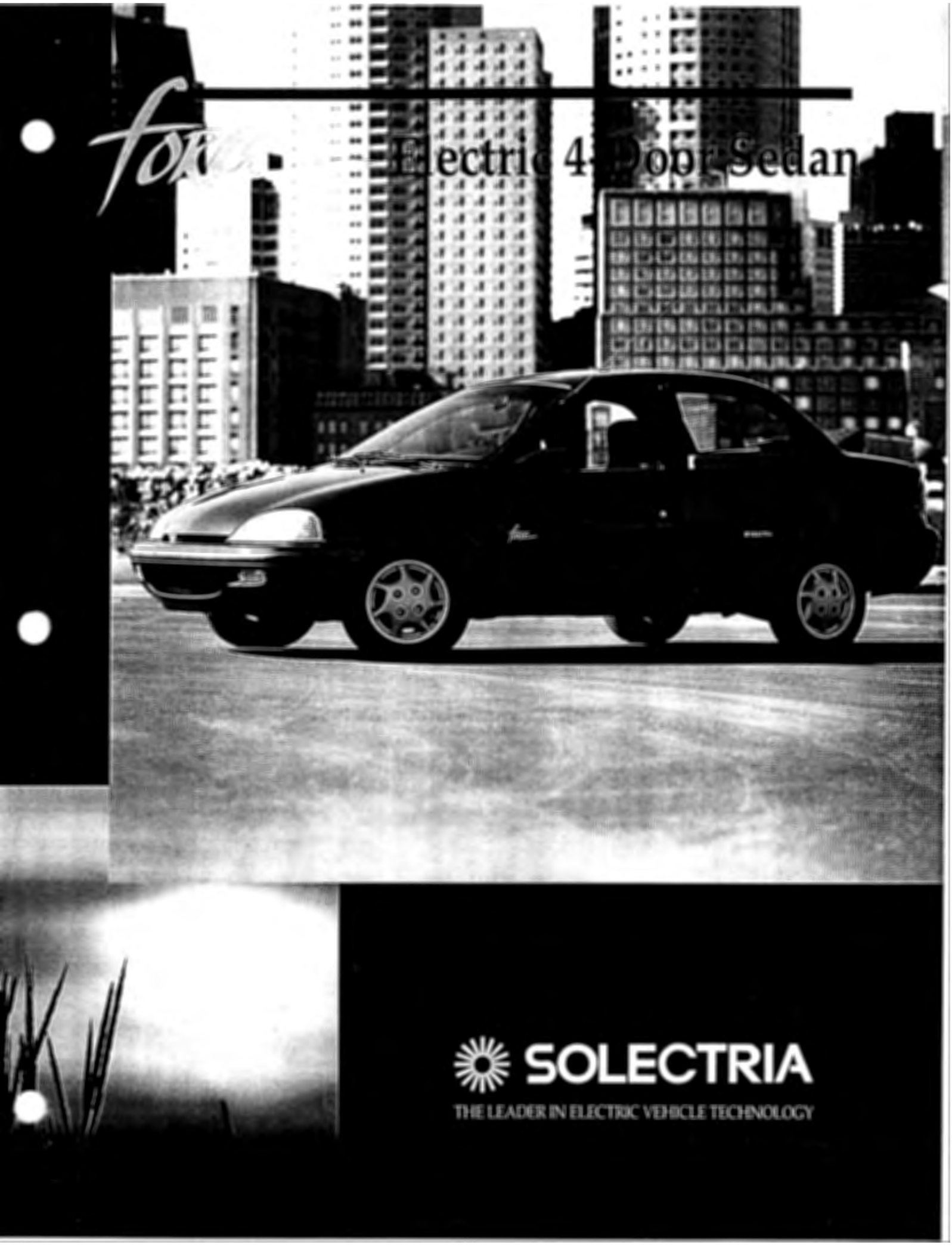
Telephone	(313) 458-9100
FAX	(313) 458-9118
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TDM TRANSPORTATION DESIGN & MANUFACTURING


Electric 4-Door Sedan
SOLECTRIA
THE LEADER IN ELECTRIC VEHICLE TECHNOLOGY

The all-electric vehicle that combines personal comfort and safety with environmentally sound technology.

The *Force* from Solectria contains the world's most advanced electronic drive system in a body styling that is practical, safe and appealing. The technology which drives the *Force* has powered many Solectria cars to victory in international electric car competitions, and has been proven in on-road use since 1986.

Designed for emission-free operation, the *Force* requires almost no regular maintenance, and operates on stored battery energy obtained from any standard electrical outlet. Costs of operation and maintenance are only a fraction of typical gas-powered vehicles. The new *Force* offers smoother and nearly silent operation due to engineering advances and a more powerful direct-drive system. Ample head room, leg room and trunk space are provided by the re-designed platform.

Meeting our environmental needs no longer requires the personal sacrifices of the past – relax in comfort in the *Force*, and enjoy state-of-the-art performance from Solectria, the world's leading developer of electric car technology.

SOLECTRIA

SOLECTRIA CORPORATION
68 Industrial Way · Wilmington, MA 01887 USA
508-658-2231 / Fax 508-658-3224

VEHICLE SPECIFICATIONS

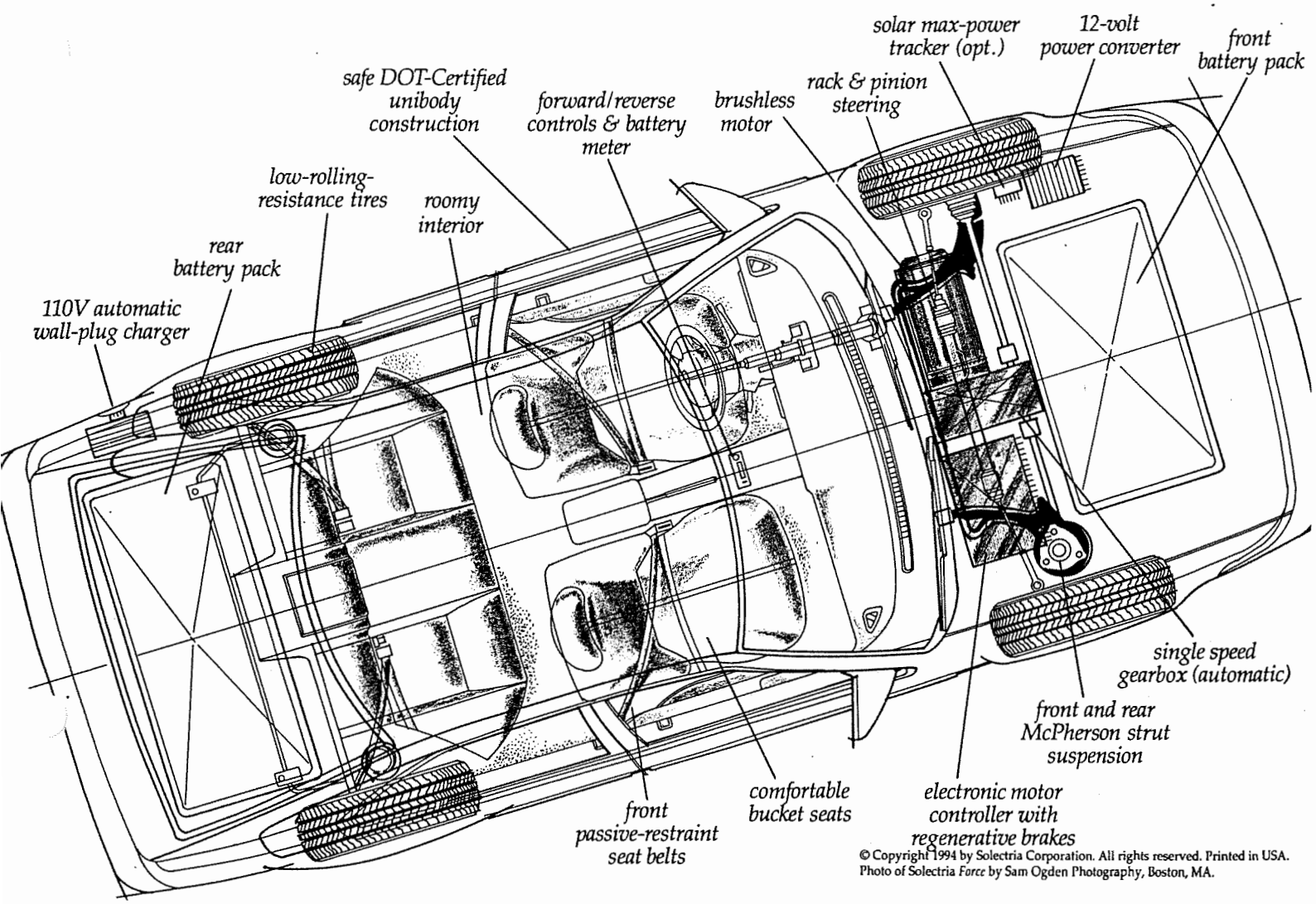
System Power		42 kW
Length		164"
Width		70"
Height		56"
Curb Weight		2390 lb
Top Speed		70 mph
Efficiency @ 45 mph		160 Whr/mi
Acceleration:	0 - 30 mph	8 sec
	0 - 60 mph	19 sec
Range:	Standard Lead Acid	60 mi @ 45 mph
	Optional Nicad	100 mi @ 45 mph

STANDARD

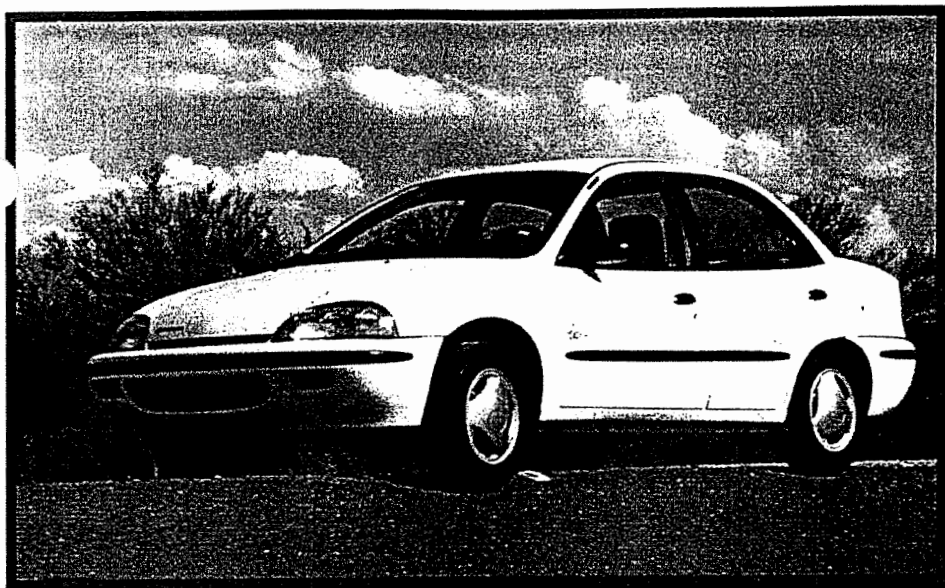
High-Efficiency AC Induction Drive System featuring Direct-Drive and Regenerative Braking, Power-Assist Brakes, Electric Heater/Defroster, 12V DC-DC Converter, 8-Hour Onboard Battery Charger (1kW/120 VAC for Lead Acid Model; 2kW/208-240VAC for Nicad Model), Sealed Maintenance-Free Lead Acid Batteries, Power Saver, Battery Level Gauge (Digital Amp-Hour Meter), Dual Airbags, Front & Rear Crumple Zones, Side Impact Reinforcement

OPTIONS

AM/FM Stereo Radio (Cassette or CD available)
Air Conditioning
Cruise Control
Automatic Battery Thermal Management System
(for top cold-climate performance)
Super Charger – 2 kW/120VAC, 5-Hour Fast Charge for Lead Acid Model
3 kW/208-240VAC, 6-Hour Fast Charge for Nicad Model
Rear Window Defogger
Solar Panel, Roof Mounted
Ammeter and Voltmeter



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Photo of Solectria *Force* by Sam Ogden Photography, Boston, MA.



SOLECTRIA FORCE

VEHICLE TYPE
Conversion Of: Geo Metro
VIN No: 2CIMR5299567000106
Seating Capacity: 4 Adults
Features: AM/FM Radio, Heater, Battery Thermal Management, Power Steering, Power Brakes, Front Wheel Drive, Front Disc Brakes & Anti-Lock Brakes

DIMENSIONS
Wheelbase: 93.0 inches
Track F/R: 55.0/53.9 inches
Length: 164.3 inches
Width: 62.0 inches
Height: 54.5 inches
Ground Clearance: >50 mm
Cargo Space: No Intrusion On OEM Space

WEIGHT
Curb Weight: 2290 lbs
Test Weight: 2424 lbs
Distribution F/R: 49/51%
Conversion GVWR: 2800 lbs
OEM GVWR: 2800 lbs
Payload: 376 lbs

WHEELS & TIRES
Wheel Size: 13 inches
Tire Mfg: Goodyear Invicta
Tire Size: P165/70R13
Tire Pressure: 44/44 psi
Spare Tire Installed: No

DRIVE SYSTEM
Drive Type: 35 kW AC Induction
Motor Mfg: Solectria.
Controller Mfg: Solectria
Transmission: Single Speed

BATTERY
Mfg: Hawker Energy
Type: G12V26Ah10C Sealed Lead Acid
Number of Modules: 30
Total Traction Voltage: 180 volts
Battery Pack Weight: 690 lbs
Location In Vehicle: Under Trunk & Engine Compartment

CHARGER
Location: Trunk
Input Voltage(s): 120/208/240 volts AC
Input Current(s): 15/14.4/12.5 amperes AC

INTERLOCKS
Key Removable When Off Only: Yes
Key Off In Park Only: Yes
Start In Park Only: Yes
Start Blocked By Accelerator: No
Start Blocked On Charge: Yes

REQUIREMENTS
Manual Disconnect Present & Operable: No
Batteries Sealed or Valve Regulated: Yes
Charger Automatic Control: Yes
SOC Indicator: Yes
Battery Voltage Indicator: No
Battery Current Indicator: No
Regenerative Current Indicator: No
Transmission Single Speed: Yes
Transmission Parking Pawl: Yes
No Open Access to High Voltage: Yes
All High Voltage Clearly Marked: Yes
Control Efforts Similar To OEM: Yes

Test Date: October 1994
Notes:
RED - Results did not meet EV America Performance Goal
* - Tested at gross vehicle weight

TEST EXCEPTIONS
- *Prototype vehicle*
- *Payload 324 lbs less than required*
- *Required charger adjustment*
- *Required battery module replacement*

PERFORMANCE STATISTICS

ACCELERATION AT 90% SOC *
Zero to 30 mph: 8.5 sec
Zero to 40 mph: 12.6 sec
Zero to 50 mph: 18.4 sec
Zero to 60 mph: 27.0 sec
Performance Goal: 13.5 seconds: 0 to 60 mph

ACCELERATION AT 50% SOC *
Zero to 30 mph: 9.4 sec
Zero to 40 mph: 14.2 sec
Zero to 50 mph: 21.5 sec
Zero to 60 mph: 34.1 sec
Performance Goal: 13.5 seconds: 0 to 60 mph

MAXIMUM SPEED *
At 50% SOC: 70 mph
Performance Goal: 70 mph

CONSTANT SPEED RANGE
45 mph Distance: 49.5 miles
45 mph Energy Used: 7.2 kWhr
45 mph Efficiency: 0.145 kWhr/mile
45 mph Specific Energy: 0.0104 kWhr/lb

60 mph Distance: 26.6 miles
60 mph Energy Used: 5.3 kWhr
60 mph Efficiency: 0.199 kWhr/mile
60 mph Specific Energy: 0.0077 kWhr/lb

DRIVING CYCLE RANGE
77 °F Distance: 45.4 miles
77 °F Energy Used: 7.77 kWhr
77 °F Efficiency: .0171 kWhr/mile
77 °F Specific Energy: 0.0113 kWhr/lb

19 °F Distance: 43.5 miles
19 °F Energy Used: 7.75 kWhr
19 °F Efficiency: 0.178 kWhr/mile
19 °F Specific Energy: 0.0112 kWhr/lb

Performance Goal: 60 miles

GRADEABILITY *
Maximum Grade: 15.2%
Performance Goal: 25%

Speed At 3% Grade: 60 mph
Performance Goal: 55 mph

Speed At 6% Grade: 47 mph
Performance Goal: 45 mph

HANDLING COURSE
Average Time At 90% SOC: 58.6 sec
Average Time At 50% SOC: 58.3 sec
Average Time At 20% SOC: 58.1 sec

Average Dodge Neon (ICE) Time: 54.62 sec
Average Chevrolet S10 (ICE) Time: 58.29 sec

BRAKING STABILITY
Controlability: No Stability Problems
Distance Dry/Wet: 164.4/214.4 feet

CHARGER
Ground Current During Charge: < 0.01 mA
Battery Leakage Current: <0.01 mA
Charger Efficiency: 95.2%

Average Power Factor: 0.937
Performance Goal: 0.95
Average THD: 29.0%
Performance Goal: 5%
Time From 80% DOD: 3 hours 54 minutes
Performance Goal: <8 hours

EVAMERICA

Marketing Contact: Barry Pearson (916) 381-3509

SOLECTRIA

QUOTATION NO. 1310

Date: June 24, 1996

Quote to:
Phil and Jane Damron
1611 Edwin Avenue
Woodland, CA 95695
tel 976-662-2282
fax 976-662-5010

Respond to:
Solectria Corporation
68 Industrial Way
Wilmington, MA 01887
tel 508-658-2231
fax 508-658-3224

Description:

Item	Qty.	Product	Unit Price
1	1	1996 Solectria Force sedan, 4-door	$33,995.00

STANDARD EQUIPMENT

High-Efficiency 42kW AC Induction Drive System with Direct-Drive (Automatic) and Regenerative Braking, Tri-Power Selector, Sealed, Maintenance-Free Batteries, Dual Airbags, Power-Assist Brakes, Electric Heater/Defroster, 12V DC-DC Converter, Battery Level Gauge (Digital Amp-Hour Meter), Onboard Battery Charger (2kW/110VAC), Reclining Cloth Front Bucket Seats, All-Season Radial Tires, Exterior Color White (unless otherwise noted), Solectria Owner's Manual

OPTIONS

2	1	AM/FM Stereo Radio with Cassette	495.00
3	1	AM/FM Stereo Radio with CD	795.00
4	1	Air Conditioning with CFC-Free Refrigerant	2970.00
5	1	Onboard Battery Charger Upgrade to 3kW/208-240VAC	2650.00
6	1	Rear Window Defogger	300.00
7	1	Standard One-Year Warranty	no charge
8	1	Comprehensive One-Year Warranty	1000.00
9	1	Comprehensive Three-Year Warranty	2000.00
10	1	Full-Day Technical Training Session (at your site)	1000.00 plus travel expenses
11	1	Shipping to Woodland, CA. (per vehicle, estimated)	1,500.00

Warranty: Please see Solectria's Vehicle Warranty Policy for full details. The battery warranty is offered directly by the battery manufacturer; Solectria does not offer a warranty on batteries. All Solectria decals and labels must remain on vehicle as sold for warranty to remain valid. Terms: 50% deposit due upon placement of order; 50% net 30 days upon shipment of vehicle(s). Shipping charges shown are estimated; actual shipping charges are the responsibility of the buyer and will be billed at cost. FOB Wilmington, Massachusetts. This quotation is valid for 30 days unless amended and is valid only if the total number of vehicles quoted are ordered. No changes to this quotation will be allowed without a written amendment from Solectria. Customer is responsible for any and all applicable taxes. Any additional engineering time or labor requested by the customer will be at additional cost and is not covered by this quotation.
Delivery Time: Delivery to commence approximately 12-16 weeks from receipt of deposit. Prepared by: Douglas Alderton

SOLECTRIA CORPORATION
68 INDUSTRIAL WAY
WILMINGTON, MA 01887
USA
508-658-2231
FAX 508-658-3224


Cityflee

CityBee

Technology for Friendly Mobility

The CityBee is a purpose-built electric vehicle (EV), a neighbourhood car for use in cities. It is small, yet roomy and safe. It is sleek, yet it is made for ease of maintenance. It is designed for long life, yet it is recyclable and environmentally-friendly.

The CityBee is small, yet it is built on a space frame of welded, corrosion-resistant aluminium. The motor, batteries, running gear and body are fastened to the space frame.

This concept puts safety first. Shock-absorbing zones and longitudinal frame members dissipate forces in front collisions, and door members protect against side impact. The CityBee has been collision tested, both by computer simulation and in real life. The CityBee will meet all European safety regulations.

The resilient thermoplastic body absorbs shock: a blow with a sledgehammer cannot dent it. Its colour is far more than skin deep; it is throughout the plastic. The CityBee needs no paint.

The CityBee is just 2.8 m long and 1.5 m wide. It is easy to manover and is easy to park. It weighs just about 750 kg including batteries, yet comfortably accommodates two adults with their baggage.

From the ground up, the CityBee is the ultimate in environmentally-friendly EVs. Its space frame, its body parts and even its batteries can readily be recycled.

The CityBee is scheduled for full-scale production in 1997, one year before the implementation of the ZEV (Zero Emission Vehicle) requirement in California. The CityBee is the city-friendly EV, developed by PIVCO with contribution from leading institutes of technology in Norway and Switzerland, backed by a consortium of Norway's leading firms in aluminium, plastics and energy.

Technical specifications

Number of seats	**2**	
Length	**2.8 m**	**(9.2 ft)**
Width	**1.5 m**	**(5 ft)**
Height	**1.5 m**	**(5 ft)**
Wheelbase	**1.8 m**	**(6 ft)**
Curb Weight (with batteries)	**750 kg**	**(1650 lb)**
Batteries	**120 V**	
Maximum power	**30 kW**	
Energy use, city driving	**1.1 kWh/10 km**	**(1.8 kWh/10 miles)**
Charging time, 80% capacity	**5 hours**	
Charging time, full capacity	**9 hours**	
Driving range, 50 km/h	**150 km**	**(90 miles)**
Driving range, city driving	**110 km**	**(65 miles)**
Top speed	**90 km/h**	**(55 mph)**

For more information about the CityBee, please contact:

PIVCO

Stanseveien 4
N-0975 Oslo, Norway
Tel: +47 22 25 20 50
Fax: +47 22 25 41 20
Email: pivco@telepost.no

PIVCO

PRESS RELEASE

PIVCO AS
Stanseveien 4
N-0975 Oslo, Norway

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Fax: +47 22 25 41 20

A Norwegian Clean Car Introduced in California

An inexpensive and totally recyclable electric vehicle from Norway is now introduced for testing on the US market. The CITI car, designed and built by PIVCO, a Norwegian-led consortium, is a true purpose-built electric vehicle. It will be manufactured in California from 1997. The CITI car is developed in collaboration with other leading industrial partners and research institutes in Norway.

PIVCO set a goal to create a car for active people needing individual transportation in their local area, and who also care for our environment. "We wanted to make a zero emission vehicle for the average user, not only for the environmental activist. Therefore we put a focus on safety and room to move and to maneuver", says Managing Director Jan-Otto Ringdal in PIVCO. Though the car is only nine feet long and a breeze to park, the CITI car easily fits two people with headroom to spare, and space for luggage.

Integrating a strong aluminum space frame and a recyclable thermoplastic body, PIVCO made a safe car with unique features:

- The weight of the car was reduced to only 1650 pounds. Yet the lightweight aluminum space frame will provide crash protection in compliance with modern automotive standards.
- The car is totally recyclable, and the thermoplastic body is durable, shock-absorbing and easily repairable - with the color built in, not painted on the body.

The CITI will be used during 1995 and 1996 in electric station car demonstration programs throughout California. Electric station cars create flexible, non-polluting options for transit users to travel between transit stations and homes, offices or other destinations.

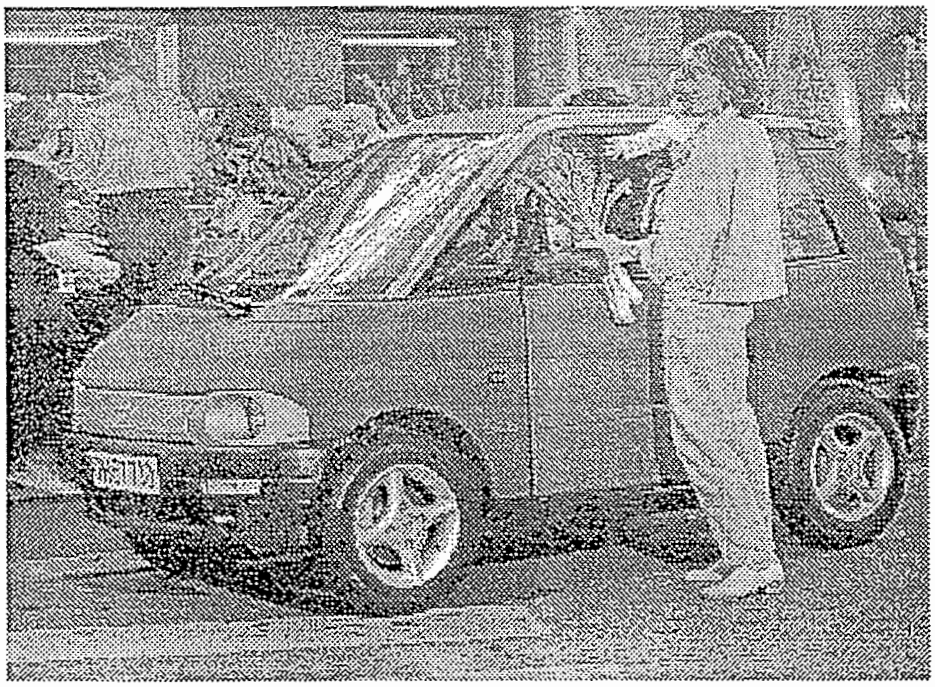
For more information contact PIVCO or CALSTART in California.

PIVCO

CITI

electric vehicle

Technology for Friendly Mobility



PIVCO AS
Stanseveien 4,
0975 Oslo, Norway
tel: +47 22 25 20 50
fax: +47 22 25 41 20

PRESS / PUBLIC INFORMATION

CITI

The CITI car is a unique electric vehicle specially designed to provide clean, intelligent transportation for one or two individuals with some luggage, in cities and urban areas. It is very safe and easy to handle; it is rugged and requires little maintenance; it is small and light-weight and friendly to the environment; and it is planned for sales under $10,000.

As pollution becomes a growing issue in most European and international capitals, the market-introduction of cleaner concepts for individual transportation is needed: CITI is an urban electric vehicle designed to respect the environment.

The end of the 20th century is being characterised by growing pollution concerns, based on two global factors: the green house effect and the ozone layer depletion. Yet, the polluting agents are still being generated every day in even bigger quantities: carbon dioxide, chlorofluorocarbons, NOx, SOx etc. Among the main convicted actors: the car.

Despite great benefits in terms of mobility, the commonly used "internal combustion engines" have also brought about negative consequences one would not have ever imagined. Most striking is certainly the impact in city centres. Concentrated pollution is seen to have direct effects on personal health (not to mention degradation on buildings and monuments!). And traffic has raised the noise level to annoying proportions.

Electric vehicles (EVs) can be part of a solution to these issues. They are clean and quiet, and can contribute to a cleaner environment. With reduced acoustic noise and no exhaust gases at all, EVs will definitely decrease air and noise pollution in urban centres.

CITI is an electric vehicle braking away from the usual concept of road transportation. It is specially fit for city use, designed to respect the environment, and engineered to provide maximum safety.

CITI: a car for the city

Comprehensive studies of traffic patterns in industrialized countries show that approx. 70% of all traffic take place in cities and urban areas. The average speed is low, 25-35 km/h, and typical travelling distances are less than 50 km per day. Number of occupants averages 1.2 per car.

The CITI car is designed to carry two persons and daily luggage in maximum comfort (total payload of some 250 kg), and fulfil the needs for individual mobility.

With a range of 110-150 km (65-90 miles) on one battery "filling", the CITI car is perfectly designed for multicar city dwellers, using their vehicles for daily "short-range" trips such as: commuting to work, shopping or leisure.

The CITI car is easy to park: it is only 2.8 meters long (9.2 ft), and 1.5 meters wide (5 ft). Yet the monospace interior gives a roomy feeling as maximum comfort is dedicated to the users. The trunk can handle all types of baggage, including all shopping, and provides sufficient space for bulky objects.

It has a top speed of 80-90 km/h (55mph) which is perfectly adequate for all types of configuration which the CITI car may encounter in city use.



CITI: saving the environment

Zero emission

The CITI car is a true "zero emission vehicle", moving around without emitting any exhaust fumes. When stopped at a red light or by congested traffic, there is no engine running idle with exhaust fumes.

The CITI car complies with the ZEV mandate, already enacted in some states in North America.

By replacing traditional automobiles with specialized small electric vehicles in cities and urban areas, significant environmental benefits are obtained.

Light-weight

The CITI car is a light-weight vehicle: it only weighs 750 kg. (1650 lb), including a 250 kg. battery pack. Because of low weight, such a vehicle consumes only a fraction of the energy consumed by traditional, gasoline powered automobiles which may weigh 2-3 times as much. This makes it very energy efficient compared to regular cars as more energy is dedicated to moving persons, rather than giving power to a heavy vehicle of over 1 ton.

The energy savings achieved during short trips and in "stop-and-go" traffic are very substantial. Under such driving conditions, gasoline vehicles emit 10 times or more pollutants per kilometer than they do on long trips at optimal speed, and consume much more energy. For electric vehicles, emissions from the first miles are as low as from the last.

Recyclable

The CITI car has been engineered to include all aspects of an environmentally-friendly vehicle of the future, and has been designed for a high recycling ratio.

Main structural elements such as the chassis are made out of extruded aluminium. This material - which is very light, strong, and resistant to corrosion- can be entirely recycled at low cost.

The body is moulded thermoplastic. This material can be very easily recycled by being chopped down and melted again, also at low cost. It is also very resistant to deformation: it can be hit by a very heavy object without any damage, and comes back into shape after most impacts.

The CITI car is not a painted vehicle: the materials are self-colored and perfectly UV resistant. There is no painting process during manufacturing and no polluting solvents are released into the environment.

Batteries are also entirely recycled: the valuable cadmium of the NiCad batteries is reused at 99.9%, in a perfectly environmentally-friendly fashion. And, of course, other types of batteries of similar or better performances can also be used.

CITI: maximum safety

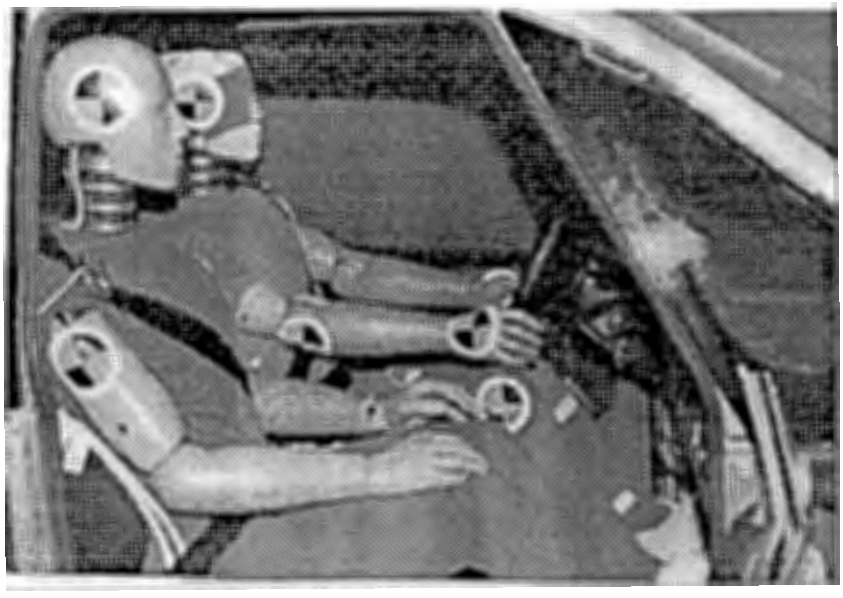
Safety in a small and light-weight vehicle is of prime concern. The CITI car has been designed to provide a safe means of local transportation. Advanced computer simulations of crash deformations were undertaken at a very early stage and helped design the space-frame structure. The safety of the passenger compartment has been successfully confirmed in a series of crash tests.

The CITI car when available on the user-market in the US will comply with the US Federal Motor Vehicle Safety Standards.

The front of the vehicle has been engineered as deformation zone in case of frontal impact. The aluminium chassis features shock-absorbing zones in strategic areas of the vehicle. In case of impact, forces are also transmitted to the rest of the chassis through longitudinal beams, therefore dispersing impact effects.

The passenger compartment is also protected from side impact thanks to the use of anti-intrusion bars in the doors. In addition, the relatively high seats of the CITI car as well as the distance to the windscreen are additional features increasing passive safety. In case of rear impact, a special deformation zone in the trunk absorbs the energy through compression of the aluminium beams.

A belt tightening system as well as air bags will be standard to provide an even greater safety to the passengers.



PIVCO and the CITI story

The CITI car is developed by the Oslo-based company PIVCO of Norway, in collaboration with other leading industrial partners and research institutes:

- *Statoil:* number one oil company and operator in Norway.
- *Hydro Aluminium:* one of the world's largest aluminium producer and leading manufacturer of aluminium automotive products, a subsidiary of Norsk Hydro.
- *Oslo Energi*: Norway's largest electric utility company.
- *SINTEF:* one of Europe's largest R&D institution.
- *Technological Institute (TI):* a major Norwegian engineering institution.
- *Polytechnic University of Zurich:* 20 years of expertise in safety for light weight vehicles.
- *Bakelittfabrikken:* a pioneer in plastic technology.

The Norwegian government and public institutions have also provided strong support and financing.

PIVCO is a privately-owned company backed by considerable Norwegian resources. PIVCO is a growing company employing at present 30 qualified engineers and technicians with expertise in plastics, aluminium and automotive technologies.

PIVCO has set up a pilot assembly plant in the Oslo region. This assembly plant has produced all the present vehicles, and has been scaled up to assemble the European pre-series vehicles end-1995.

The CITI car is the North American version of the CityBee European vehicle.

The CITI car / CityBee is not a regular car converted to electric propulsion. Rather, it is based on an innovative concept: the integration of a one-piece thermoplastic body and a welded aluminium chassis. It was designed from the start to integrate all dimensions of an environmentally-friendly vehicle of the future.

Pre-series production is starting in Europe now.



CITI: demonstration programmes

Tested at the Lillehammer Winter Olympics

10 European CityBee prototypes were presented for the first time at the Winter Olympic Games in Lillehammer, in February 1994, and tested in hard climate conditions. The vehicles performed flawlessly in far below zero temperatures.

A winning car at the 1995 Scandinavian Electric Car Rally

Four of the latest version of the European CityBee participated in the 1995 Scandinavian Electric Car Rally from Göteborg (Sweden) to Oslo (Norway) in August 1995. Two of these vehicles ranked first respectively in the prototype class and the series-light-weight class. The CityBee was also awarded the prize of the "Scandinavian Electric Car of the Year 1995". Other participating companies included Ford, Toyota, Renault, Solectria, altogether 28 vehicles from Europe, the US and Japan.

Environmental profiling for the Norwegian Post

The Norwegian Post is investigating environmentally-friendly ways of distributing mail. Four customized CityBees were successfully tested in routine mail-distribution circuits in the Oslo area. The Norwegian Post has confirmed their interest in the PIVCO project as several vehicle preorders were concluded. The vehicles will be used for local mail distribution.

Growing interest in major Scandinavian cities

Major scandinavian cities are showing a growing interest in the CityBee vehicle and its potential environmental benefits. In Norway: Oslo, Bergen and Stavanger are initiating vehicle pre-orders for their municipal services. In Sweden: Stockholm, Göteborg and Malmö are also considering purchase of CityBee electric vehicles.

Bay Area station car demonstration

Initiated by the Bay Area Rapid Transit (BART) and CALSTART, the Bay Area Station Car Demonstration will be using 40 CITI cars for a period of 2 years and demonstrate the viability of the station car concept. Vehicles will be mainly used as individual means of transportation in connection with the public Bay Area rapid transit system: from home to BART station, from station to work site or vice-versa. Eight vehicles are already in California; the remaining vehicles will be delivered subsequently.



CITI: Production in California

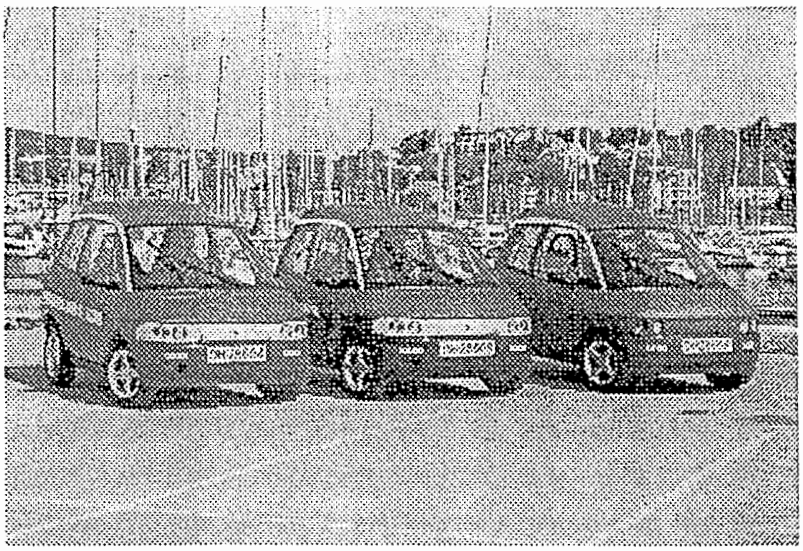
The CITI car is based on a breakthrough design concept and patented technology which permits a simple and low cost production at low volumes. It is simple to produce and requires small investments in manufacturing facilities.

The PIVCO manufacturing concept is based on a decentralized system: local production to be close to market needs and product customization.

PIVCO is preparing production in California with the assistance of CALSTART. Local production in California is scheduled for late 1996 - early 1997.

The CITI car is priced to sell at under $10,000 when full-scale production is reached.

The CITI car project is aiming at a niche-market for urban and sub-urban transportation, and with its unique concept looks for a significant portion of the environmentally-friendly transportation market.





A California Non-Profit Consortium Developing Advanced Transportation Technologies

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Rapid Transit District

FOR RELEASE
October 10, 1995

CONTACT: Bill Van Amburg or
Dave Sotero/CALSTART
(818) 565-5606

CALSTART UNVEILS $10,000 ELECTRIC CAR -- TEAMS WITH EUROPEAN CONSORTIUM TO BUILD IT IN CALIFORNIA

PIVCO PROTOTYPE ELECTRIC CAR PROVES AFFORDABLE, FUN, PRACTICAL CAR CAN BE MANUFACTURED NOW

Burbank, Calif.-- CALSTART -- California's advanced transportation consortium -- today unveiled a purpose-built, affordable personal electric car designed to cost under $10,000, and announced plans to bring the car to California for manufacturing by late 1996 or early 1997.

The pre-production car, known as the PIVCO City Bee, is a roomy, fun and cute two-passenger commuter car that perfectly fits a prime, early market for electric vehicles -- as a family's second or third car used for commuting and errands around town. It will be customized for the California market and provide freeway speeds, air conditioning, meet all U.S. safety standards -- including dual air bags -- and provide a range of 60-80 miles per charge...for a price around $10,000.

"Some traditional automakers continue to complain they can't make an electric car people will want," said Michael J. Gage, president and CEO of CALSTART. "Well -- this is the car that proves it can be done. What it takes is realizing this is a new kind of vehicle, not just a gasoline-powered car with an electric motor. What the personal computer is to mainframe computers, the PIVCO is to gasoline cars -- this is personal transportation."

CALSTART has teamed with PIVCO (Personal Independent Vehicle Company), part of a Norwegian consortium that developed the City Bee prototype, to bring the vehicle to California. CALSTART will help locate a California manufacturing site and investors, as well as identify partners to incorporate California technologies into upgrades of the vehicle. The new California effort will call itself CITI (Clean Intelligent Transportation, Inc.).

(more)

PIVCO/CITI achieves safety, utility and low cost by reinventing how a car is made. Its structure uses a strong aluminum "space frame" -- essentially the car's skeletal framework -- for safety and light weight. It features an attractive thermoplastic body that resists dents, requires no painting, and can be applied in just two pieces. The result is a fully recyclable car that can be manufactured inexpensively because it requires extremely minimal capital investment in facilities.

"We started with a clean slate when we built the City Bee," said Christophe Malaterre, manager of international programs for PIVCO. "We designed a whole new class of vehicle, the personal car. It's safe and fun. It's meant to be efficient to make and to drive. And we think Californians will buy a product that gives them a choice that is both clean and affordable. That's why we're working with CALSTART to build and sell it here."

One of the key early markets identified for electric vehicles is as a second car, for use in commuting, city driving and errands. The average mileage driven in such uses is less than 30 miles per day, easily within the range of electric cars. According to a comprehensive study conducted by the Institute of Transportation Studies (ITS) at U.C. Davis, the market for such a car represents a significant niche among buyers that far exceeds the minimal requirement for clean, zero emission cars set by the state of California starting in 1998.

"To clean its air, California has demanded that 2% of automakers' cars emit zero pollution by 1998. This car not only meets the emission requirement -- this is the kind of car that can sell," said Dr. Daniel Sperling, director of the ITS program at U.C. Davis. "Our 'hybrid households' study showed range is not a huge issue for people who can use a clean electric commuter car together with a traditional car. As for price, people are actually willing to pay slightly more. Here's a case where the price is less than for most gasoline cars. This car will be part of what makes the case for electrics."

Already achieving international recognition, the City Bee was voted Scandanavian Electric Car of the Year, 1995. Its design will be now be additionally tested in CALSTART station car projects throughout the state. The first, and largest, will involve 40 vehicles staged at four Bay Area Rapid Transit (BART) stations in the San Francisco Bay Area. The first few vehicles will be prototypes of European design and construction. By next summer, the California upgrade of the vehicles will be shipped, and by late 1996 or early 1997, the cars will be manufactured in California.

"Here is an affordable, highly efficient electric car design," added Gage, "that's rapidly moving to the marketplace. It's proving itself now using batteries available today. It's easy to maintain. And most important, it's cute and really fun to drive. It will be tested, proven and in California production by 1997. Can marketable electric cars be built? It's time to end the debate and get to work."

CALSTART is a California non-profit consortium dedicated to creating an advanced transportation industry in the state. Its 140 participants include electronic, defense and aerospace technology firms, vehicle manufacturers, transit districts, all the state's major natural gas and electric utilities, public agencies, and labor and environmental groups.

-30-

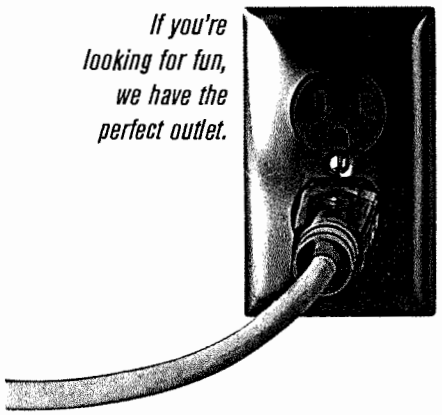


NEIGHBORHOOD ELECTRIC VEHICLES

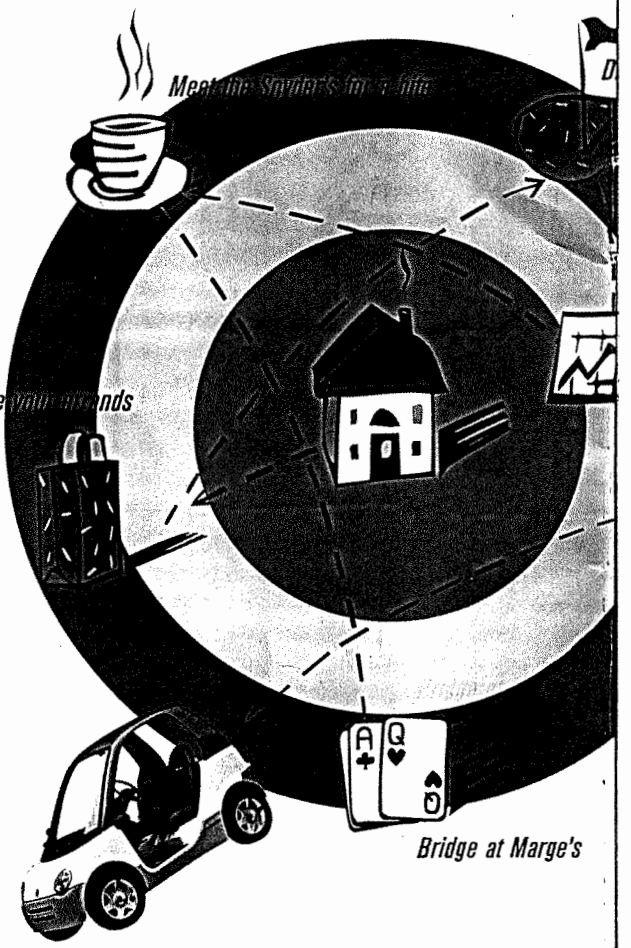
™

The Neighborhood Electric Vehicle.
It drives home the concept of fun.

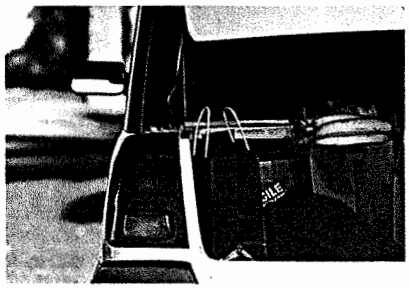
Call it NEV, for short. What is it? The first of a new generation of electric powered vehicles. And a great new way to get from here to there. Where can you take it? Almost anywhere the road leads in your community. How will it make you feel? Free. To go where you want. When you want. Simply. And comfortably. With the NEV, getting there isn't half the fun. It's all of it.



If you're looking for fun, we have the perfect outlet.



Bridge at Marge's





It's practical. It's spacious.
The NEV trunk adds a whole new dimension.

Drive a quick round

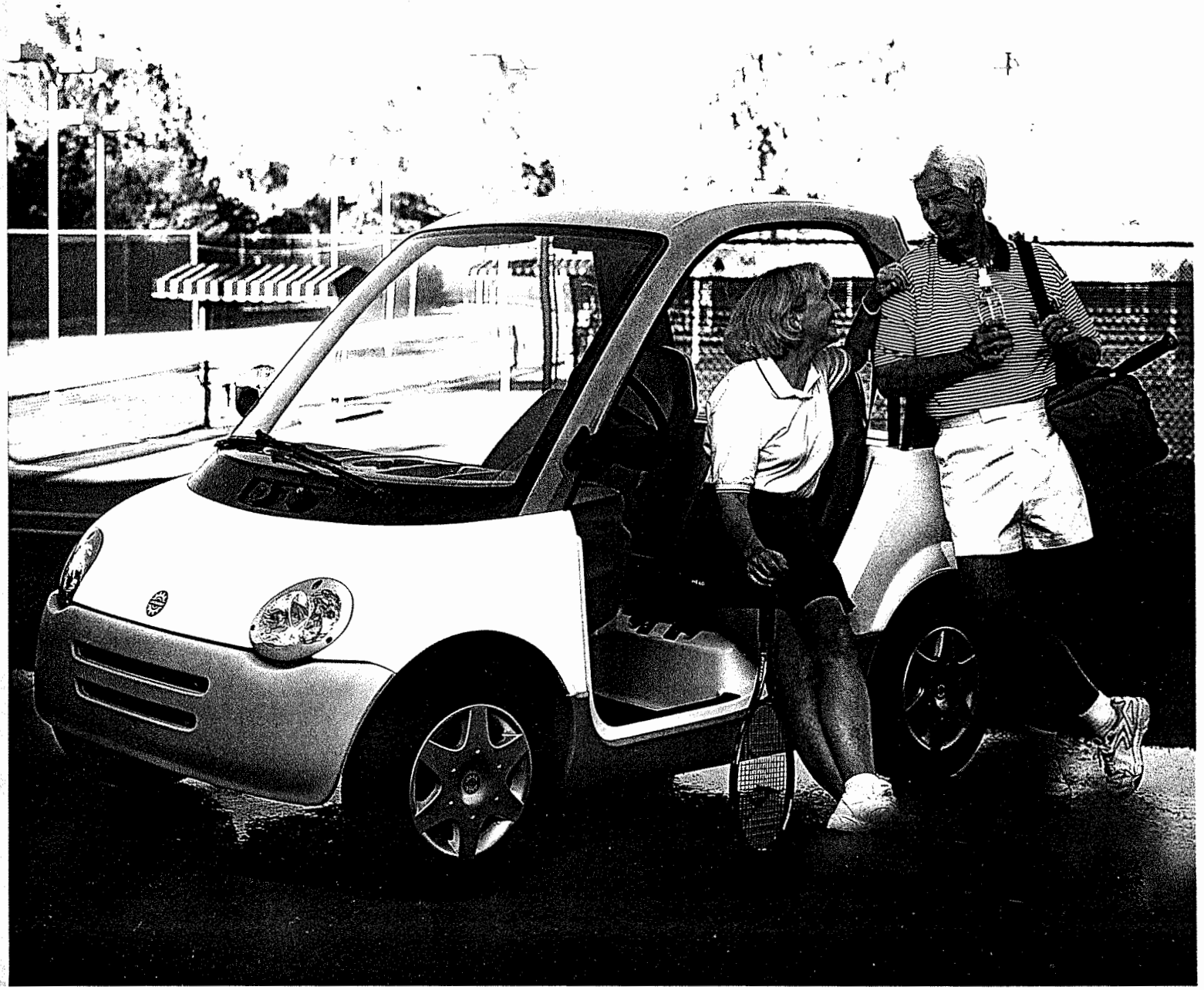
Huddle with stockbroker

Ace Astrophysics class

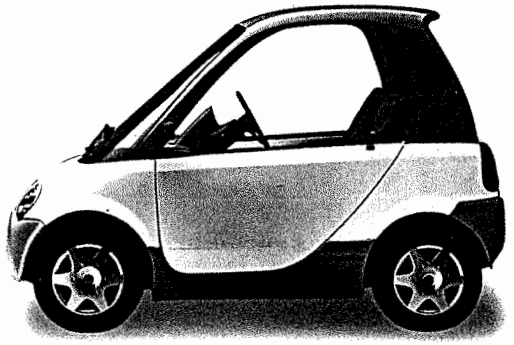
*30 mile range.**
Where in your neighborhood can you go in a NEV? Where did you have in mind?

Zero emissions add up to a cleaner environment.

*Actual distance may vary according to driving style and conditions.

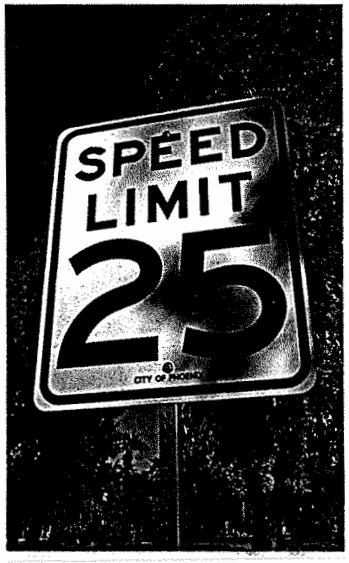


It took a lot of complex thinking to make a vehicle this simple.



Available doors put something between you and the outside world.

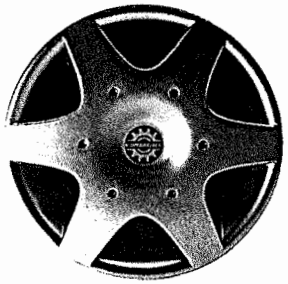
Plug it in. One charge can take you more than 30 miles. Sit in it. You'll notice the NEV was specifically designed for easy entry and exit. Settle back in it. You'll be cradled in its ergonomically designed bucket seats. Drive in it. Feel how it handles the road. But wait. The road may not be your final destination. You may be following a different course.



The NEV can zip you almost anywhere within your community.



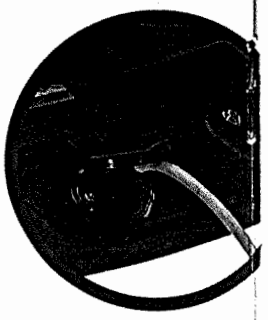
Spacious glove compartment



Stylish automotive details



3-point retractable seatbelts



Quick and easy plug-in



Consider the NEV with the Golf Option Package.

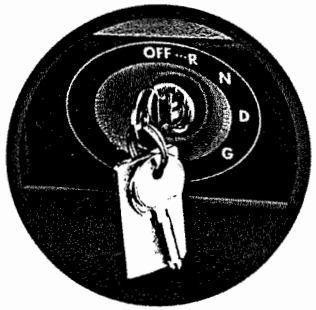
Special low speed golf mode

Golf bag holder in trunk

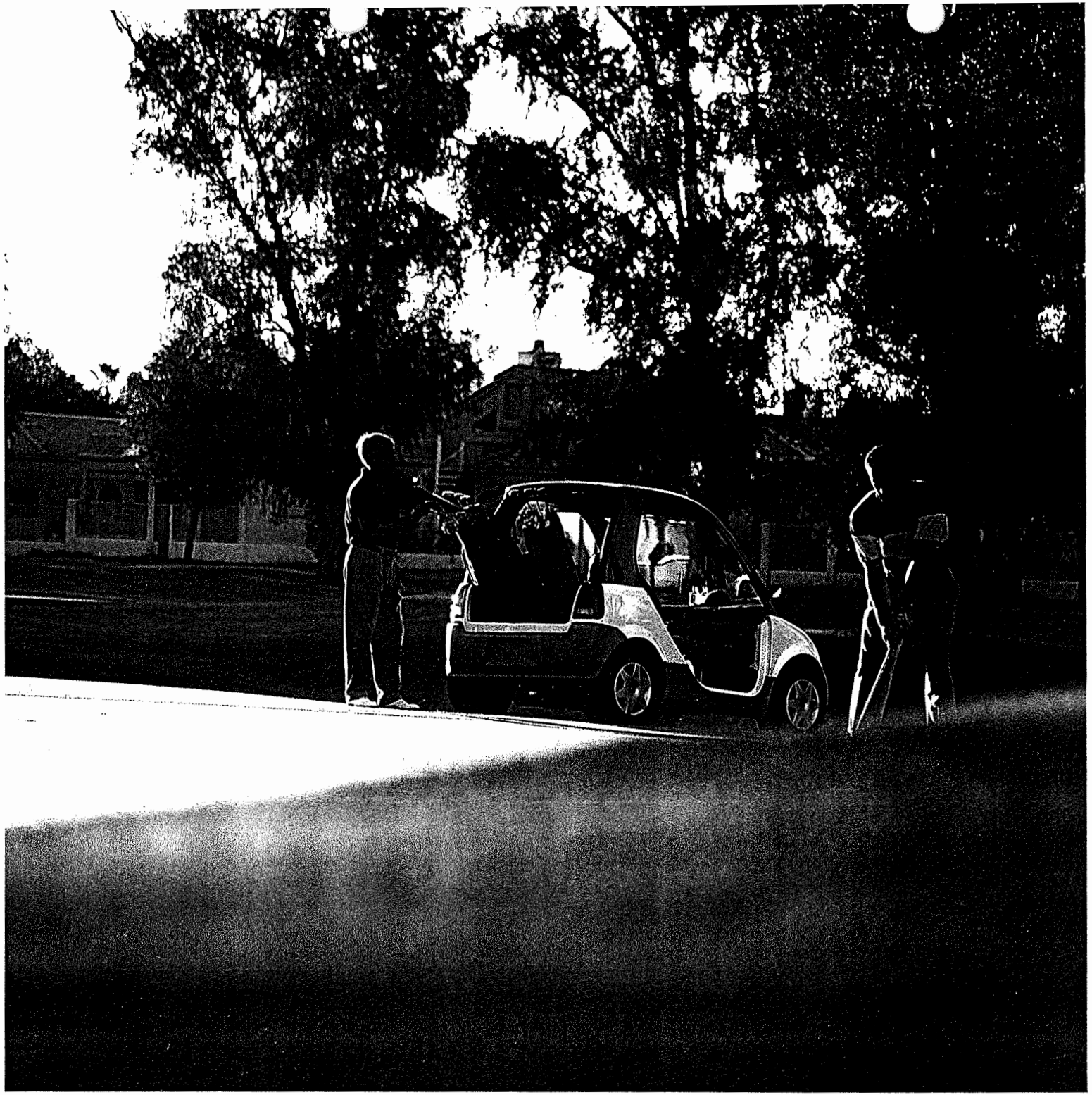
10" turf tires

Passenger side restraint system

Service brake pedal with foot brake



Truly simple operation



We've been around the block a few times. Not to mention the world.

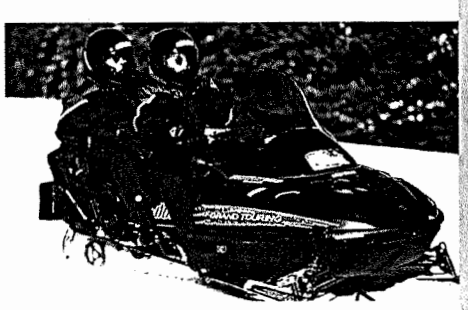


Bombardier (say Bom-bar-dee-yay). The name may be new to you.

But we introduced Ski-Doo,® the world's first production snowmobile.



Built Sea-Doo® watercraft, the world's best-selling boat. Created the Canadair® 50 passenger regional jet. Designed subway cars for the world's largest cities. And monorail systems.



And the Learjet.® And have become the exclusive builder of America's fastest train. We have a long record of innovation behind us. With the NEV, the road ahead looks every bit as promising.



Specifications:

Length
100"/254 cm

Width
55"/140 cm

Height
61.25"/156 cm

Wheel Base
65"/165 cm

Curb Weight
1275 lb/580 kg

Gross Weight
1725 lb/785 kg

Ground Clearance
5.75"/15.3 cm

Curb to Curb
21'/6.4 cm

72V, 4KW DC
shunt motor

6-12 V L/A batteries

Onboard, 110 V charger

Available Accessories:

Door kit

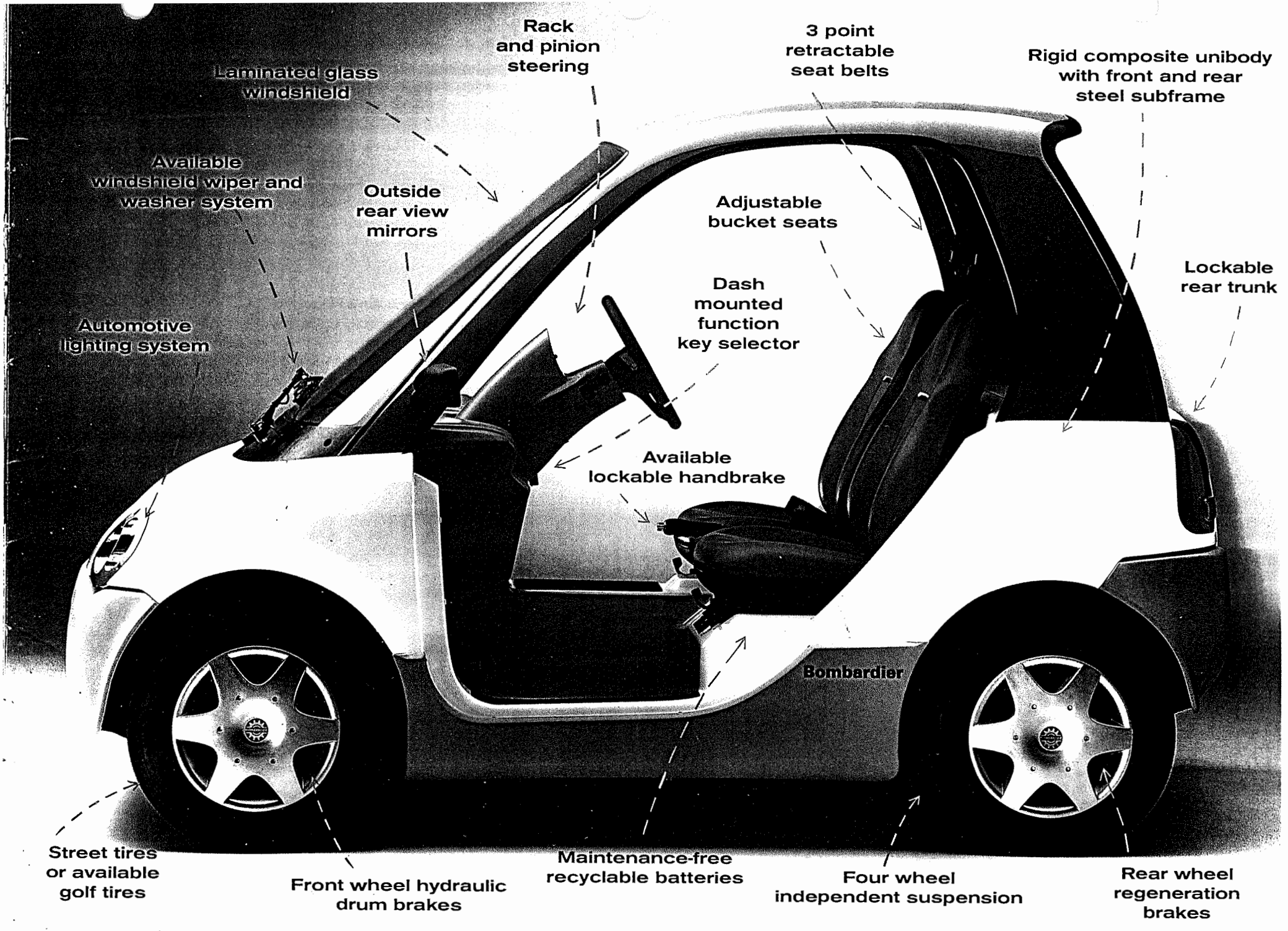
Seeder bottle & rack

AM/FM cassette
stereo system

Windshield wiper &
washer system

Side/rear rain curtain

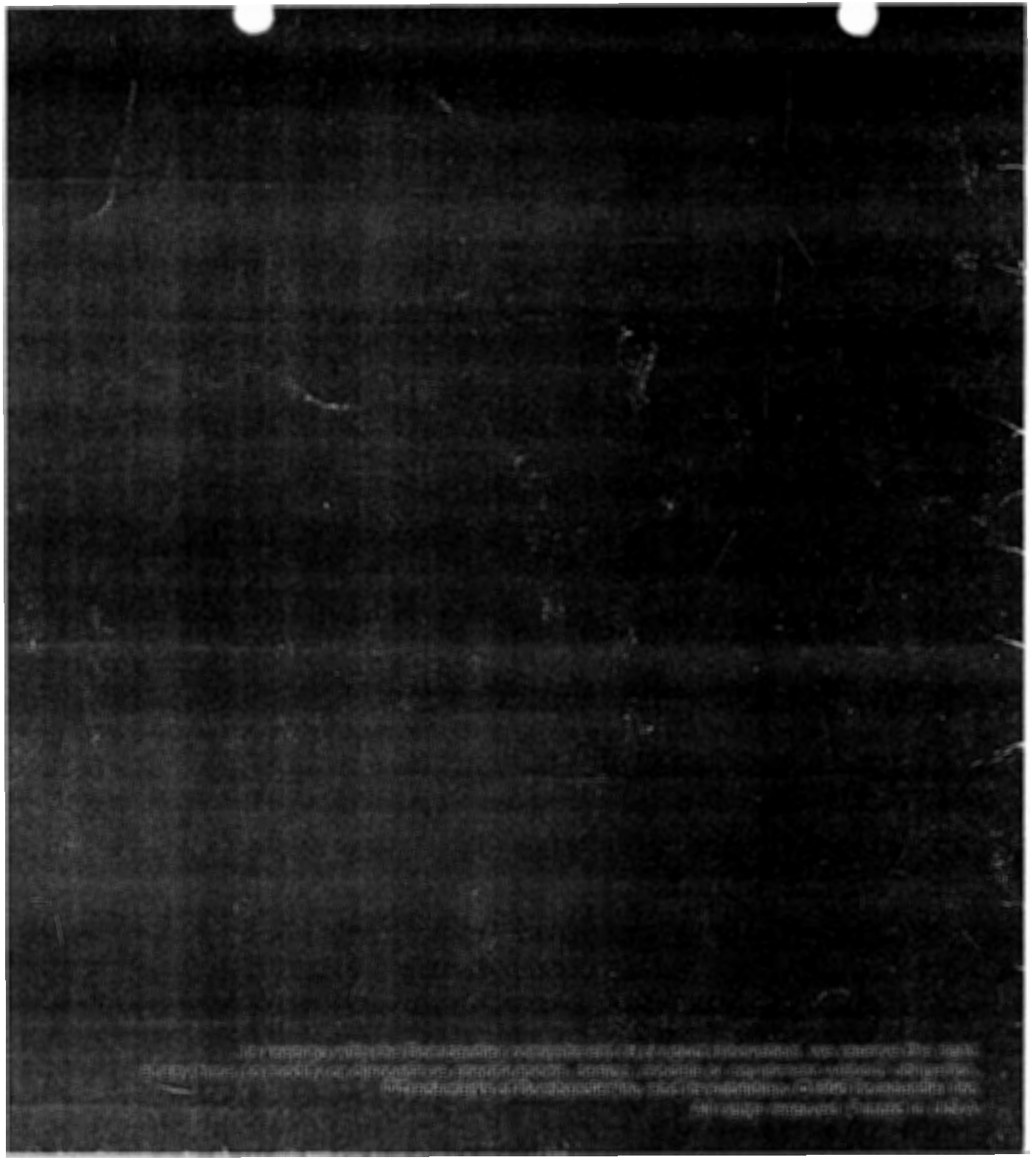
Full body NEV cover


Laminated glass windshield
Rack and pinion steering
3 point retractable seat belts
Rigid composite unibody with front and rear steel subframe
Available windshield wiper and washer system
Outside rear view mirrors
Adjustable bucket seats
Lockable rear trunk
Automotive lighting system
Dash mounted function key selector
Available lockable handbrake
Bombardier
Street tires or available golf tires
Front wheel hydraulic drum brakes
Maintenance-free recyclable batteries
Four wheel independent suspension
Rear wheel regeneration brakes

Important Notice

Drivers and passenger should be advised that the Bombardier NEV is not a motor vehicle as defined by the National Highway Traffic Safety Agency. Nor does it meet Federal Motor Vehicle Safety Standards. It was designed to be used in residential areas with low density traffic, and low speed zones. Refer to your local and state laws for specific details as to where it may be driven.

NEIGHBORHOOD ELECTRIC VEHICLES
Bombardier Motor Corporation of America
2202 West Lone Cactus Drive, Suite 4
Phoenix, Arizona 85024-5505
602-581-1515 Fax 602-581-2760
bomb@goodnet.com



NEV Specifications & Features

Performance

Range	30 miles approx.
Maximum Speed	25 mph
Charge Time	8 hrs through standard AC outlet

Power Train

Batteries	6 - 12V lead acid
Charger	Onboard, 110V
Shunt Motor	72V, 4KW DC

Dimensions

Length	100 in./254 cm
Width	55 in./140 cm
Height	61.25 in./156 cm
Wheel Base	65 in./165 cm
Curb Weight	1,275 lbs./580 kg
Gross Weight	1,725 lbs./785 kg
Ground Clearance	5.75 in./15.3 cm
Curb to Curb	21 ft./6.4 m

Standard Features

Three-point retractable seat belts
Adjustable bucket seats
Automotive lighting system
Four-wheel independent suspension
Front wheel hydraulic drum brakes
Laminated glass windshield
Lockable rear trunk
Outside rear mirror
Rack and pinion steering
Rigid composite unibody w/front and rear steel subframe
Radial tires

Available Accessories

AM/FM stereo cassette system
Detachable doors
Full body NEV cover
Lockable handbrake
Side/rear rain curtain
Windshield wiper and washer system

Golf Option Package

Seeder bottle and rack
Golf tires
Low-speed mode
Golf bag holders
Service brake pedal (w/foot brake)

NEV Fact Sheet

Pricing and Operating Costs:

- Suggested retail price $6,699-Street NEV , $6,999 - Golf NEV
- Eight-hour charge projected costs: $0.66 to $1.14*
- Recyclable batteries require no maintenance

  * Based on 1996 Arizona Public Service kilowatt/hour rates which vary seasonally.

Environmental Facts and Benefits:

- Reduced air pollution:
  - NEVs are zero emission vehicles.
  - As alternatives to gasoline engine cars for short trips, NEVs present needless "cold starts," during which automobiles produce more of their operational emissions.
- No engine noise.
- Batteries are recycles in accordance with state and federal guidelines:
  - Dealers are required to collect spent batteries from owners before new ones may be installed. Spent batteries are recycles in special bins provided to Dealers by battery suppliers who then recycle them.

Legislative and Regulatory Trends:

- Arizona - 1996 Amendment to state Motor Vehicle Code Section 28 created a separate category for Neighborhood Electric Vehicles, and permission from legislative for local municipalities to allow for their operation in speeds of 35 mph or less.

  Sierra Club Phoenix Chapter - recognition of NEVs as a means to curb air pollution.

- California - Passage of Assembly Bill 110 into law in 1995 allowed for use of slow-moving vehicles in specially-designated lanes on public roads zones 25 mph or less, and encouraged local cities to develop alternative transportation programs.

  Sierra Club California - support for NEV concept in communities throughout state.
  South Coast Air Quality Management District - support for NEV concept as a means of reducing air pollution.
  City of Palm Desert Golf Cart Program - allows for use of golf carts in specially designed lanes and on roads zones 35 mph or less.
  City of Davis Alternative Vehicle Program - receives federal funds to purchase Eves.

- Florida - House Bill 725 amended state Motor Vehicle Code 95-330 to allow local municipalities to permit the use of slow-moving vehicles in specially-designed lanes on public roads.

  Dade County Electric Vehicle Program - endorsement of NEV concept for Dade County.

2202 W. Lone Cactus Drive #4
Phoenix, AZ 85027

Growth of Planned Communities:

- Planned or gated communities are expected to grow by 10-25 percent per year throughout the United States over the next decade based on federal housing agency statistics.
- Gated communities and planned residential neighborhoods have grown by 40 percent per year in Arizona since 1991.
- Since 1980, California has experienced strong growth in planned communities, particularly in the Coachella Valley and inland desert regions of the state.

Market Research and Testing:

- Bombardier puts its NEV through more than 22,000 miles of street testing (that's about four round-trips between Los Angeles and New York City).
- Eighteen couples in master-planned communities were given a NEV for extensive driving; their feedback was incorporated into the final stages of product development.

Driver Safety:

- Bombardier **highly recommends use of this vehicle in residential areas with low-density traffic and speed zones of 35 mph or less.**
- Bombardier urges drivers to operate NEVs and all other vehicles in a responsible and safe manner.
- NEVs are designed for operation by adults with valid driver's licenses.
- Bombardier posts specific safety and operational guidelines on NEVs in full view of the driver.
- NEV owners are instructed to read the operators guide.
- NEV dealers are given extensive safety training by Bombardier.

TASK 3 - Research and Evaluate Infrastructure, Chargers, and Instrumentation

Overview of Charging Station Considerations

The following is a summary of the considerations relating to charging stations.
- Prepared by W.R. Warf, PE, Pacific Electric Vehicles

Most of the EV's which would be considered for the ZEV Project use conductive charging connectors. Only General Motors products require the inductive system, and it is furnished at additional cost. It is assumed that if a GM product is acquired, the inductive system (s) could be installed adjacent to conventional conductive equipment, perhaps at the same service.

- Public Safety is major concern
  - we want to avoid extension cords, shock hazards
- Standards SAE J1772 (conductive) and SAE J1773 (inductive)
  - use conductive type station since it's more common
- With government entities involved, best to use UL Listed charging station(s)
  - also note NEC 625 (1996) applies
- Most EV's will require charging at both ends of Willits-Ukiah commute
- EV chargers can cause nuisance tripping of standard GFI's, even without an actual fault
- Since major OEM's (original equipment manufacturers) have invested in making vehicles comply with charging standards, we should use state of the art technology in our charging stations if possible
- Possible suppliers:
  - Local manufacturers/suppliers
  - Square D has built prototypes for EPRI (Electric Power Research Institute)
  - Other suppliers with NEMA 3R but no "active" GFI
  - Milbank RV power station, UL Listed (but not for EV's), and no GFI on 220
  - Electric Vehicle Infrastructure Inc. (EVI)

Recommendation

Purchase EVI MCS-100 station. It is the best system, also most expensive. EVI is working with the OEM's to keep it current and is the most familiar with quirks of the various vehicles.

EVI MCS-100:

- UL Listed as EV charging station
- Compliant with NEC 625
- Selector switch, no current when plugging in
- Active GFI
- Handshake upgrade for Honda available

Discuss metering...Ohio Semitronics AC- W-h meters or can be installed on the vehicle for about $600 including labor. This allows separate monitoring of power use by vehicle, instead of assuming all use at a given charging outlet is for the project vehicle.

Power cost: estimate 15 kW-h AC if charge at both ends, 30 kW-h if at one end.

Attachments

- Charging Station Cost Estimates
- Product literature
- Countywide map of charging stations
- Electric Vehicle Assn. of the Americas (EVAA) - EV Charging Site Directory
  - California listing

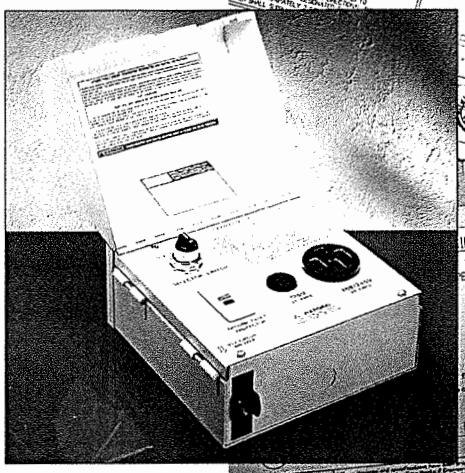
Item	Description	Cost		
1	Nema 3R Enclosure	$100.00		
2	Selector Switch, dpdt	$64.00		
3	20 A circuit breaker	$20.00		
4	14-50R outlet	$67.75		
5	GFI, 40-50 A	$127.69		
6	GFI, 20 A	$55.11		
7	Contactor, 3 pole, 40 A	$279.00		
8	Contactor, 2 pole, 20 A	$130.50		
	proprietary GFix	?		
		$844.05		
	MSC Retail Costs!!			
Electric Vehicle Infrastructure Inc.				
	MCS-100	$1,100.00		
	MCS-600	$3,000.00		
	ICS-200	$2,000.00		
These are EV specific charging stations, UL Listed as such, and				
they comply with NEC 625 and SAE J1772				
Two Box (homegrown) System:				
Discussed with Industrial Electric, 4/1/97				
Item	Description	Cost		
1	Enclosure QO6 12L 100RB	$34.34		
2	40 A GFI Breaker sq. D	$113.33		
3	20 A GFI Breaker, Sq. D	$58.98		
4	6x6x4 Nema 3R	$12.44		
5	14-50R receptacle	$15.42		
6	5-20R receptacle	$1.93		
7	misc. hardware	$20.00		
		$256.44		
Milbank 100 Amp pole mount power outlet system used in Fort Bragg				
		$1000 installed		
Milbank 100 Amp pole mount, 1/2 outlets of Fort Bragg:				$172.93

MANUAL CHARGING STATION

Electrical vehicle users want charging stations that are easy to use, attractive, and unquestionably safe. Electrical service providers need these stations to be cost effective, rugged, and extremely reliable. That's why we developed the MCS-100. For applications that require durability and simplicity, the MCS-100 series is a superior value. As the first in an advanced line of infrastructure products, the MCS-100 also delivers standards compatibility, flexibility, and a high degree of functionality.

These ergonomically designed, wall-mounted units accommodate one vehicle at a time and have been proven through extensive use in the field. They are available now in volume.

MCS-100 SERIES



In addition to having a UL "EV Power Outlet" listing for safety, the MCS series features an enhanced ground fault protector that removes power at the first sign of difficulty. The EVI-developed GFIX is a proprietary product that eliminates the problem of nuisance tripping caused by electrical noise generated in some on-board battery chargers. The unit removes the effects of that noise without compromising normal GFCI operation. With GFIX, nuisance tripping is virtually eliminated.

As a consulting resource, our successful relationship with a long list of satisfied clients has shown that our comprehensive and methodical approach to design, installation, and project management has made EVI one of the most experienced and qualified firms in this dynamic, emerging field.

When you make the switch to electric, make it simple, safe, and reliable. Take the first step with EVI and the MCS-100.

ELECTRIC VEHICLE INFRASTRUCTURE, INC.

11839 INDUSTRIAL COURT AUBURN, CALIFORNIA 95603

(916) 823-8077 FAX: (916) 823-0857

MCS-100 SPECIFICATIONS

General specifications:

The MCS-100 series use the CALSTART Infrastructure Group's interim plug configuration (NEMA 14-50R and 5-20R) and EPRI's IWC voltage standards for today's marketplace. Their switch-selectable 120V-20 amp or 208/240V-40 amp power can be wired directly to the service panel with a single 208-240V-40 amp branch circuit, reducing wiring costs. A safety switch assures that only one outlet is on at a time and provides an OFF position. The MCS series is a NEMA 3-R type enclosure with an optional locking door. Two LEDs indicate level of power delivered for either voltage.

GFCI personal protection device:

Nuisance tripping virtually eliminated on either voltage with optional GFIX module.

Service entrance

208/240V 40 amp, single phase, 3-wire, with ground. Single-branch circuit splits internally to accommodate 120V 20 amp on-board circuit breaker.

Dimensions:

10"W x 10"H x 8"D

Weight:

15 lbs.

Color:

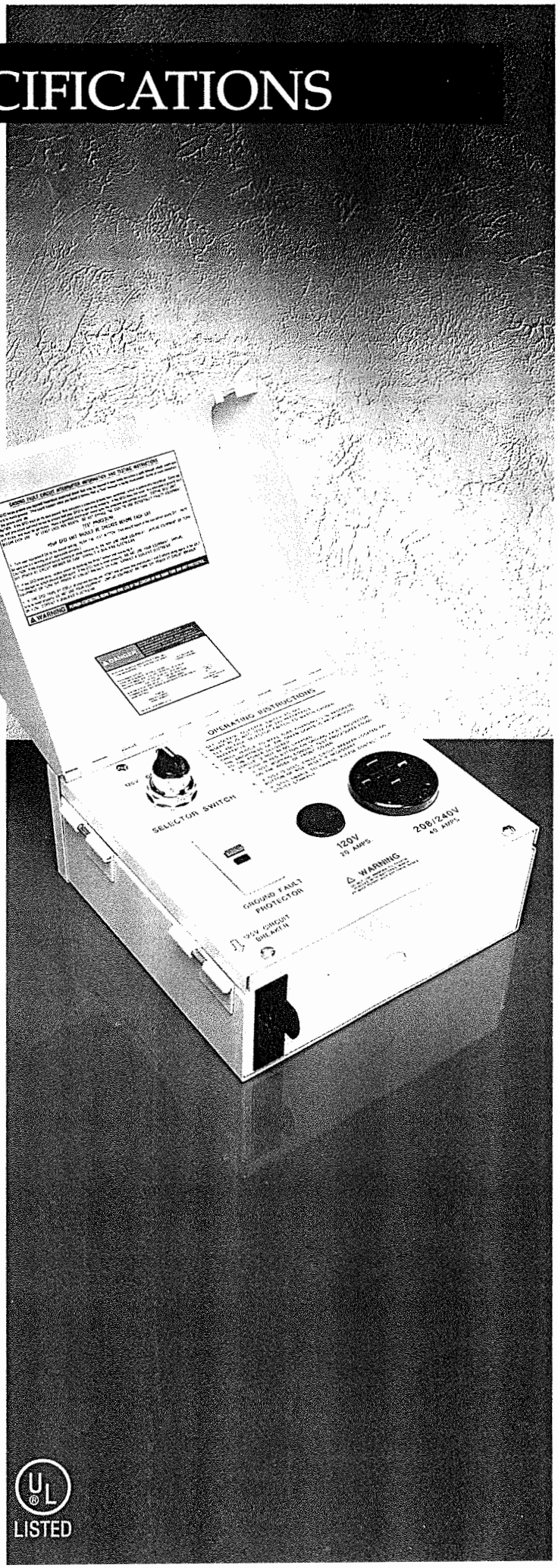
Almond texture
Optional powder-coated colors available.

Warranty period:

90 days
UL Listed

Also from EVI:

For dual-vehicle applications, the MCS-600 series free-standing station provides outlets mounted on opposite sides of the enclosure, designed for public parking areas.



ELECTRIC VEHICLE INFRASTRUCTURE, INC.

11839 INDUSTRIAL COURT AUBURN, CALIFORNIA 95603

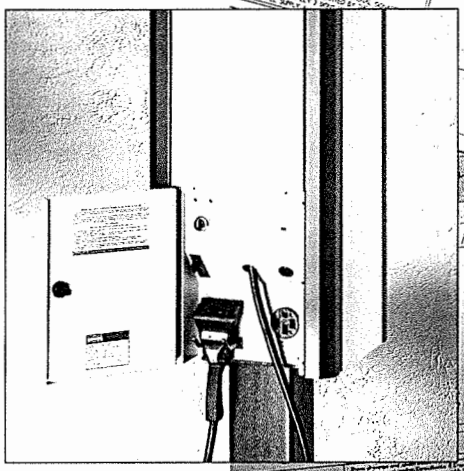
(916) 823-8077 FAX: (916) 823-0857

DUPLEX MANUAL CHARGING STATION

EVI's dual-vehicle manual charging station, the MCS-600, was developed for use in commercial facilities and public parking areas. It incorporates the same ease-of-use features and safety standards as EVI's MCS-100, but the MCS-600 provides considerably more features for public service providers.

The larger size of the MCS-600 was designed for service flexibility. The MCS-600 can be configured as a wall-mount or floor-mount charger, servicing two vehicles simultaneously in either configuration. It was also designed to accommodate two cable reels, to be added when the SAE standard connector and vehicle sockets are introduced. The cables will reach 16' from the charging unit to the vehicle.

MCS-600 SERIES



Professionally designed for ergonomics, safety, and durability, the MCS-600 features industrial-grade controls, a night light on top, and a heavy-duty floor mount stand, all built for the demands of duty in public parking lots. The MCS-600 is available now in volume.

In addition to having a UL "EV Power Outlet" listing for safety, the MCS series features an enhanced ground fault protector that removes power at the first sign of difficulty. The EVI-developed GFIX is a proprietary product that eliminates the problem of nuisance tripping caused by electrical noise generated in some on-board battery chargers. The unit removes the effects of that noise without compromising normal GFCI operation. With GFIX, nuisance tripping is virtually eliminated.

As a consulting resource, our successful relationship with a long list of satisfied clients has shown that our comprehensive and methodical approach to design, installation, and project management has made EVI one of the most experienced and qualified firms in this dynamic, emerging field.

When you make the switch to electric, make it simple, safe, and reliable. Take the first step with EVI and the MCS-600.

ELECTRIC VEHICLE INFRASTRUCTURE, INC.

11839 INDUSTRIAL COURT AUBURN, CALIFORNIA 95603

(916) 823-8077 FAX: (916) 823-0857

MCS-600 SPECIFICATIONS



General specifications:

The MCS-600 series uses the CALSTART Infrastructure Group's interim plug configuration (NEMA 14-50R and 5-20R) and EPRI's IWC voltage standards for today's marketplace. Their switch-selectable 120V-20 amp or 208/240V-40 amp power can be wired directly to the service panel with a single 208-240V-40 amp branch circuit, reducing wiring costs. A safety switch assures that only one outlet is on at a time and provides an OFF position. The MCS series is a NEMA 3-R type enclosure with optional lockable doors. Two LEDs indicate level of power delivered for either voltage.

GFCI personal protection device:

Nuisance tripping virtually eliminated on either voltage with optional GFIX module.

Service entrance:

Two 208/240V 40 amp, single phase, 3 wire, with ground. Single-branch circuit splits internally to accommodate 120V 20 amp on-board circuit breaker.

Dimensions:

17"W x 82"H x 17"D

Weight:

125 lbs.

Color:

Almond/Blue texture
Optional powder-coated colors available.

Warranty Period:

90 days
UL Listed

Also from EVI:

The MCS-100 series are wall-mounted units to accommodate one vehicle at a time and have been proven through extensive use in the field.

ELECTRIC VEHICLE INFRASTRUCTURE, INC.

11839 INDUSTRIAL COURT AUBURN, CALIFORNIA 95603

(916) 823-8077 FAX: (916) 823-0857

INTELLIGENT CHARGING STATIONS

EVI's family of user friendly charge stations continue with the introduction of its newest member, the "ICS-200 Power Station". This unique unit is designed for use with the newly adopted SAE-J1772, Electric Vehicle Conductive Coupling Recommended Practice. The SAE J-1772 conductive standard is the choice for five of the seven major OEM's introducing vehicles in 1997, as well as many of the larger OEM's worldwide expected to enter the market.

EVI's technology is proving itself in hundreds of working installations across the nation meeting the standards recognized by industry leaders. EVI has accumulated a wealth of successful experience, with cost effective equipment and infrastructure programs for communities of all sizes. EVI is proving itself with utilities, the automotive industry, government agencies, and the private sector by developing the safest and easiest to use infrastructure products for commercial fleet and residential applications. Just ask some of EVI's clients such as Sacramento Municipal Utility District (SMUD), Southern California Edison (SCE), Los Angeles Department of Water and Power (LADWP), Florida Power and Light (FPL), City of Lancaster, Hewlett-Packard, United States Postal Service, and Ford Motor Company.

ICS-200 SERIES



EVI's is unique in its qualifications, experience and expertise. No company is more committed to making the electric vehicle a real practical alternative to present day hydocarbon vehicles. When you make the switch to electric, make it simple, safe and reliable.

Take the first step with EVI's ICS-200 Power Station.

ELECTRIC VEHICLE INFRASTRUCTURE, INC.
11839 INDUSTRIAL COURT ~ AUBURN, CALIFORNIA 95603
(916) 823-8077 ~ FAX: (916) 823-0857
(800#) (888) 823-8077 ~ E-MAIL: MOROS@EVII.COM

What is an ICS-200 Power Station?

The purpose of the ICS-200 is to provide the EV user with a safe and manageable link between the power grid and the EV. Electric power is the fuel for EV's and the ICS-200 Power Station is designed to safely manage the distribution of this new fuel.

Primary functions include the support of:

- Multiple levels of safety for the customer, the EV, and the equipment
- Automatic load shifting to off-peak hours and demand charging
- Long term durability
- Industry standard compliance, including SAE, UL, FCC, and NEC.

The ICS-200's unique voice announcer puts the user at ease with its "plug-in/walkaway", no hassle, trouble free, operation. There is no need to read directions, ... it does it automatically. There is no need to be concerned with trying to determine if it is in the off-peak mode for optimized utility charge cycle costs, ... it does it automatically. There is no diagnostics for the user to perform, ... it does it automatically. There is no need to check if the connection is made properly, ... it does it automatically. This is the ICS-200 concept! It is a friendly, walkaway, and "forget it" unit that will alert you at the first sign of trouble. The ICS-200 Power Station is a microcomputer-controlled unit built with the modern user in mind. It is simple, elegant, and robust enough to handle any of today's needs.

Electric Vehicle Infrastructure, Inc. provides market driven, performance proven products. EVI provides the user with an easy to use, attractive, and unquestionably safe station. Each is engineered to meet a variety of commercial and consumer requirements. EVI's adaptability assures the flexibility necessary to follow market evolution and growth. It is the kind of corporate philosophy that will allow EVI to remain as competitive and versatile as the market demands.

Electric Vehicle Infrastructure, Inc.
11839 Industrial Court ~ Auburn, California 95603
(916) 823-8077 ~ Fax: (916) 823-0857
(800#) (888) 823-8077 ~ E-mail: moros@evii.com

General Specifications

Service Entrance:

208/240V 60 amp, single phase, 3-wire, with ground

Dimensions:

18"W x 12"H x 8"D — NEMA 4R Construction

Operating Temperatures:

-22°F (-30°C) ~ +122°F (+50°C)

Weight:	**Color:**
21 lbs.	Almond texture

Warranty period:

1 year labor / 3 year parts warranty
UL LISTING and FCC Certification Pending

Features

SAE J-1772 COMPLIANT

VOICE ANNOUNCER:

Simple user friendly voice interface

UL 2231 - PERSONAL PROTECTION SYSTEM:

Ground fault protection with automatic re-closure, no manual testing. (patent pending)

COLD LOAD PICKUP:

Time delayed and randomized re-energizing following power outages

EXHAUST FAN CONTROLS:

Energizes exhaust fan when vehicle requires it

PRECONDITIONING:

Thermal regulation of battery pack and cabin conditioning without charging batteries

WATCHDOG SYSTEM:

Historic data collection, i.e.: counting contactor closures, logging the most recent errors, and power information

GROUND MONITORING CIRCUIT:

Constantly checking for presence of proper safety ground

CONTACTOR MONITORING CIRCUIT:

Constantly checking contacts for early signs of failure

FIELD INSTALLATION & CONFIGURATION SYSTEM: ("FICS")

Service installation software interface for re-programmability

PORTABLE ELECTRONIC TESTER: ("PET")

For field inspection testing and complete diagnostics at start-up

HARDWARE EXPANSION CAPABILITY:

To add future needs in a changing market such as UL 2293 Data Communications. No need to replace the present unit...just add a module!

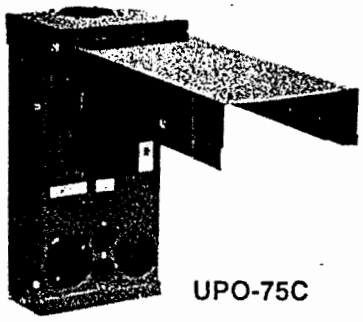
Options

PULL-FREE CABLING SYSTEMS
EXCESSIVE STRAIN DETECTION (NEC 625-19)
ELECTRONIC SECURITY LOCK SYSTEM
REMOTE INTELLIGENT CONSOLE - ("RIC")
CE-BUS COMMUNICATIONS INTERFACE
BILLING SYSTEMS

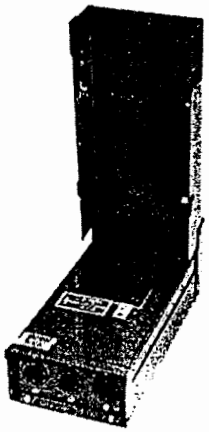
MILBANK

100 AMP POST MOUNT POWER OUTLET METERED & UNMETERED

120 / 240 VAC



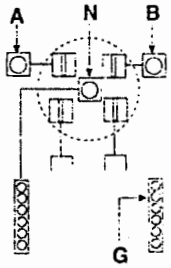
UPO-75C

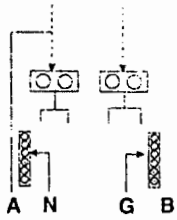


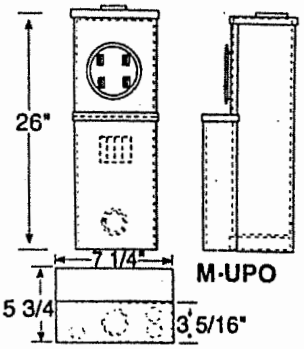
UPO-35122

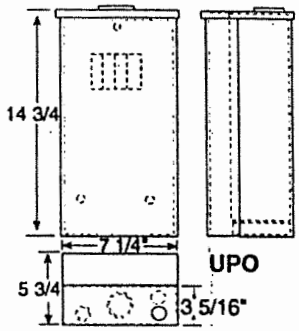


MUPO





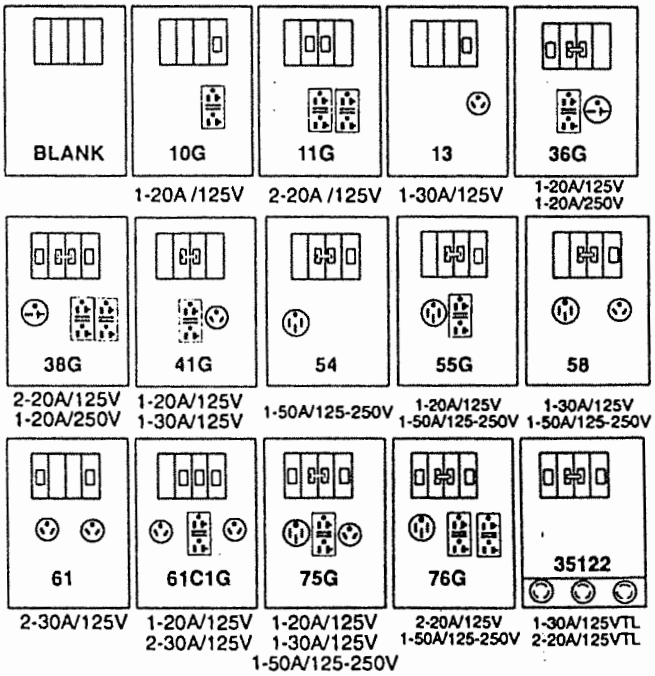




CAT. #	DESCRIPTION	WT.
UPO	100 Amp enclosed plug-in style bus	11
MUPO	100 Amp continuous duty meter socket / UPO combination	19
P-10	20 Amp with (1) 5-20R receptacle #10-14 wire range	—
P-13	30 Amp with (1) TT-30 receptacle #10-14 wire range	—
P-54	50 Amp with (1) 14-50R receptacle #4-12 wire range	—

NOTE: Receptacle selections should comply with NEC 551-71 when used for Recreational Vehicle Parks.

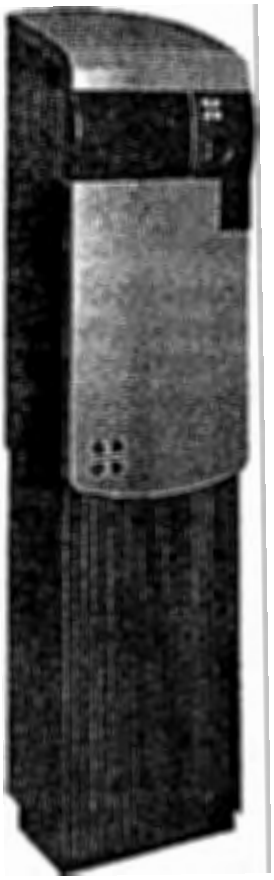
STANDARD CONFIGURATIONS



RATING: NEMA 3R, 120/240 volt,1 Ø, 100 Amp power outlet.
CIRCUIT BREAKERS: Uses plug-in, universal style circuit breakers - 4 poles available (except P-10, P-13, P-54.)
HUBS: Accepts up to 2 1/2" hub (order separately). Closure plate included (except P-10, P-13, P-54.)
CONNECTORS: Twin line terminal lugs #1 for looping standard (single lugs on M-UPO) (except P-10, P-13, P-54.)
RECEPTACLE: For 20 Amp GFI receptacle add suffix "-G".
BREAKER: For 20 Amp GFI breaker add suffix "-GB".
Loop Feed: For loop feed capability add suffix "C". (i.e. MUPO-36G becomes MUPO-36CG.)

MAGNE CHARGE™

FLOOR MOUNT CHARGER
(FM200)
OWNER'S MANUAL



ELECTRIC VEHICLE CHARGER

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS- This manual contains important instructions for the MagneCharge ™ Floor Mount Inductive Charger FM200. Carefully read these instructions and the charging instructions in the electric vehicle owner's manual before charging your electric vehicle.

The following symbols may be found in this manual or on labels affixed to the charger:



The exclamation mark within a triangle alerts the user to important operating and maintenance (servicing) instructions.



The lightning bolt with arrowhead within a triangle alerts the user to the presence of dangerous voltages which may constitute a risk of electrical shock.

1. Only use this charger to charge electric vehicles equipped with a MagneCharge™ inductive charge port (inlet). See the vehicle owner's manual to determine if vehicle is equipped with a MagneCharge™ inductive charge port.

2. VENTILATION - Some electric vehicles require an external ventilation system to prevent the accumulation of hazardous or explosive gases when charging indoors. Check the vehicle owner's manual to determine if your vehicle requires ventilation during indoor charging. Do not attempt to defeat ventilation system control mechanisms. If a malfunction of the ventilation system is suspected contact your MagneCharge ™ Sales and Service Representative. If the charger is used outdoors, no ventilation system is required.

NOTE: This charger will not charge vehicles that require ventilation if the ventilation system has not been installed and properly connected to the charger.



WARNING: If a malfunction of the ventilation system is suspected, DO NOT charge a vehicle that requires ventilation indoors. Contact your MagneCharge™ Sale and Service Representative for service

3. Do not block the air intake (upper left side) or exhaust (lower back) vents. Allow 46 cm (18 inches) of clearance on all sides of the unit. Blocking the vents may lead to reduced output power and significantly increase charging time.

4. When removing the charge coupler from vehicle's charge port utilize the handle rather than pulling on the cable.

5. Make sure the charger's output cable is positioned so it will not be stepped on, tripped over, or otherwise subjected to damage or stress.

6. Do not attempt to repair or service the charger yourself. There are no user serviceable parts inside. Contact your local MagneCharge™ Sales and Service Representative.

7. Do not operate charger with a damaged output cable or coupler. Contact your local MagneCharge™ Sales and Service Representative for service immediately.

8. Do not operate charger if it has received a sharp blow or been dropped or otherwise damaged in any way. Contact your local MagneCharge™ Sales and Service Representative for service immediately.

9. Turn off input power to charger at the circuit breaker before cleaning. Refer to **MAINTENANCE** section.

INTRODUCTION

Welcome to the new and exciting world of electric vehicles. The MagneCharge™ Floor Mount Inductive Charger FM200 is designed to be installed either outdoors or indoors. The floor mount charger is intended to be the primary charger for your electric vehicle. Refer to your vehicle owner's manual for charging times and additional information. The charging operation is fully automatic and is described in the following section.

OPERATION

The charging procedure is described below. The charger also supports additional functions, such as "delayed charging" that may or may not be supported by your vehicle. Refer to charging instructions in the vehicle owner's manual for your vehicle's specific charging information.

1. Unlock the charger door and remove the charge coupler from holster. The charger display reads "******" then "CONNECT TO VEHICLE".

2. Open the vehicle's charge port access door (refer to vehicle owner's manual).

3. Fully insert the charge coupler into the charge port.

NOTE: When properly inserted, the charge coupler will snap into place with a solid click.

4. Charging begins automatically. The display reads "XX% FULL" alternating with "HOURS /MINUTES TO COMPLETE" indicating battery state of charge.

5. If "FULL LEVELING" appears on the display, the batteries are more than 98% full. The display continues to read "FULL LEVELING" while the battery levels are being "equalized", once they are "equalized" the display will read "COMPLETE".

6. When the batteries are fully charged; the display reads "FULL COMPLETE"

NOTE: If the display reads "FULL SUPPORT" the vehicle's batteries are fully charged and the charger is supplying power to auxiliary equipment in the vehicle (air-conditioning, heater or defroster).

NOTE: If a fault is detected during charging, the charger will automatically stop charging and display the appropriate fault message on the display (see "TROUBLESHOOTING").

7. In some vehicles it may be possible to lock the charge coupler in the charge port (refer to vehicle owner's manual).

NOTE: The charge coupler can be safely removed from the charge port at any time during charging . The charger will automatically stop charging when the charge coupler is removed.

8. Remove the charge coupler from the charge port. Make sure to firmly secure the charge coupler in its holster and lock charger door.

9. Close the charge port access door or cover on vehicle.

CHARGER DISPLAYS

NOTE: Not all displays may pertain to your vehicle. Refer to your vehicle owner's manual.

	Blank Display - Charger power turned off.
**********	Charger self test running.
CONNECT TO VEHICLE	Charger is operational but has not established communications with the vehicle.
STANDBY	Vehicle has placed the charger in Standby mode.
CHARGING	Charger has established communications and is transfering power to the vehicle.
CHARGING pp%_FULL	Main battery pack State of Charge is between 0-100% and is charging.
CHARGING hhH_mmM TO FILL	Vehicle's estimated time to completion of charging (hh=Hours, mm=Minutes).

NOTE: Display will toggle between the two above diplays during charging indicating % full and time to completion.

FULL LEVELING	Main battery pack has been charged and the charger is now leveling "equalizing" the batteries.

FULL LEVELING hhH_mmM TO_GO	Main battery pack has been charged and the display indicates the length of time to complete leveling.
FULL SUPPORT	Main battery pack is fully charged and the charger is providing power to auxillary equipment in the vehicle.
FULL COMPLETE	Main battery pack is fully charged.
VEHICLE DELAY	Main battery pack is not fully charged and the charger is now in a vehicle requested DELAY mode.
VEHICLE DELAY hhH_mmM TO START	Main battery pack is not fully charged and the charger is now in a vehicle requested DELAY mode of less than 24 hours.

The following displays are fault conditions, refer to the "TROUBLESHOOTING" section for additional information.

CHECK VENT	FAULT MESSAGE This vehicle requires external ventilation during charging and the ventilation system was not ready.
CHECK CHARGER	FAULT MESSAGE Charger shutdown due to a fault condition. Contact local MagneCharge™ Sales and Service Representative.
CHECK VEHICLE	FAULT MESSAGE Charger shutdown due to a vehicle fault condition. Contact local vehicle Retailer Service Representative.

VENTILATION

Some electric vehicles require ventilation to prevent the accumulation of hazardous or explosive gases when charging indoors. Check the vehicle owner's manual to determine if your vehicle requires ventilation during indoor charging. If ventilation is required, a ventilation system providing at least 197 cubic feet per minute (cfm) must be installed in the charging area by a qualified electrician in accordance with the 1996 National Electric Code (ANSI/NFPA 70), Article 625, 725.

The MagneCharge™ Floor Mount Inductive Charger is capable of controlling an external ventilation system. See MagneCharge™ Floor Mount Inductive Charger (FM200) Installation Guide for how to connect the charger to an external ventilation system.

NOTE: If your floor mount charger is installed outdoors no ventilation system is required.

NOTE: Connection of the charger to an external ventilation system should only be performed by a qualified electrician. It is recommended that the ventilation system be connected during installation of the charger.

When properly connected to an external ventilation system, the charger will automatically turn on and off the ventilation system as required during charging (ventilation requirements are communicated from the vehicle to the charger during charger initialization and throughout the charging process). If the vehicle requires ventilation and no ventilation has been provided, the charger will not charge the vehicle and "CHECK VENT" will be displayed on the charger display.

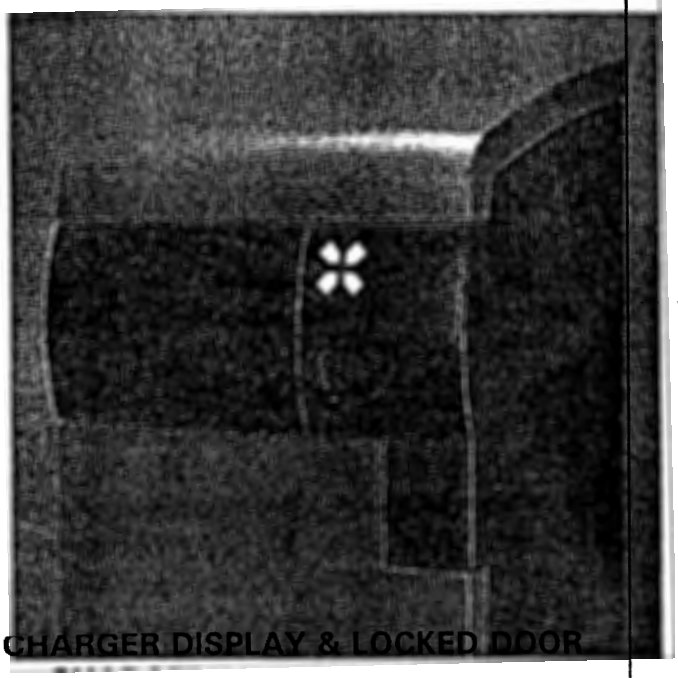
WARNING: Do not attempt to defeat the charger's ventilation controls as this may lead to a hazardous or explosive gas buildup during charging. If a malfunction of the external ventilation system is suspected, do not charge vehicles that require ventilation. Contact a qualified electrician for immediate service of the ventilation system.

MAINTENANCE

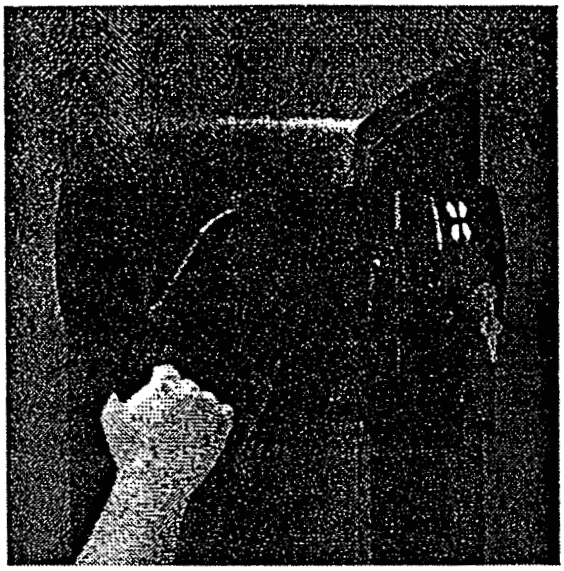
Cleaning:

Turn off the charger at the circuit breaker before cleaning. Clean the charger with a soft cloth lightly moistened with mild detergent solution. Do not use any type of abrasive pad, scouring powder or solvent such as alcohol or benzene. To reduce the risk of electrical shock or equipment damage, do not allow moisture to enter the charger while cleaning.

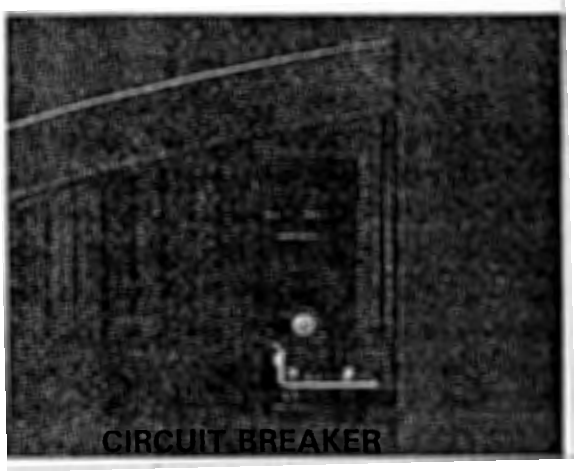
FEATURES



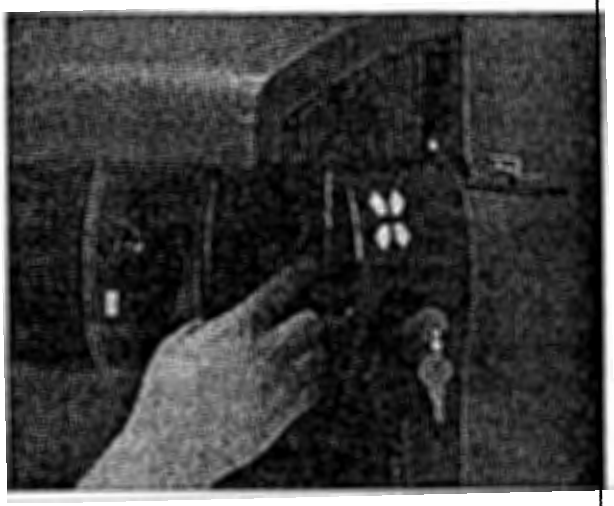
CHARGER DISPLAY & LOCKED DOOR



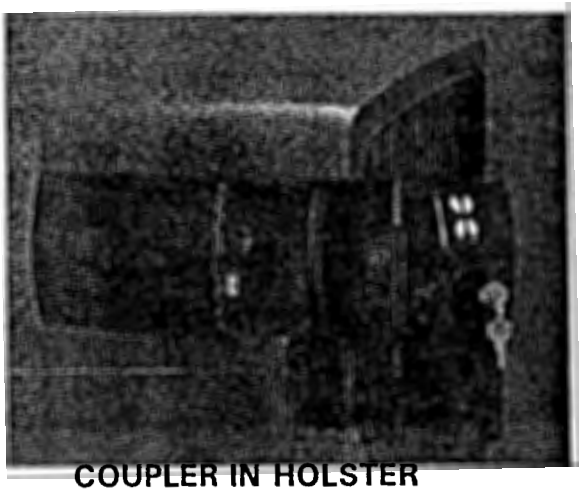
CHARGE COUPLER REMOVAL



CIRCUIT BREAKER



CIRCUIT BREAKER DOOR
AND
RELEASE BUTTON



COUPLER IN HOLSTER

TROUBLE SHOOTING

The charger display does not illuminate when the charge coupler is pulled out of its holster.

Indicates the charger is not receiving power.

Check to see if the charger's ON/OFF circuit breaker has been tripped (see Features section); if so, reset circuit breaker.

- Check to see if the circuit breaker at the service panel serving the charger circuit has been tripped; if so, reset circuit breaker.
- If both circuit breakers are engaged properly and condition persists, call your local MagneCharge™ Sales and Service Representative immediately.

The charger display blinks CONNECT TO VEHICLE while the charge coupler is inserted into the vehicle charge port.

Indicates the charger has not established a communication link with the vehicle.

- Make sure the charge coupler has been fully inserted into the charge port.

NOTE: Remember that the charge coupler will snap into place with a solid click

- If the charge coupler is fully inserted and the condition persists, attempt to reset the charger by putting the charge coupler back into its holster; then attempt to charge the vehicle again.
- If this condition still persists, call your local MagneCharge™ Sales and Service Representative immediately.

The charger display continuously blinks CHECK VEHICLE.

Indicates the vehicle has detected a malfunction.

- Refer to the vehicle owner's manual for service contact point.

The charger display blinks CHECK CHARGER.

Indicates the charger has detected an internal malfunction.

- To reset the charger after a fault has been detected, put the charge coupler back into its holster, or turn the Charger circuit breaker off, then on again.
- If this condition still persists, call your local MagneCharge™ Sales and Service Representative.

The charger courtesy light is not lit.

Indicates the charger is not receiving power or the light is burned out.

- Check to see if the charger ON/OFF circuit breaker has tripped (see Features sections); if so, reset circuit breaker.
- Check to see if the circuit breaker at the service panel serving the charger circuit has been tripped; if so, reset circuit breaker.
- If both circuit breakers are engaged properly and the charger operates properly, the light is probably burned out. Call your local MagneCharge™ Sales and Service Representative.

The charger displays CHECK VENT.

Indicates the vehicle requires external ventilation and charger does not have confirmation that a ventilation system is operational or connected to the charger.

- If the charger is indoors and the ventilation system is not functional, call your local MagneCharge™ Sales and Service Representative immediately.
- If the charger is installed outdoors, call your local MagneCharge™ Sales and Service Representative immediately.

CHARGER SPECIFICATIONS

(FM200) FLOOR MOUNT CHARGER:

ITEM	CHARACTERISTIC
INPUT	
Voltage	208 -240 VAC
Current	30 A (MAX.)
Frequency	50/60 HZ
OUTPUT	
Power	6.6 kW (MAX.)
Vent Enable	12v, 50 mA
DIMENSIONS	
Height	1460 mm (57.5 in.)
Width	356 mm (14.0 in.)
Depth	325 mm (12.8 in.)
Charge Coupler Cable Length	2.28 to 2.25 m (7.5 to 8 ft)
WEIGHT	82 kg (180 lbs)
ENVIRONMENT	
Temperature F)	0° C (32 ° F) to 40 ° C (104 °
Indoor	Yes
Outdoor	Yes

LISTED
EV BATTERY CHARGER
7M60

FCC INFORMATION

The MagneCharge™ inductive charger operates on a radio frequency subject to Federal Communications Commission (FCC) Rules.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This product has been designed to protect against radio frequency interference (RFI). However there may be some instances when high powered radio signals or nearby RF-producing equipment (such as digital phones, RF communications equipment, etc.) could affect operation.

If interference to the charger is suspected, we suggest the following steps before consulting your dealer for assistance: (1) Try reorienting or relocating nearby electrical appliances or equipment during charging. (2) Turn off nearby electrical appliances or equipment during charging.

Changes or modifications to this product by other than an authorized service facility could void authorization to use this equipment.

MAGNE CHARGE™

1-800-482-6644

Power Control Systems, Torrance, CA
90509-2923

16243352

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FLOOR MOUNT CHARGER INSTALLATION GUIDE (FM200)

Before you begin --
Read these instructions completely, including the important safety instructions.

Note to Installer - Be sure to leave these instructions with the consumer.

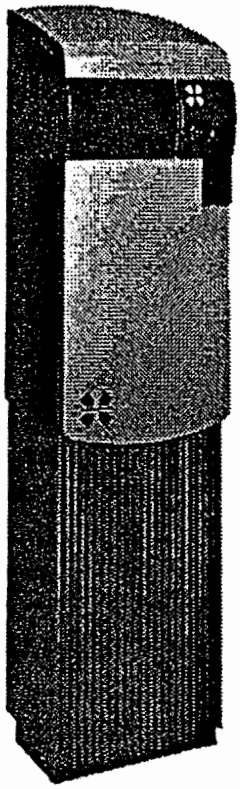
Note to Consumer - Keep these instructions for future reference.

Required Installation Tools and Materials

- Ventilation System (see text)
- Site Preparation (see text)
- Mounting hardware and 14 MM socket
- Common hand tools
- Wire nuts Qty 4 (8-10 AWG)
- Jumper (Outdoor use only)
- TORX PLUS Driver M4

Inventory

- Floor mount (FM200) Owner's Manual
- Floor Mount (FM200) Installation Guide
- Keys Qty 2
- Warranty card
- Floor Mount Charger (FM200)



ELECTRIC VEHICLE CHARGER

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS--

This installation guide contains important instructions that should be followed during installation of the MagneCharge™ Floor Mount Inductive Charger (FM200). **Carefully read these instructions before installing the charger:**

- **VENTILATION** - This charger contains provisions for control of an external ventilation system (e.g., fan turn on/off) while charging indoors. If ventilation is required during indoor charging, connect an external ventilation system to the charger per instructions contained in the VENTILATION section of these instructions. Improper connection of the ventilation control may lead to hazardous or explosive gas buildup during charging. **Refer to the vehicle Owner's Manual to determine if your vehicle requires a ventilation system while charging indoors. If the vehicle Owner's Manual is unclear or does not address ventilation requirements, contact the service representative where the vehicle was purchased.**
- Disconnect power to the charger branch circuit at the service panel before installation.
- The charger should be installed by a qualified electrician in accordance with all local electrical codes and ordinances and the instructions contained in this Installation Guide.
- Do not install in a location that blocks the air intake (upper left side) or exhaust (middle back) vents. Allow at least 46 cm (18 in) of clearance from any wall or fixture.
- **GROUNDING INSTRUCTIONS** - The charger should be connected to a grounded, metal, permanent wiring system. An equipment-grounding conductor should be run with circuit conductors and connected to equipment-grounding terminal or lead on the battery charger. Connections to the battery charger should comply with all local codes and ordinances.

The following symbol may be found in this manual or on the labels affixed to the charger.



This symbol alerts the installer to the presence of dangerous voltages that may constitute a risk of electrical shock.

Read all installation requirements and instructions before performing the installation.

ɹquirements

NOTE: Refer to the vehicle Owner's Manual to determine if the vehicle requires ventilation while charging indoors. If the Owner's Manual is unclear or does not address ventilation requirements for the vehicle then contact the service representative where the vehicle was purchased. For all vehicles that require ventilation systems, refer to the section in this installation guide titled VENTILATION.

1. The charger requires a dedicated branch circuit rated at 208-240 VAC (single phase) with a minimum capacity of 40 amps and an overcurrent protection of 40 amps.

NOTE: Do not install a Ground Fault Circuit Interrupter (GFCI) in the branch circuit. The charger contains a built-in ground fault protection device that may cause nuisance tripping of commercially available GFCIs.

2. The charger weighs approximately 82 kg (180 lbs). This installation is a two-person operation.
3. The installation instructions assume that the installer has prepared a suitable mounting base to accommodate the dimensions outlined in Figure 1, and has provided the proper power inputs and ventilation system wiring if required. See section "SITE PREPARATION" in this installation guide.
4. To meet requirements for handicap access to the charger, the height of the charge coupler should not exceed cm 121 cm (48 in) from the grade for front access. If side access is available, the height of the charge coupler should not exceed 137 cm (54 in) from the grade.
5. The top left side and the middle back of the charger must remain unobstructed for proper air flow. Allow for a minimum of 46 cm (18 in) clearance on all sides.
6. The charger must be mounted within access of the electric vehicle charge port (inlet). Note that the coupler cable minimum useable length is 229 cm (7.5 ft).

INSTALLATION



WARNING: Turn off the circuit breaker at the service or distribution panel supplying the charger before attempting to perform the following steps.

Instructions

NOTE: Do not attempt to remove the coupler from its holster without removing the retraction locking screw (see step 5).

1. Remove the charger from the shipping container.

NOTE: Packing material and shipping container is re-useable do not destroy.

2. Familiarize yourself with the charger (see Figure 2).
3. Remove the six screws securing the kick panels to the bottom of the charger; remove kick panels (see Figure 2).
4. Remove the lower front panel as follows:
   a) Remove the two screws securing the lower front panel to the top front panel.
   b) Working from the bottom up, push in the side tabs of the lower front panel while gently pulling on the panel.
   c) Note the location of the vent control terminal block as shown in Figure 2, View C.
5. Remove the retraction locking screw from the charge coupler retraction mechanism as shown in Figure 2. Retain the screw for future use.
6. Remove the front cover of the junction box.
7. Attach a flexible conduit to the rigid power conduit coming out of the mounting base. The distance from the mounting base surface to the junction box is approximately 25 cm (10 in).

Note: Two following steps require two people to perform.

8. Move the charger to the mounting base.
9. Align the holes of the charger with the studs and electrical conduit, set the charger on the base.

   CAUTION: The charger is not stable until fully secured to base!

10. Place a flat washer, lock washer and nut, in this order, onto a mounting stud.
    a) Hand tighten the nut.
    b) Repeat for each stud (4 times).
    c) Tighten down all nuts with a wrench to (80 lbs-in).

11. Unlock and open the charge coupler door. Depress the red release button to access the circuit breaker(see Figure 2, View A).

    Set the circuit breaker to the OFF (down) position.

NOTE: If the charger is to be mounted indoors, go to the **VENTILATION** section.

13. If the charger is to be located outdoors, place a jumper between the Vent Confirm and Vent Confirm Rtn terminals (see Figure 2, View C).

    NOTE: Construct a jumper using 18 gauge 600 volt, UL Style 1015 wire and two spade lugs.

14. Note the color of the three power feed wires; two black and one green.

15. Two black 10 AWG wires are for input power.

16. One green 10 AWG wire is for equipment ground.

17. Connect the flexible conduit to the junction box (see Figure 2).

18. Connect the wires using wire nuts as shown in Figure 2, View D as follows:

    Input power: 208 - 240 VAC

    Line 1 (HOT) **BLACK WIRE**

    Line 2 (HOT) **BLACK WIRE**

    Ground **GREEN WIRE**

NOTE: Supply side wire may be a different gauge wire.

NOTE: Neutral wire is not required or connected. If the neutral wire is present then cap it off with a wire nut.

9. Replace the cover on junction box.

20. Bend all spade lugs to allow installation of front panel.

SYSTEM TEST

21. Turn on the circuit breaker located in the service panel, and set the charger circuit breaker to the ON (up) position.

22. Pull the charge coupler out of its holster. Verify the display reads "*******" and then changes to "CONNECT TO VEHICLE".

    NOTE: If display does not illuminate, check all circuit breakers and wiring to the charger and check charger's input voltage.

    NOTE: Refer all other problems to MagneCharge™ Sales and Service Representative.

23. Return the charge coupler to the holster.

24. The charger display will go blank.

25. Close and lock charge coupler door.

26. Re-install front panel utilizing the two screws removed in step 4.

27. Re-install kick panels utilizing the six screws removed in step 3.

28. The charger is now ready for use.

SITE CLEAN UP

29. Carefully recover the packing materials for return to distributor.

30. Pick up all debris around the work area and sweep clean.

31. Present the keys to the customer.

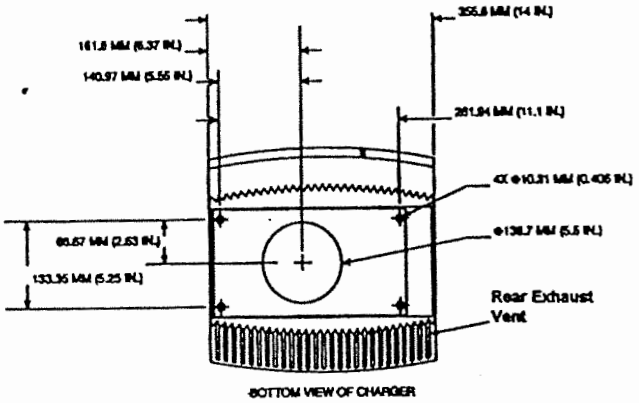


Figure 1. Charger Mounting Hole Locations

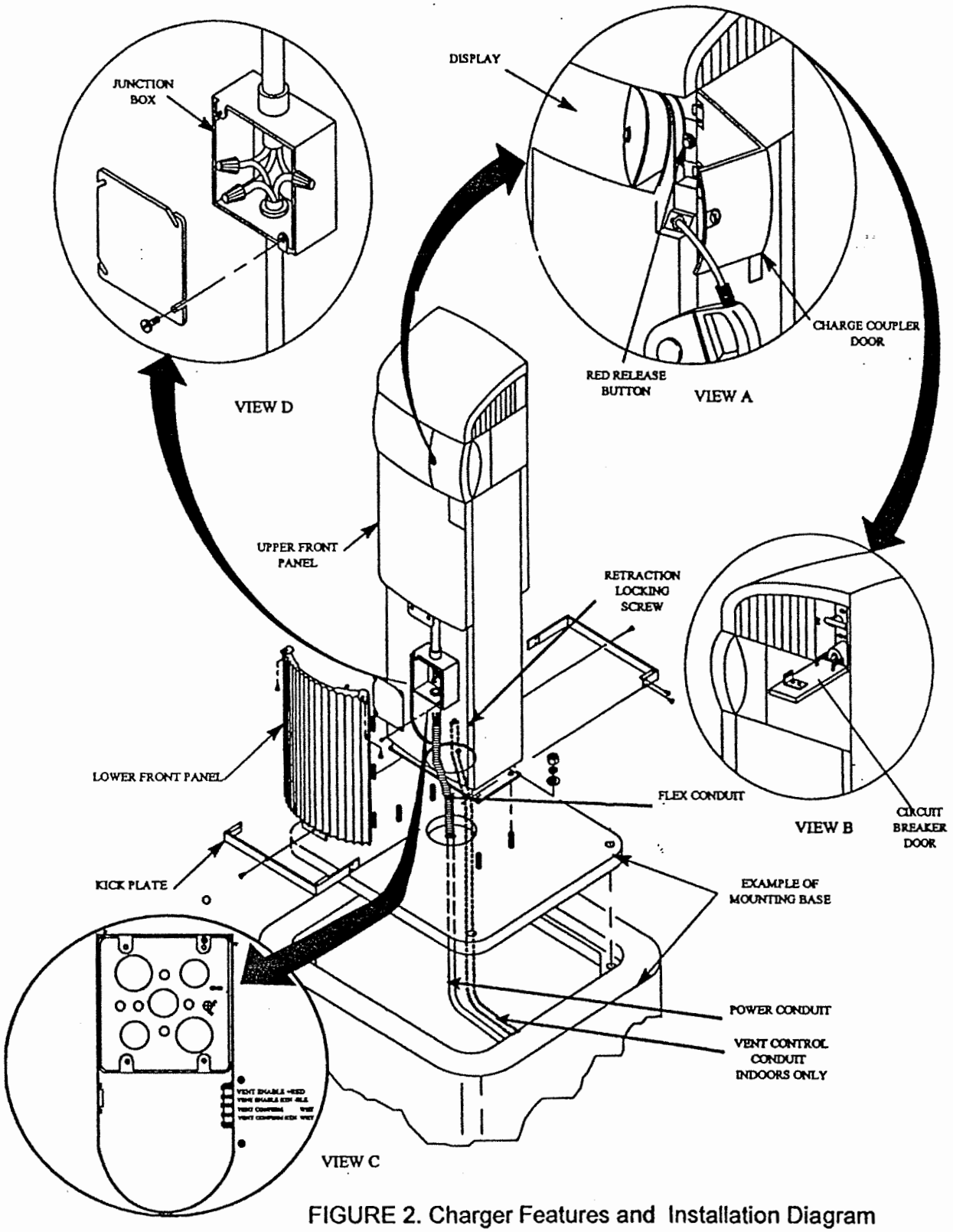


FIGURE 2. Charger Features and Installation Diagram

VENTILATION

NOTE: An external ventilation system may be required to reduce the risk of hazardous or explosive gases building up during indoor charging. Check the vehicle Owner's Manual to determine if the vehicle requires ventilation during indoor charging. If the charger is to be used with a vehicle that requires ventilation during indoor charging, the charger must be connected to a ventilation system that provides at least 197 cubic feet per minute (cfm) air flow during the charging cycle in accordance with the 1996 National Electric Code (ANSI/NFPA 70), Article 625, 725.

WARNING: Turn off the circuit breaker at the service or distribution panel supplying the charger and ventilation before attempting to perform the following steps.

NOTE: Refer to the Ventilation Specifications of **SITE PREPARATION** section.

1. Note the color of the four vent control wires: one red, one black and two white.
2. One red 18 AWG wire is for Vent Enable.
3. One black 18 AWG wire is for Vent Enable Return.
4. Two white 18 AWG wires are for Vent Confirm.
5. Install spade terminal lugs on each wire.

VENT ENABLE (refer to Figure 3)

6. Connect the RED Vent Enable wire to the Vent Enable terminal on the charger.
7. Connect the BLACK Vent Enable Return wire to the Vent Enable Return terminal on the charger.

VENT CONFIRM (refer to Figure 3)

8. Connect the WHITE Vent Confirm wires to Vent Confirm terminals on the charger.

Continue installation with step 14.

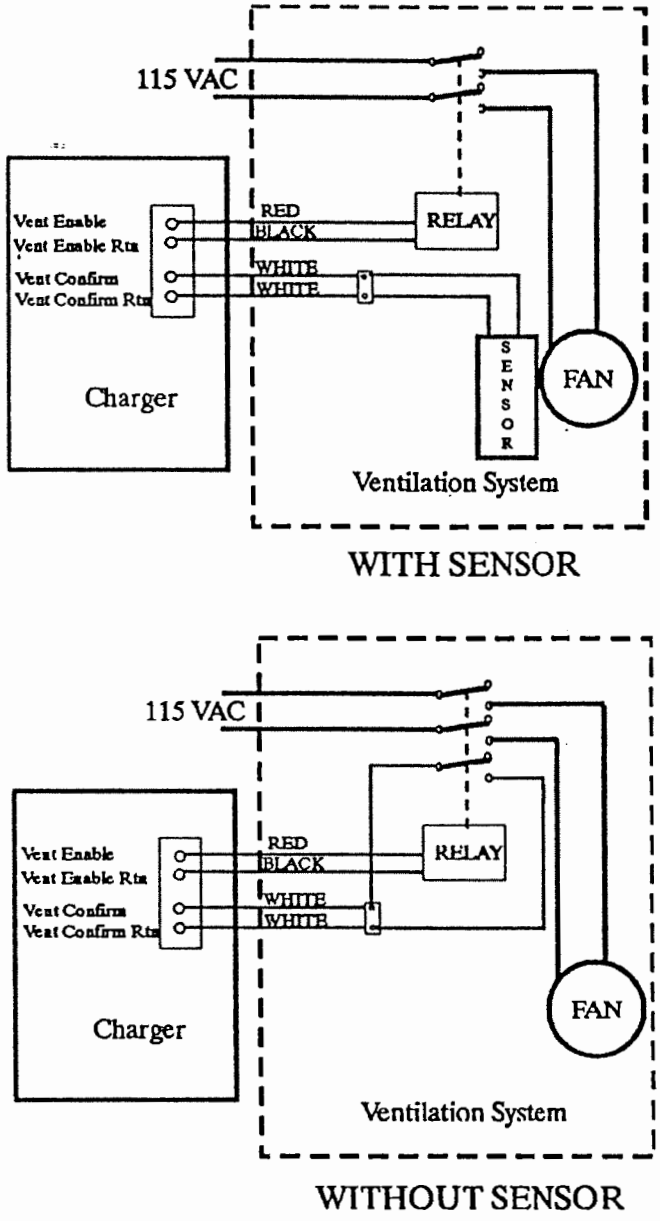


FIGURE 3 Ventilation Wiring Examples

SITE PREPARATION

The following guidelines are presented for site preparation:

POWER SPECIFICATIONS (see Figure 2)

INPUT

Voltage	208-240 VAC, 50/60 HZ
Service Requirement	40 Amp Service

NOTE: Commercial installations may require a neutral wire. Future Pay System will require neutral wire.

NOTE: Route power feed wires through conduit per local codes.

DIMENSIONS

Height	1460 mm (57.5 in.)
Width	356 mm (14.0 in.)
Depth	325 mm (12.8 in.)
Effective Coupler Cable Length	2.28m (7.5 ft)
WEIGHT	82 kg (180 lbs)

VENTILATION SPECIFICATIONS (see Figure 2,3)

Ventilation system that provides at least 197 cubic feet per minute (cfm) air flow during the charging cycle in accordance with the 1996 National Electric Code (ANSI/NFPA 70), Article 625, 725.

A 12 VDC Ventilation Activation Relay (Normally Open) is required to switch the fan supply voltage.

Use 18 gauge 600 volt, UL Style 1015 wire for class one wiring from ventilation system to charger.

NOTE: Route wiring through conduit per local codes.

Vent Enable (Red Wire)

12 VDC, 50 ma (Source)

Vent Enable Rtn (Black Wire)

12 VDC Retum (Switched)

NOTE: If the activation relay terminals are not marked positive or negative then polarity is not an issue and the Vent Enable wires may be connected to either terminal without conflict.

Vent Confirm (switch closure) (White Wires)

+5 VDCSwitch voltage

COMMUNICATIONS (Optional)

For future pay system installation route a standard telephone line through conduit per local codes.

MOUNTING BASE SPECIFICATIONS

Mounting Stud Size	10 mm (3/8 in.)

NOTE: Mounting stud height above the mounting surface to be 2 to 2.5 cm (3/4 to 1 in).

TBD

If you have questions about the installation of this product, contact your MAGNECHARGE™ Sales and Service Representative at

1-800-482-6644

MAGNE CHARGE™

LISTED

EV BATTERY CHARGER

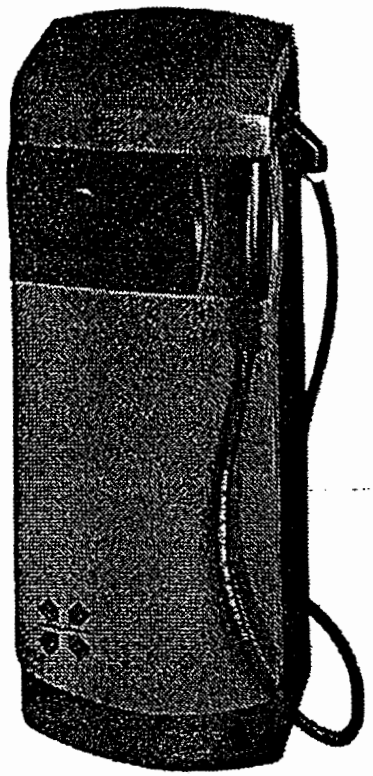
7M60

Power Control Systems, Torrance, CA
90509-2923

16243363

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WALL MOUNT CHARGER INSTALLATION GUIDE (WM200)



ELECTRIC VEHICLE CHARGER

Before you begin -
Read these instructions completely, including the important safety instructions.
Note to Installer- Be sure to leave these instructions with the consumer.
Note to Consumer - Keep these instructions for future reference.

Required Installation Tools and Materials

- Four #12 x 2 1/2 inch wood screw, zinc plated
- Common hand tools
- 6 MM wrench
- Torque wrench and 6 mm crows foot
- Philips #2 - screwdriver
- Torx Plus driver M20
- Qty 4 (6 mm) self-locking nuts
- Qty 4 wire nuts (8-10 AWG)
- Bracket - Wall Mount Charger (WM200)
  (Refer to text for mounting bracket selection)
- 6 MM Socket with 10 in Socket
- Qty 2 (6 mm) Flat washers

Inventory

- Owners Manual
- Installation Manual
- Warranty Card
- Wall Mount Charger (WM200)

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS--

This installation guide contains important instructions that should be followed during installation of the MagneCharge ™ Wall Mount Inductive Charger (WM200). **Carefully read these instructions before installing the charger:**

- VENTILATION - This charger contains provisions for control of an external ventilation system (e.g., fan turn on/off) during charging. If ventilation is required during charging, connect an external ventilation system to the charger per instructions contained in the VENTILATION section of these instructions. Improper connection of the ventilation control may lead to hazardous or explosive gas build up during charging. **Refer to the vehicle Owner's Manual to determine if the vehicle requires a ventilation system while charging. If the vehicle Owner's Manual is unclear or does not address ventilation requirements, contact the service representative where the vehicle was purchased.**
- When installing the charger, it must be mounted at least 46 cm (18 in) from the bottom of the charger to the floor.
- Do not install the charger in a location that exposes the charger to sources of extreme heat.
- Disconnect power to the charger branch circuit at the service panel prior to installation.
- The charger should be installed by a qualified electrician in accordance with all local electrical codes and ordinances and the instructions contained in this Installation guide.
- Do not install in a location that blocks the air intake (upper left side) or exhaust (bottom) vents. Allow at least 46 cm (18 in) of clearance from any wall or fixture.
- Do not install in a location that exposes the charger to rain or excessive moisture.
- **GROUNDING INSTRUCTIONS** - The charger should be connected to a grounded, metal, permanent wiring system. An equipment-grounding conductor should be run with circuit conductors and connected to equipment-grounding terminal or lead on the battery charger. Connections to the battery charger should comply with all local codes and ordinances.

The following symbol may be found in this manual or on the labels affixed to the charger.



This symbol alerts the installer to the presence of dangerous voltages which may constitute a risk of electrical shock

INSTALLATION

R(all installation requirements and nstructions before performing the nstallation.

Requirements

NOTE: Refer to the vehicle Owner's Manual to letermine if the vehicle requires ventilation vhile charging. If the Owner's Manual is unclear or does not address ventilation requirements contact the service representative where the vehicle was purchased. For all vehicles that equire ventilation systems, refer to the section n this installation guide titled VENTILATION.

1. The charger requires a dedicated branch circuit rated at 208-240 VAC (single phase) with a minimum capacity of 40 amps and an overcurrent protection of 40 amps.

NOTE: Do not install a Ground Fault Circuit Interrupter (GFCI) in the branch circuit. The charger contains a built-in ground fault protection device that may cause nuisance tripping of commercially available GFCIs.

2. The junction box for power connections should be located within sixteen (16) inches above the center line of the charger to be in reach of the wiring attached to the charger and be installed per local code.

3. If Ventilation is required mount the Ventilation Control Junction Box within 24 inches above the top of the mounting bracket and to the left of the Power Junction Box.

4. If the unfinished wall mounting bracket is being installed (see Figure 3 B & C), measure the distance between the centers of the wall studs. The distance measured must be 41 cm (16 in).

5. The charger must be mounted at least 46 cm (18 in) above the floor. Additionally, the area beneath the charger must remain unobstructed for proper air flow.

6. To meet requirements for handicap access to the charger, the top of the mounting bracket must not exceed 147 cm (58 in) from the floor.

7. The charger must be mounted in a location that allows an unobstructed clearance of at least 46 cm (18 in) on both sides of the unit to provide proper air flow and to provide access to service the unit.

8. For Ventilation Systems, see VENTILATION CONTROL SIGNAL INTERFACE SPECIFICATION section.

9. The charger must be mounted within access of the electric vehicle charge port (inlet). Note that the charge coupler maximum cable length is 245 cm (8 ft).



WARNING: Turn off the circuit breaker at the service or distribution panel supplying the charger before attempting to perform the following steps.

Instructions

1. Unpack the charger from the shipping container.

NOTE: The packaging material and shipping container are reusable materials. Save these items and return them to the Distributor.

2. Insure the charge coupler is in its holster as shown in Figure 1.

3. Familiarize yourself with the charger.

   a) Note the location of the two slotted mounting holes as shown on Figure 1.

   b) Note the location of the two bottom mounting holes as shown on Figure 1.

   c) Note the color of the three electrical wires; two black and one green.

      i) Two black 10 AWG wires are for input power.

      ii) One green 10 AWG wire is for chassis/ equipment ground.

NOTE: An external ventilation system may be required to reduce the risk of hazardous or explosive gases building up during indoor charging. Check the vehicle Owner's Manual to determine if the vehicle requires ventilation during indoor charging. If the charger is to be used with a vehicle that requires ventilation during indoor charging, the charger must be connected to a ventilation system that provides at least 197 cubic feet per minute (cfm) air flow during the charging cycle in accordance with the 1996 National Electric Code, ANSI/NFPA 70, (Article 625, 725).

4. If ventilation is not required use the mounting bracket for finished wall installations (Figure 3A, 7A) or the bracket for unfinished wall installations (Figure 3B, 7B). If ventilation is required go to step 6.

5. Using a #20 Torx Plus driver remove the three screws that secure the vent access cover (see Figure 5). Remove the Vent Control Access cover, disconnect the pigtailed wires, and proceed to step 12.

6. If ventilation is required use the mounting bracket for finished wall installations (Figure 3D, 7D) or the bracket for unfinished wall installations (Figure 3C, 7C).

7. Using a #20 Torx Plus driver remove the three screws that secure the vent access cover (see Figure 5).

8. Install a flexible metal conduit fitting onto the top of the vent access cover per Figure 8.

9. Connect a flexible metal conduit to the top of the charger's vent access cover.

10. Thread the 18 AWG wire through the metal conduit.

    Reinstall vent access cover using a #20 Torx Plus driver. Hand tighten the three retaining screws (see Figure 5).

NOTE: Do not pull on the charger's power wiring or charge coupler cable.

BRACKET INSTALLATION

12. Depending on the bracket used, locate the center of the nearest stud(s) and to mark the location for the mounting screws using the bracket. Insure the bracket is level. **NOTE:** The measurement from the floor to the top of the bracket should be 147 cm (58 In).

13. Locate the center of each stud and drill pilot holes where the # 12 screws will be installed.

14. Fasten the bracket to the wall using four #12x2 1/2 inch zinc plated wood screws (see Figure 3).

15. Thread a 6 MM self locking nut on both of the top mounting studs of the bracket allowing a 1/4 inch gap between the nut and the bracket plate. This will allow for an easier installation of the charger (see Figure 2, View A).

CHARGER INSTALLATION

16. Remove the two screws holding the plastic valence from the bottom front of the charger and remove the valence (see Figure 4).

17. Lift the charger up to the bracket and place the top slotted mounting holes over the two 6 MM nuts installed in step 3 (see Figure 2, View A). Allow the charger to rest on the mounting studs between 6 MM nuts and the bracket surface.

18. Align the bottom of the charger so the mounting studs of the wall bracket slide through the bottom mounting holes of the charger.

19. Install the two remaining 6 MM self-locking nuts with flat washers on to the lower mounting studs.

20. Tighten all four nuts to a torque setting of 19 lbs-in.

21. Push on the charger's circuit breaker door to open (Figure 6, View A).

22. Set charger circuit breaker to the OFF (down) position as shown in Figure 6, View B.

23. Connect the flexible conduit from the top of the charger to the charger power source (see Figure 2).

24. Connect the wires using wire nuts as shown in Figure 2, View B as follows:

    Input power: 208 - 240 VAC

    Line 1 (HOT) BLACK WIRE

    Line 2 (HOT) BLACK WIRE

    Ground GREEN WIRE

    NOTE: Supply side of wire may be a different gauge of wire.

    NOTE: Neutral not required or connected. If the neutral wire is present cap it off with a wire nut.

25. Replace the cover on the junction box.

26. Re-install the plastic valence to the bottom front of the charger using the screws removed in step 16.

NOTE: If vehicle does not require ventilation go to SYSTEM TEST section (step 27).

NOTE: If vehicle requires ventilation continue installation with the VENTILATION section.

SYSTEM TEST

27. Turn on the circuit breaker located in the service panel, and set charger circuit breaker to the ON (up) position and close the circuit breaker access door .

28. Pull the charge coupler out of its holster. Verify the display reads "*******" and then changes to "CONNECT TO VEHICLE".

    NOTE: If display does not illuminate, check all circuit breakers and wiring to the charger and check charger's input voltage.

    NOTE: Refer all other problems to MagneCharge™ Sales and Service Representative.

29. Return charge coupler to holster.

30. The charger display will go blank.

31. The charger is now ready for use.

SITE CLEAN UP

32. Carefully recover the packing materials for return to the distributor.

33. Pick up all debris around the work area and sweep clean.

VENTILATION

NOTE: An external ventilation system may be required to reduce the risk of hazardous or explosive gases building up during charging indoors. Check the vehicle Owner's Manual to determine if your vehicle requires ventilation during indoor charging. If the charger is to be used with a vehicle that requires ventilation during indoor charging, the charger must be connected to a ventilation system that provides at least 197 cubic feet per minute (cfm) air flow during the charging cycle in accordance with 1996 National Electric Code (ANSI/NFPA 70), Article 625, 725.



WARNING: Turn off the circuit breaker at the service or distribution panel supplying the charger and ventilation before attempting to perform the following steps.

VENT ENABLE (refer to Figure 9)

1. Connect the RED Vent Enable (+12 VDC) to the Ventilation System's 12 VDC activation relay's positive coil terminal.

2. Connect the BLACK Vent Enable return to the Ventilation System's 12 VDC activation relay's negative coil terminal.

NOTE: If the activation relay terminals are not marked positive or negative then polarity is not an issue and the Vent Enable wires may be connected to either terminal without conflict.

VENT CONFIRM (refer to Figure 9)

3. If the Ventilation System contains an airflow (or similar)sensor, connect the white Vent Confirm wires to each terminal of the Confirmation sensor output switch.

4. If the Ventilation System confirmation is an additional set of relay contacts on the Activation Relay, then connect the white vent Confirm wires to the terminals designated for Vent Confirmation.

5. Continue installation with SYSTEM TEST (step 27).

VENTILATION CONTROL SIGNAL SPECIFICATIONS

A 12 VDC Ventilation Activation Relay (Normally Open) is required to switch the fan supply voltage.

Vent Enable

12 VDC, 50 ma (source)

Vent Enable Rtn

12 VDC Return (Switched)

Vent Confirm (Switch closure)

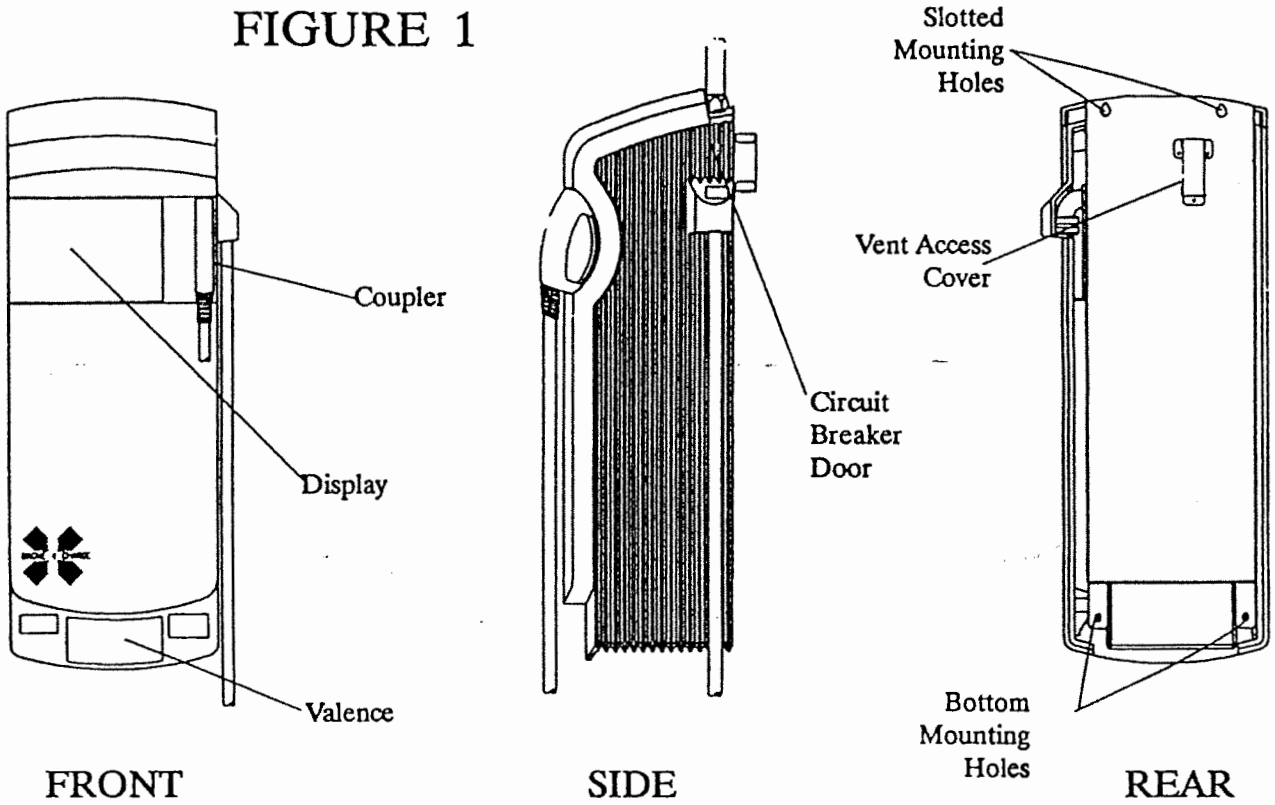
+5 VDC Switch voltage
0 VDC External Vent installed/functioning

Vent Confirm Return

+5 VDC Return

INSTALLATION

FIGURE 1



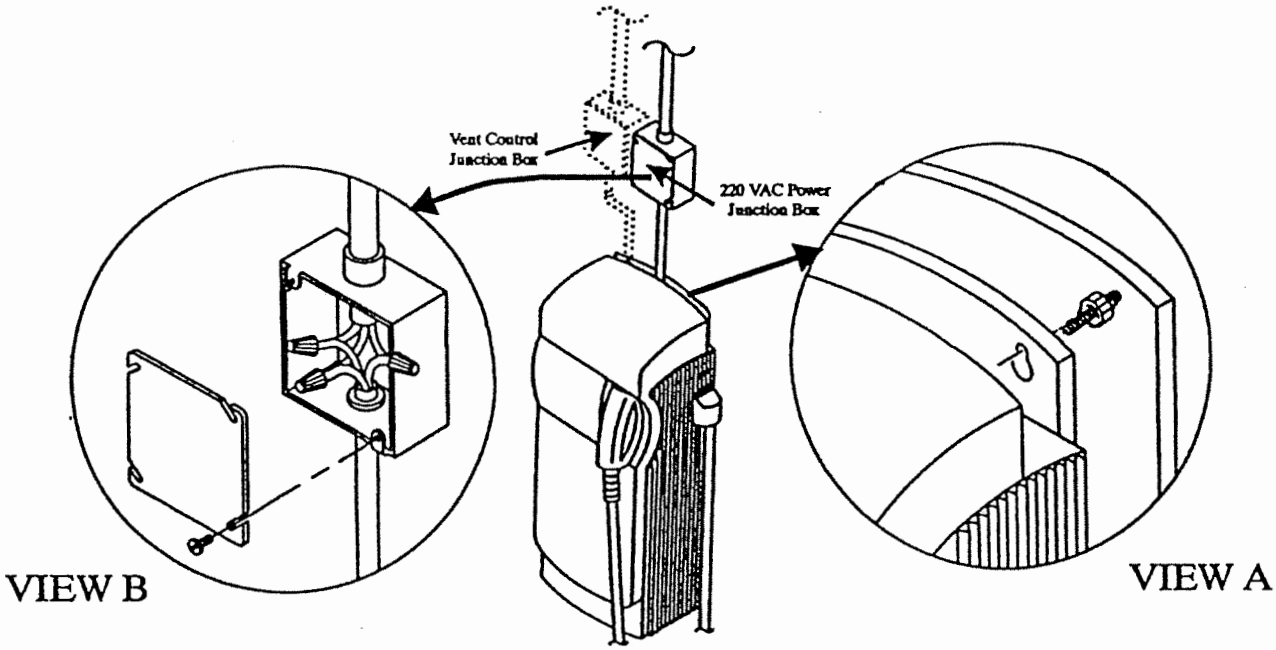
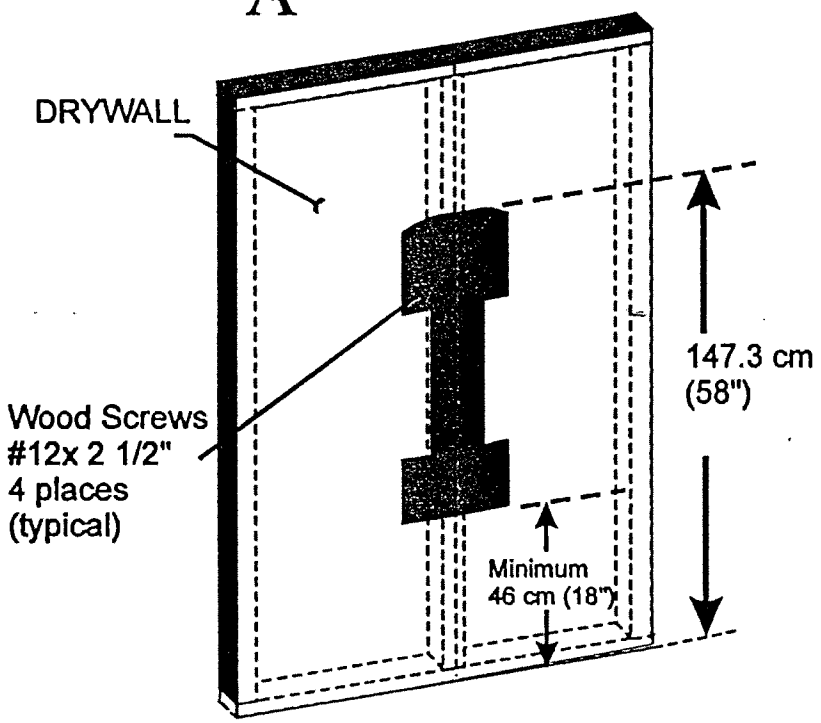


FIGURE 2

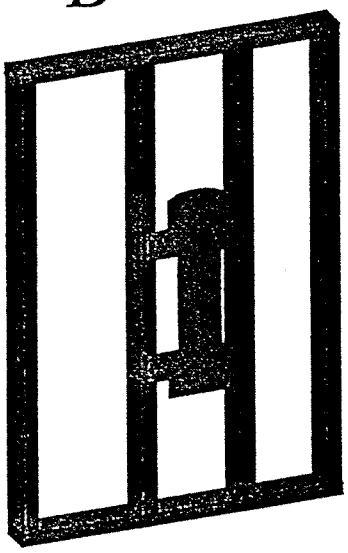
INSTALLATION

A



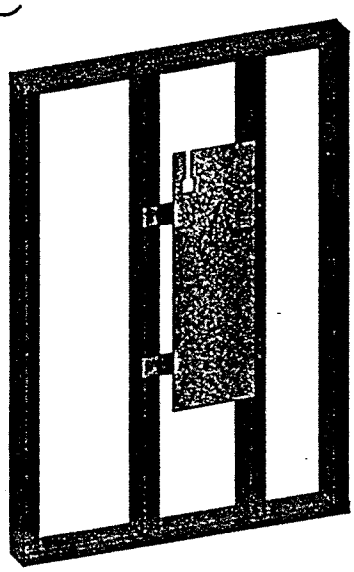
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No Ventilation
P/N 16215922

B



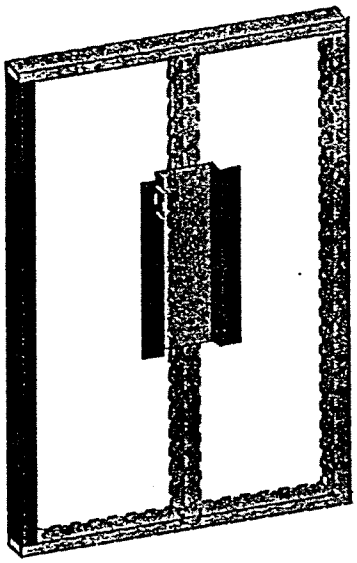
Unfinished wall
No Ventilation
P/N 16215921

C



Unfinished wall
With Ventilation
P/N 16246576

D



Finished wall
With Ventilation
P/N 16266575

Call your local MagneCharge™ Sales and Service Representative for MagneCharge™ Authorized parts.

FIGURE 3

INSTALLATION

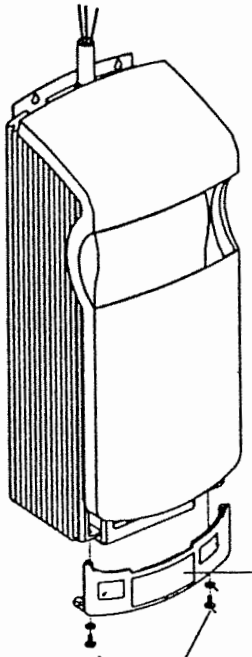


FIGURE 4

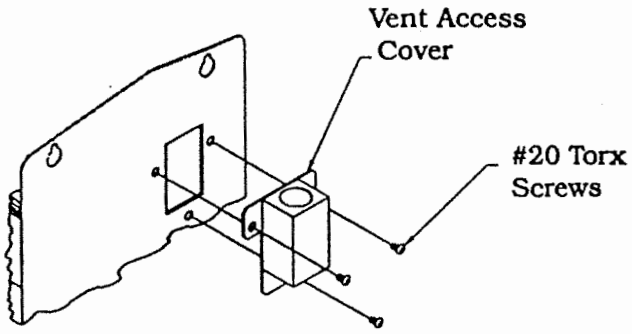


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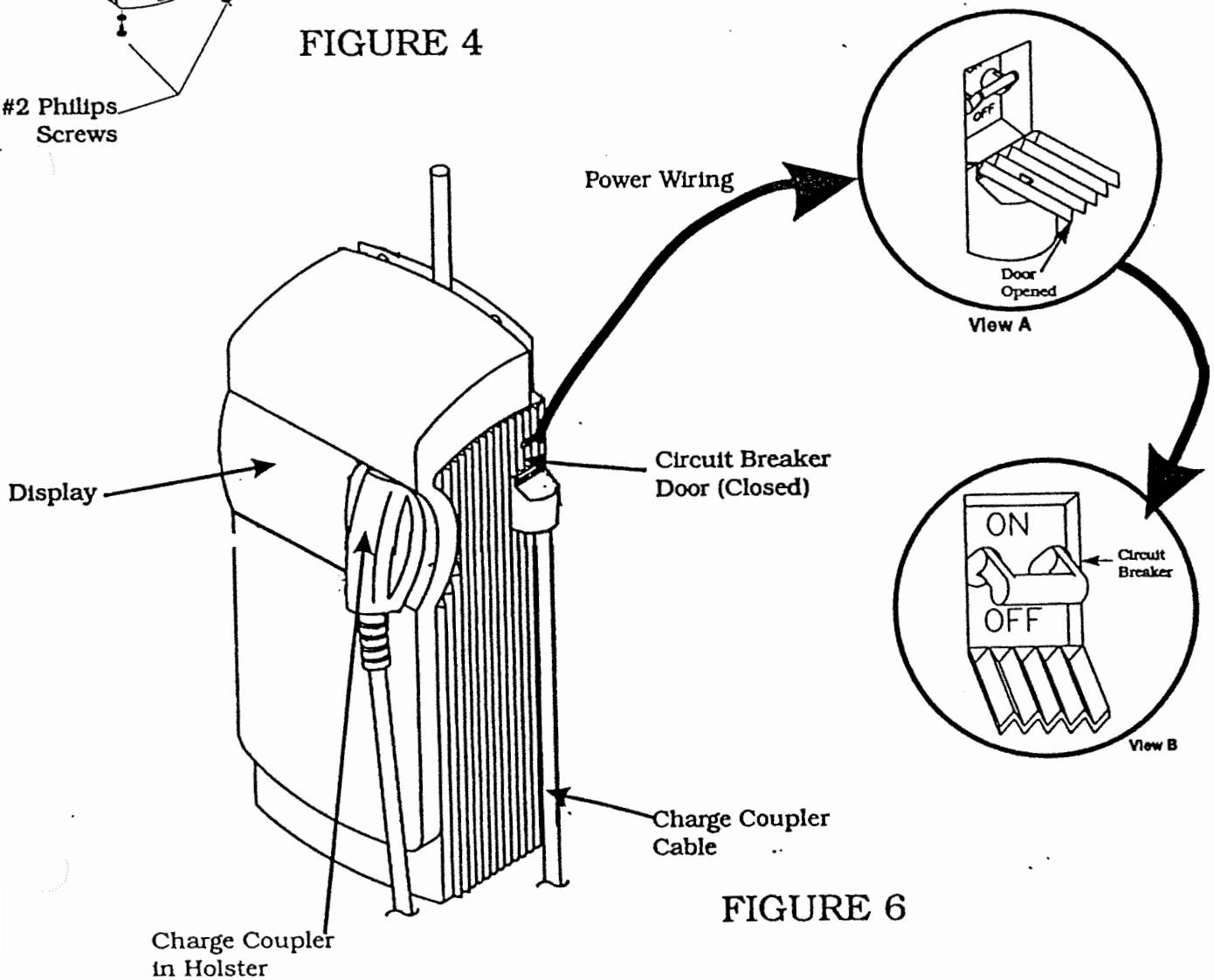
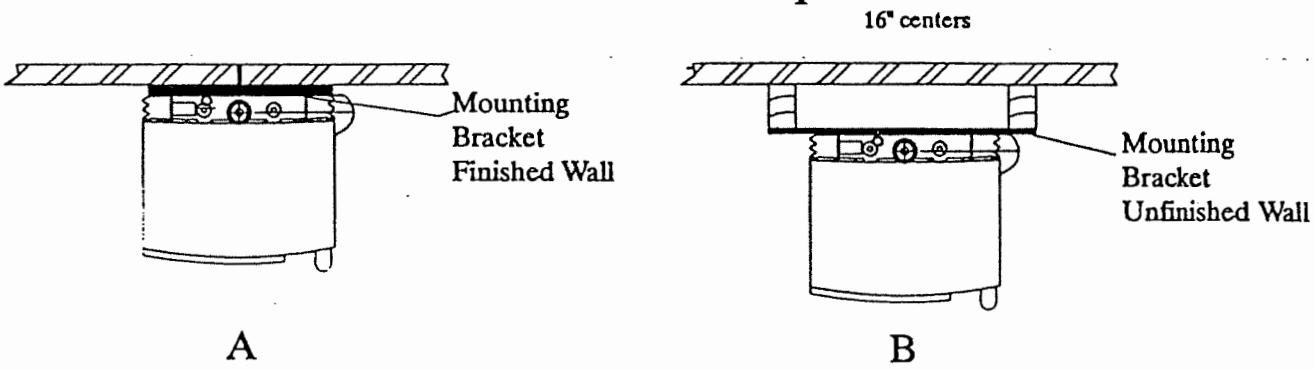


FIGURE 6

INSTALLATION

Bracket Mounting
For No Ventilation Required



Bracket Mounting
For Ventilation Required

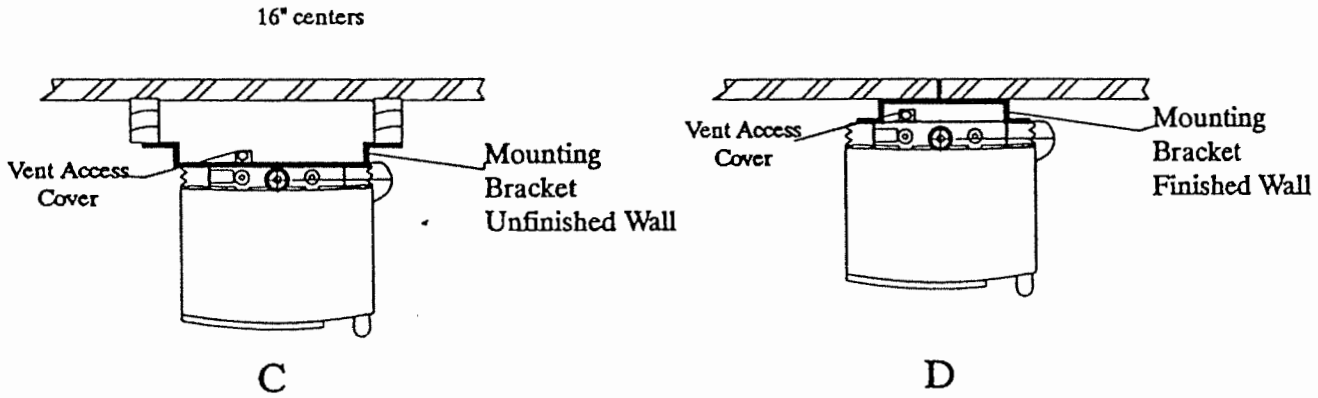


FIGURE 7

INSTALLATION

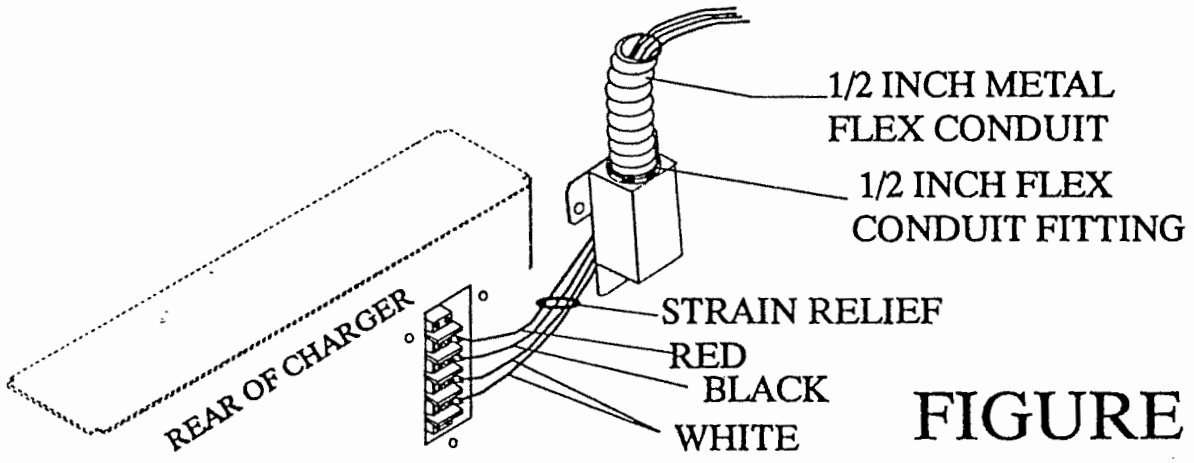
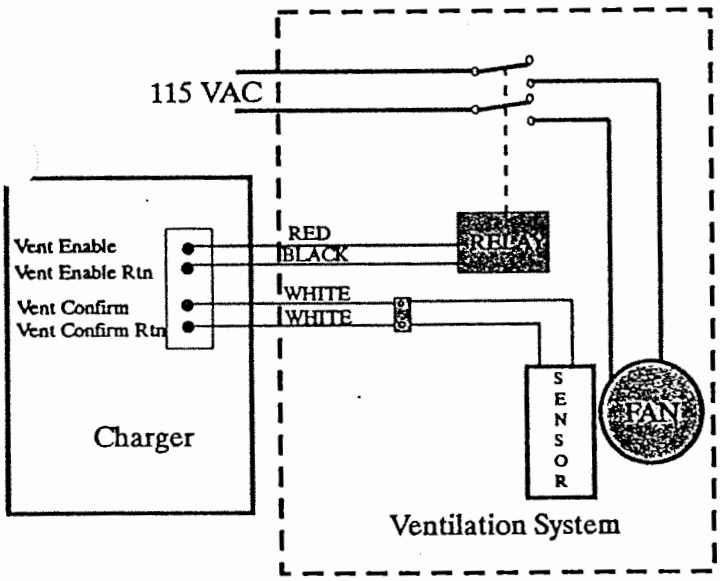
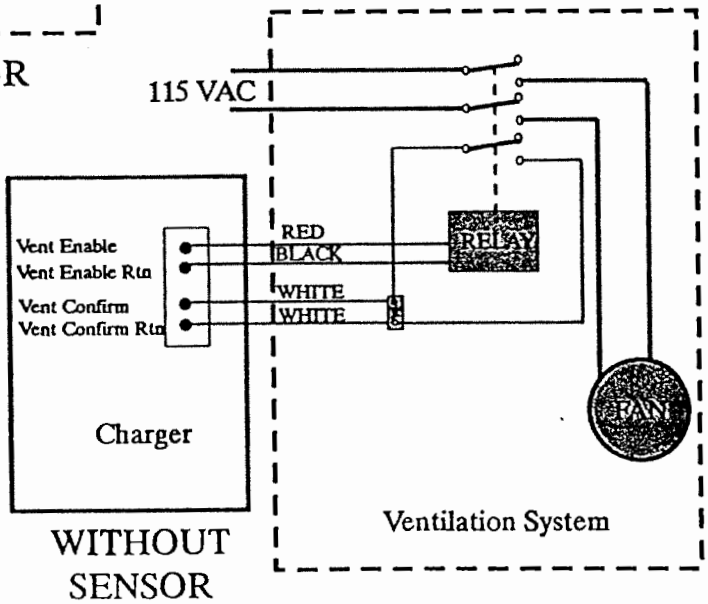


FIGURE 8



WITH SENSOR



WITHOUT SENSOR

FIGURE 9

If you have questions about the installation of this product, contact your
MAGNECHARGE™
Sales and Service Representative
at

1-800-482-6644

MAGNE CHARGE™

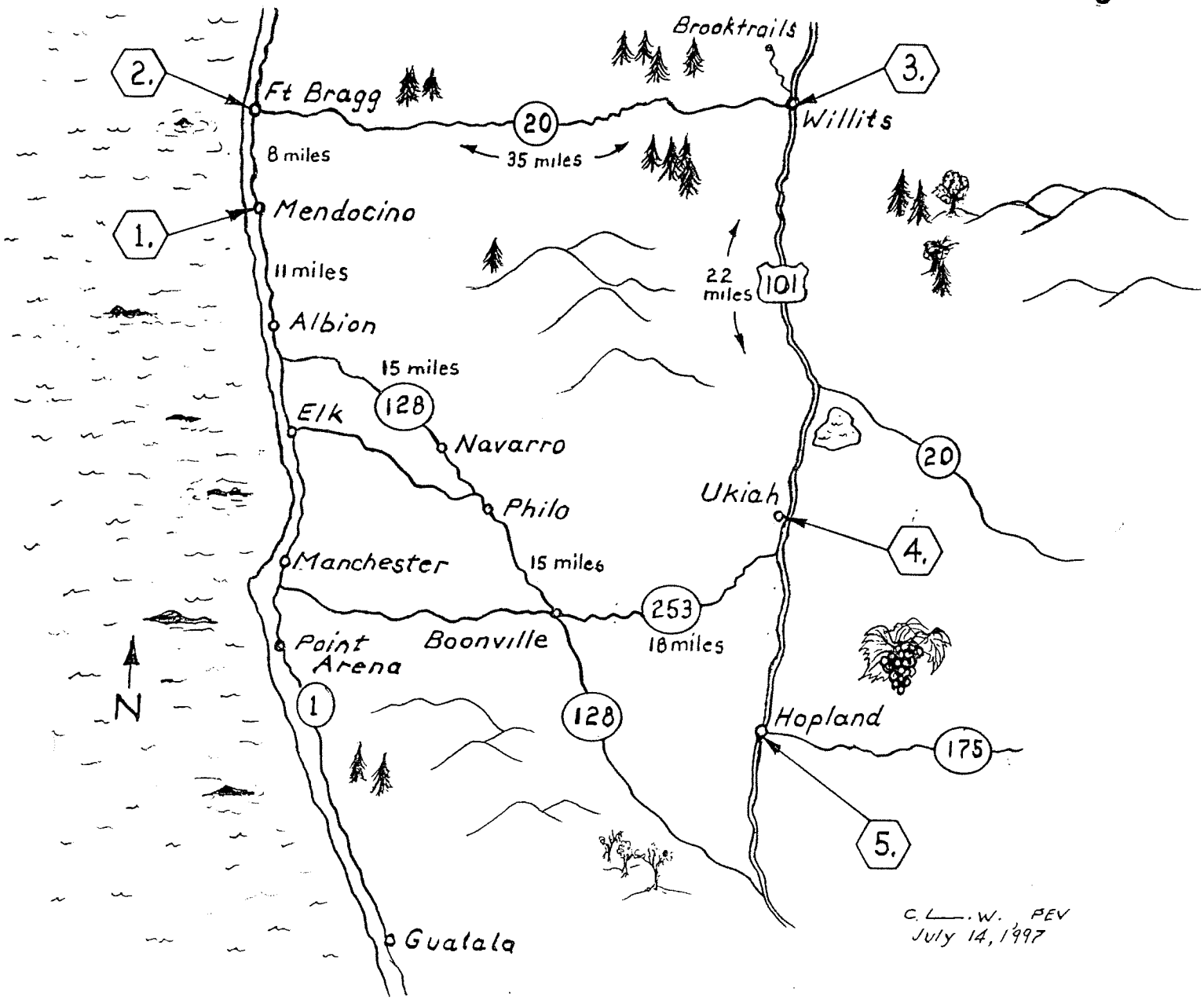
LISTED
EV BATTERY CHARGER
7M60

Power Control Systems, Torrance, CA 90509-2923

16243356

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E.V. Charging Stations in Mendocino County



1. Mendocino Environmental Center - 10500 Lansing Street. Check inside before plugging, donations to pay for power requested.
2. Fort Bragg, at Laurel & 1.
   (1) 14-50 R 240 V 50 A, (4) 15 A 120 V, (1) 30 A 120 V,
   (1) 6-20 R 240 V 20 A "1893" is combination,
   no motorhomes please.
3. Proposed site in Willits at Community Center Park.
4. Proposed site in Ukiah, downtown parking area.
5. Real Goods, south of Hopland on highway 101
   (4) 14-50 R, (8) 5-20 R 120 V, 20 A w/ GFI,
   240 V, 50 A

   SOLAR & WIND Power Supply, open during business hours, please inquire before plugging in.

Events & Information

EV Charging Site Directory

Location of Non-Residential EV Charging Sites in the United States

To go straight to the Online Charging Site Directory listings, **click here**.

The equipment for charging electric vehicles (EVs) can be located virtually anywhere there is up-to-date electrical wiring -- home garages or carports, shopping center parking lots, roadside rest facilities, transit station parking lots, municipal garages and elsewhere. While it is anticipated that most EV owners normally will recharge their vehicles at their homes overnight (or for fleet-owned EVs, at the fleet operators' garages), publicly-accessible EV charging facilities are also necessary. Drivers of EVs need to know they have the opportunity to recharge their vehicles away from home if their trip exceeds the range of their batteries' current charge level.

This directory provides the first-ever nationwide listing of the location of non-residential EV charging sites in the U.S. The listing is organized by state and contains the following elements for each charging site:

Operator: Name and address of the owner of the site, and where possible, a contact name and phone number.

Outlets: Number of outlets at the site -- thereby indicating the number of vehicles that can be accommodated at any one time.

Access: Public, public-access-by-arrangement, or private.

Manufacturer & Model: Charging equipment available at the site, by manufacturer name and model type.

Voltage/Amperage & Power Quality: Electrical specifications of the charging equipment at the site.

Two caveats about the information in the directory are important to note. First, most of the charging sites identified in the directory were installed prior to adoption of recent EV-specific codes, standards and industry practices. Therefore,

the identified charging facilities may not be in conformity with these measures. Examples of recent measures are Article 625 of the National Electric Code, the Society of Automotive Engineers' recommended practice for inductive EV couplers (SAE J1773) and SAE's proposed recommended practice for conductive EV couplers (SAE J1772, working draft). For a list of applicable codes, standards and industry practices, see EVAA's Market Brief referenced below.

Second, it is acknowledged that this directory is not likely to be entirely comprehensive, since it is a first-time effort. In compiling the directory, the Electric Vehicle Association of the Americas has made every effort through extensive surveys and other research to locate all qualified sites. EVAA invites the submission of additional information about qualified sites which may not have been identified.

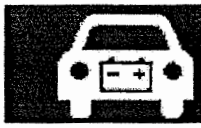
View EVAA's Online Charging Site Directory.

For additional analysis of the data contained in this directory and for background information about EV charging, please refer to EVAA's companion publication, **Market Brief: Profile of Electric Vehicle Charging Sites**, MB-6, March 1996.

Download a pdf version (192k) of the Charging Site Directory, or **contact EVAA** to order a printed version. You will need Acrobat Reader software to view and print the pdf version.

[EV Events] [EVAA Resource Catalog] [EVAA Online Library]

[Events & Info] [Vehicles] [EV Ready] [Fleets] [Members Only] [Home]



EV Charging Site Directory

California ..... Total: 103 sites, 663 Outlets

Additional California pages: 1 2 3 4 5 6 7 8 9 10 11

Operator, Address Contact	Outlets	Access	Manufacturer & Model	Voltage/Amperage Power Quality
Amerigon Inc. 404 East Huntington Dr. Monrovia, CA 91016 (818)932 1200	3	Private	Hughes, Dolphin 50kw, (I) Marconi, (C)	110/220V/15A, GFI 220V
BART (Bay Area Rapid Transit) I-680 & Ygnacio Valley Rd. Walnut Creek, CA 94596 Victoria Nerenberg (510)869 2416	7	Public	Hughes PCS 6.6, (C),(I)	240V/Variable Amps 240V/Variable Amps THD > 2% PF = 1 EFF = 90+%
Bill Strodde and Sons (Ford Dealer) 2330 Cherry Ind. Circle Long Beach, CA 90805 Jaime Martinez	4	Private	Hubbell, (C)	220V/30A
California Air Resources Board 9540 Telstar Avenue El Monte, CA 91731	6	Public*	Not Identified	208/240V/30A, GFI
CALSTART 3601 Empire Avenue Burbank, CA 91505 Glenn Perry (810)565 5600	3 6	Private Public*	Not Identified	4@110V 5@240V

City of Emeryville Emeryville, CA	2	Public	Not Identified	120V/20A
City of Santa Maria Santa Maria, CA	1	Private	(Bus Charger)	480V/50A
* **City of Santa Rosa** Santa Rosa, CA	1	Private	(G-Van Charger)	240V/50A
Downey Ford (Ford Dealer) 9500 Lakewood Downey, CA 90240 Bob Johnson (310)861 6771	2	Private	Hubbell EV Power Port , 220V (C)	
Electric Power Research Institute 3412 Hillview Avenue Palo Alto, CA 94303 Gary Purcell	4	Public*	S.Q.D., Hubbell, Chloride, (C)	220V/40A GFI

Next10 Sites

Key to Symbols

Access ..... Public* = by arrangement

Manufacturer & Model ..... (I) = Inductive ..... (C) = Conductive

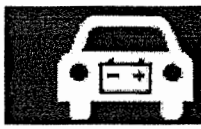
Voltage/Amperage ..... V* = Voltage not specified ..... A* = Amperage not specified

Power Quality ..... GFI = Ground Fault Interrupt ..... THD = Total Harmonic Distortion
PF = Power Factor ..... EFF = Power Quality Control Efficiency

[Directory of EV Charging Sites]

[Events & Info] [Vehicles] [EV Ready] [Fleets] [Members Only] [Home]

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EV Charging Site Directory

California (*continued*)

Additional California pages: 1 2 3 4 5 6 7 8 9 10 11

Operator, Address Contact	Outlets	Access	Manufacturer & Model	Voltage/Amperage Power Quality
Pacific Gas & Electric Company Service Center Front & T Streets Sacramento, CA Al Belisio	2	Private	Hubbell, (C)	240V/30A
Pacific Gas & Electric Company 77 Beale Street San Francisco, CA Al Belisio	8	Private	Hubbell. (C)	5@240V/40A 3@120V/20A
Pacific Gas & Electric Company 111 Stony Circle Santa Rosa, CA	1	Private	Not Identified	120V/20A
Pacific Gas & Electric Company 999 Third Street San Rafael, CA 94901 Shawn Considine (415)257 3483	5	Private	Hubbell. (C)	3@240V/40A 2@120V/20A.GFI
Pacific Gas & Electric Company Service Center San Luis Obispo, CA	3	Private	Not Identified	1@480V/50A 2@240V/40A

Pacific Gas & Electric Company Service Center 1030 Detroit Avenue Concord, CA	10	Private	Hubbell. (C)	220V/20A
Ride On Transit 1160 Marsh Street San Luis Obispo. CA 93401	1	Private	Not Identified	240V/50A
Riverside City Hall 3900 Main Street Riverside. CA 92522	4	Public	Hubbell. (C)	120V/20A
S & C Ford 450 Rhode Island Street San Francisco. CA 94107 Bob Radcliffe (415)553 4400	1	Private	Hubbell EVWL2 . (C)	240V. A*
Sacramento Municipal Utility District (SMUD) City of Sacramento Public Garage 13th & I Streets Sacramento, CA 95816 Steve Revenaugh (916)732 5283	10	Public	Not Identified	120/208V. A* GFI

Next10 Sites - **Previous 10 Sites**

Key to Symbols

Access ..... Public* = by arrangement

Manufacturer & Model ..... (I) = Inductive ..... (C) = Conductive

Voltage/Amperage ..... V* = Voltage not specified ..... A* = Amperage not specified

Power Quality ..... GFI = Ground Fault Interrupt ..... THD = Total Harmonic Distortion
PF = Power Factor ..... EFF = Power Quality Control Efficiency

TASK 4 - Develop Documentation and Reporting Procedures

Recommended documentation and reports are as follows.

- Compare vehicle performance in day-to-day use, including driving/usage patterns, full-size vs. NEV vs. sport utility, and costs to operate.

- Collect driver experience data using a questionnaire format during performance testing

  - It is recommended that the basic data collection variables include individual trip length, charging energy, and other comments and notes. Basically a log book is placed in the vehicle, and each driver enters the odometer reading before and after each trip and charge. If an Amp hour meter or other energy gage or fuel guage is used, it is often valuable to be able to track battery energy used as well as utility grid power.

  Questions for various operators:

  - General driving impressions
  - Trips that they would take
  - Trips that they wouldn't take
  - Charge at home
  - Change of route compared with gas car
  - Performance impressions compared to gas car

- Document best applications locally based on performance results

- Address transportation planning and infrastructure. The planners are working on the General Plan. The plan's duration is a 5-10 year window, and the planning process takes 3 years. How does the ZEV Project provide vital information for use in General Plan revision? Please consider the following questions:

  - How many charging stations are required?
  - Where will charging stations be located, and how long will construction take?
  - What are the safety related issues related to charging stations?
  - Are there safety related issues related to the lack of appropriate charging stations?
  - Are there any safety related questions regarding the use of electric power for transportation?
  - Will the location of charging stations affect traffic patterns?
  - What is the affect of charging on the peak electric power demand?
  - How will City and County facilities be affected?
  - How will distribution of gas be affected?

- Is the battery distribution and recycling infrastructure in place in the County?
- What budget is needed to accommodate changes in transportation-related infrastructure and distribution of energy and energy storage?
- Will NEV(neighborhood EV's) usage affect traffic patterns?
- Will special routes for NEV's be needed?

- Consider other factors including:
  - Vehicle definitions
  - Signage/symbols, permits
  - Traffic patterns/routes, lane classes/design

- Assess effectiveness of mitigating local air quality concerns

- Provide photographic documentation

- Develop educational materials such as brochures specific to the project

- Prepare press releases for public outreach

Quick calculation of avoided gas distribution based on 3% of cars being electric powered in 10 years:

- 100,000 cars in county * 15,000 miles/year=1.5 billion miles/year
- 3% of 1.5 bil. miles=45 million miles in electric power
- If fuel economy is 20 mpg; 1.5 billion miles/20 = 75 million gallons of gas consumed and, 45 million miles/20 =2.25 million gallons of gas not needed
- If average EV saves 1 kW/h per mile, energy savings is 45 million kW-h.
- See separate calculation for savings per mile at point of delivery. A gas car getting 20 mpg is using about 1.6 kW-h per mile, calculated at point of gas delivery, and an EV like the Honda Plus uses 0.6 kW-h/mile [AC] at the wall outlet. The savings is about 1 kW-h per mile)
- Total annual energy use by EV's with 3% assumption:
  45 million miles * 0.6 kW-h/mile= 27 million kW-h of electricity.

TASK 5 - Conduct Fundraising and Research Partnership Opportunities

The following funding sources and partners have been identified.

- MCOG as lead agency, $15,000 approved for Phase II, and in-kind staff time
- REDI as project administrator, providing in-kind contributions of directors time, office resources, contacts, and expertise
- Pacific Electric Vehicles, LLC, providing consulting services
- County of Mendocino Air Quality Management District (AQMD), providing in-kind contributions of staff time
- Pacific Gas & Electric, providing funds for installation of charging stations in public places
- Petroleum Violation Escrow Account (PVEA), $20,000 application pending decision by the State Legislature in August (federal funds through the State)
- City of Willits, locations for charging stations and PV net metering demonstration
- Brooktrails Township Community Services District, location for charging
- City of Ukiah, $1,000 for an EV charging station

The following additional funding sources and partners have been contacted and/or considered. The final Phase II plan will help facilitate these partnerships.

- County of Mendocino, Cities of Fort Bragg and Point Arena, pending ZEV Project final plan
- MTA, transit operations
- Sacramento Municipal Utilities District (SMUD), possible loans of vehicles and source of experience data
- Energy Conversion Devices, Inc. and Ovonic Battery Company, pending visit to Troy, Michigan, scheduled for August 6-9 courtesy of Stanford Ovshinsky, President & CEO (major travel expenses donated)
- ZEV/LEV manufacturers such as General Motors, Honda, Toyota, Solectria, PIVCO, and others.
- Evergreen Shopping Center in Willits for EV charging location, and others such as Walmart

Attachments

- Board of Supervisors resolution supporting ZEV mandate
- Air Quality Management District letter of support
- City of Ukiah approval for project contribution
- City of Willits letter of support
- Brooktrails Township letter of support
- Database listing of project participants and contacts

RECEIVED SEP 0 6 1996

RESOLUTION NO. 95-168

RESOLUTION OF THE MENDOCINO COUNTY BOARD OF SUPERVISORS IN SUPPORT OF CALIFORNIA AIR RESOURCES BOARD MANDATE FOR ZERO EMISSION VEHICLES

WHEREAS, every urban area is struggling to meet federal Clean Air Act standards and frequently fails them. Over 75% of the air pollution is caused by petroleum burning vehicles; and

WHEREAS, the inland areas of Mendocino County experience ozone smog just below the state standard each summer; and

WHEREAS, oil is a finite resource which will be exhausted in 40 years at current levels of consumption and 99% of California's transportation is fueled by oil; and

WHEREAS, the California Air Resources Board (CARB) has mandated that 2 percent of all vehicles sold in California be zero emission vehicles by the year 1998 in an attempt to reduce air pollution caused by the burning of fossil fuels; and

WHEREAS, a concerted effort has been made by the petroleum and auto industry to fight the mandate by disseminating information that is untrue and misleading; and

WHEREAS, California's energy policy is supported and signed by Governor Pete Wilson and clearly states that transportation alternatives, i.e. fuels, vehicle efficiency technology and modes be "aggressively pursued"; and

WHEREAS, research and development and consequent production of zero emission vehicles will create and is already creating high-tech high-wage jobs needed by the state of California and its people; and

WHEREAS, the state of California has a unique opportunity to lead the nation toward clean transportation technology, reduced air pollution and lowering its dependence on a finite resource, while at the same time capturing the economic opportunities that arise from new technology; and

WHEREAS, increased use of electric vehicles reduces the threat of offshore oil exploration and development and encourages the development of non-polluting and renewable energy sources.

NOW THEREFORE, BE IT FURTHER RESOLVED, that the Mendocino County Board of Supervisors supports and endorses a zero emission mandate; and

BE IT FURTHER RESOLVED, that the Mendocino County Board of Supervisors encourages the California Air Resources Board to stand by its 2% mandate.

BE IT FURTHER RESOLVED, that the Mendocino County Board of Supervisors strongly urges the Governor of the State of California Pete Wilson, to support California Air Resources Board in said determination.

BE IT FURTHER RESOLVED, that it is the intent of Mendocino County to voluntarily reflect the percentages required by the mandate in any new county fleet purchases, with vehicles that meet comparable full cost criteria and performance capability.

The foregoing resolution was introduced by Supervisor Peterson, seconded by Supervisor Henry, and carried on this 15th, day of August, 1995, by the following vote on roll call:

AYES: Supervisors Pinches, Henry, Peterson, and Sugawara
NOES: None
ABSENT: Supervisor McMichael

WHEREUPON, the Chairman declared said Resolution adopted, AND SO ORDERED.

Seiji Sugawara
CHAIRMAN, Board of Supervisors

ATTEST: JOYCE A. BEARD
Clerk of Said Board

Joyce A. Beard

I hereby certify that according to the provisions of Government Code Section 25103, delivery of this document has been made.

JOYCE A. BEARD
Clerk of the Board

By: Norma L. Keon, Deputy

DAVID FAULKNER
Air Pollution Control Officer
PHILIP W. TOWLE
Air Quality Specialist

306 East Gobbi Street
Ukiah, California
(707) 463-4354
Fax: (707) 463-5707

COUNTY OF MENDOCINO
AIR QUALITY MANAGEMENT DISTRICT
UKIAH, CALIFORNIA 95482

September 17, 1996

To Whom It May Concern:

This letter is in support of the Renewable Energy Development Institute's proposal for a ZEV (Zero Emission Vehicle) Commuter Demonstration Project. The Renewable Energy Development Institute (REDI) is a charitable, nonprofit educational and scientific corporation located in Willits. REDI has applied for funding of the ZEV Project under MCOG's Planning Work Program, and I have offered the District's assistance to REDI in planning this project.

Ozone concentrations in the District have approached the state standard for ozone in recent years. Ozone is the principal air pollutant of urban areas of California -- the notorious "smog," that afflicts huge areas of the state. Maintenance of air quality meeting this standard is the greatest challenge facing the District in the next few years.

Transportation and air quality are intimately linked. The District believes that the RTP should incorporate information on alternative transportation strategies, focusing on opportunities for our growing rural area. Since motor vehicles emit about two-thirds of the ozone precursors in the District, controlling those emissions through better transportation planning and other means is vitally important in maintaining air quality. REDI's ZEV study will contribute valuable information for a relevant Regional Transportation Plan (RTP).

I encourage those considering REDI's application to support the ZEV Project as an important step in planning for Mendocino County's future transportation and air-quality needs. REDI has a six-year history of introducing leading-edge resources and education on issues of environmental sustainability, renewable energy and clean air transportation to Mendocino County. REDI's project will develop important information on mitigations for expected increases in motor vehicle travel.

Sincerely,

David Faulkner
Air Pollution Control Officer

Ukiah City Council
Approved 7/16/97

Item No. 9e
Date: July 16, 1997

AGENDA SUMMARY REPORT

SUBJECT: Authorize Support for the Mendocino Council of Governments' Electric Vehicle Demonstration Project by providing a contribution that will not exceed $1,000.

REPORT: The Mendocino Council of Governments (MCOG) is developing an Electric Vehicle Demonstration Project that will be funded through grants and participation by various governmental entities. The Project Administrator for the program will be the Renewable Energy Development Institute. The City of Ukiah has been asked to be a sponsor for the project by installing the infrastructure required for the installation of a charging station. The location of the charging station will be determined by mutual agreement between the City of Ukiah and the Project Administrator.

The City of Ukiah will provide construction of the electrical service for the charging station. Any funds remaining from the $1,000 limit, once the cost of the electrical service is subtracted, can be requested by the Project Administrator, on a reimbursement basis, to help purchase and install the service panel, charger and any required electrical or building permits. The request for reimbursement must be submitted with a proof of purchase or receipt that indicates what was purchased. MCOG will provide all other necessary equipment required to make the station functional. The electricity used will be metered and billed to the Project Administrator.

Should the City Council wish to support this project, staff recommends that the City of Ukiah's sponsorship be funded from the Public Benefits Charge to be collected as defined by AB 1890. AB 1890 clearly states that these funds can be used for "research, development and demonstration programs for the public interest to advance science or technology which is not adequately provided by competitive and regulated markets". Staff believes that this project meets the stated requirements. These funds would be released upon approval by MCOG's portion of funding and approval for the proposal.

RECOMMENDED ACTION: Authorize Support for the Mendocino Council of Governments' Electric Vehicle Demonstration Project by providing a contribution that will not exceed $1,000.

ALTERNATIVE COUNCIL POLICY OPTIONS: Direct staff as to alternative

Citizen Advised: N/A
Acct. No. 806-3765-250-000
Requested by: Darryl L. Barnes, Director of Public Utilities
Coordinated with: Candace Horsley, City Manager
Attachment: None

APPROVED: _____
Candace Horsley, City Manager

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CITY OF WILLITS

CITY HALL – 111 East Commercial Street, (707) 459-4601 • Fax (707) 459-1562
POLICE DEPARTMENT – 125 East Commercial Street, (707) 459-6122 • Fax (707) 459-040
Willits, California 95490

November 14, 1996

RE: Zero Emission Vehicle (ZEV) Demonstration Project

To Whom It May Concern:

The purpose of this letter is to express the support of the Willits City Council for the Renewable Energy Development Institute's "Zero Emission Vehicle Demonstration Project." The City of Willits would like to join the Mendocino Council of Governments, the County of Mendocino's Air Quality Management District, and others in co-sponsoring this worthy effort.

Since 1990, REDI has proved its effectiveness in advancing public awareness of renewable energy and clean air transportation issues and choices here in Willits. As a charitable, nonprofit educational and scientific corporation, REDI is uniquely qualified to conduct the "ZEV Project."

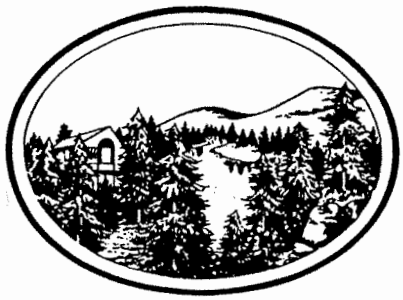
The long-term benefits of such a demonstration project are of interest to the City of Willits. Residents care about the quality of like in Willits and wish to preserve our clean air. In fact we may be willing to provide space for public display and demonstration of electric cars and other ZEVs, vehicle charging systems, and photovoltaic "net metering" of electrical energy on the utility grid.

The resulting data may be useful in potential transportation infrastructure planning in the future. As the project progresses, staff may work further with REDI to define the details of any in-kind contribution the City may provide.

Sincerely,

Bruce Burton, Mayor

RECEIVED OCT 3 1 1996



BROOKTRAILS TOWNSHIP

COMMUNITY SERVICES DISTRICT
24860 BIRCH STREET
WILLITS, CA 95490
(707) 459-2494

October 28, 1996

Ms. Janet M. Orth
Mendocino Council of Governments
215 West Standley Street
Suite 6
Ukiah, CA 95482

RE: ZEV Commuter Demonstration Project

Dear Janet,

I am writing to thank you for the opportunity to review your Commuter Demonstration Project. I think that it certainly affords some exciting potential. As it relates to Brooktrails, I see more potential for recharging stations. In addition, your project may open up opportunities for the use of such vehicles as a part of our operations in the future.

Therefore, we are looking forward to seeing the results of your project.

Sincerely,

PAUL A. WILLIAMS
General Manager

PAW:plw

ZEV Project Participants and Contacts (Partial List)
7/23/97
See also Tech. Report and Bibliog.

Janet Orth, Project Coordinator, **MCOG / REDI**
Bus: 463-4470 Alt: 468-8162
Fax: 468-8398 Res: 459-3443

215 W. Standley St., Suite 6, Ukiah, CA 95482
Alternate address: P.O. Box 1331, Willits, CA 95490

Notes: Initiated ZEV Project. REDI Director, MCOG Administrative Assistant.

Bill Warf, General Manager, **Pacific Electric Vehicles, LLC**
Bus: 485-5799 Alt:
Fax: 485-8978 Res:

3903 N. State St. #18B, Ukiah, CA 95482
Alternate address: , ,

Notes: Technical consultant for ZEV Project, contractor with REDI.

Walt Allen, Air Quality Planner, **Mendocino County Air Quality Mgmt. District**
Bus: 463-4692 Alt: 463-4354
Fax: 463-5707 Res:

306 East Gobbi St., Ukiah, CA 95482
Alternate address: , ,

Notes: Member of MCOG's Technical Advisory Committee. Early supporter of ZEV Project. Volunteered for ZEV advisory subcommitte of the TAC.

Phil Dow, Transportation Planner, **Mendocino Council of Governments**
Bus: 463-1806 Alt:
Fax: 463-2212 Res: 468-0656

367 N. State St., Suite 209, Ukiah, CA 95482
Alternate address: , ,

Notes: MCOG Staff, chairs Technical Advisory Committee meetings (non-voting).

Darryl Barnes, Director of Electric Utility, **City of Ukiah**
Bus: 463-6295 Alt:
Fax: Res:

300 Seminary Ave., Ukiah, CA 95482
Alternate address: , ,

Notes: Janet contacted Darryl, met 12/2/96, per referral by Sheridan Malone, Mayor. 4/2/97 Bill & Janet met with Candace and Darryl to propose City involvement. See notes under Candace.

Peter Caton, , **Pacific Gas & Electric**
Bus: Alt:
Fax: Res:

, Fort Bragg, CA 95437
Alternate address: , ,

Notes: Bill W. contacted. Fred Harris in San Francisco office said funds are available for public EV charging station.

Shawn Considine, , **Pacific Gas & Electric**
Bus: 415/257-3483 Alt:
Fax: 415/257-3363 Res:

999 Third St., San Rafael, CA 94901
Alternate address: , ,

Notes: Drove Honda EV to REDI'95, exhibited at Conference. Have not contacted to date re ZEV Project.

Gary Flo, Owner, **InnEVations**
Bus: 462-9705 Alt:
Fax: 462-9706 Res:

P.O. Box 1270, Ukiah, CA 95482
Alternate address: 2185 South State St., Ukiah, CA

Notes: Makes EV conversions. New shop location 6/97.

Dave Goble, Planner, **City of Fort Bragg**
Bus: Alt:
Fax: Res:

...Franklin St., Fort Bragg, CA 95437
Alternate address: , ,

Notes: Member of MCOG Technical Advisory Committee. Janet contacted 3/5, sent info 5/9. City provided parking spaces for 2 EV charging stations, which are operating now. Approved by Public Safety Committee, not by full City Council. Suggests ZEV Project approach committee first. He will identify contact person for project. However, Council directed MCOG rep to vote against.

Ray Hall, Planner, **County of Mendocino**
Bus: Alt:
Fax: Res:

...Low Gap, Ukiah, CA 95482
Alternate address: , ,

Notes: Member of MCOG's Technical Advisory Committee. Supported ZEV Project from first proposal, with specific critiques/suggestions.

Stephen Heckeroth, , **Homestead Enterprises**
Bus: 937-0338 Alt:
Fax: 937-0338 Res:

30151 Navarro Ridge Road, Albion, CA 95410
Alternate address: , ,

Notes: Contacted Janet 2/21/97. Has networked with REDI for years.

Candace Horsley, City Administrator, **City of Ukiah**
Bus: Alt:
Fax: Res:

300 Seminary Ave., Ukiah, CA 95482
Alternate address: , ,

Notes: 4/2/97 Bill & Janet met with Candace and Darryl Barnes to propose City involvement. Interested in City borrowing EV from SMUD. City staff proposal to contribute to ZEV Project passed City Council 7/16/97. Will expend $1,000 for a charging station.

Rick Kennedy, City Engineer / Planner, **City of Ukiah**
Bus: Alt:
Fax: Res:

300 Seminary Drive, Ukiah, CA 95482
Alternate address: , ,

Notes: Member of Technical Advisory Committee. Supported ZEV Project from first proposal. 7/23/97: Volunteered for ZEV advisory subcommittee of the TAC.

Christopher Koveleski, Staff, **Renewable Energy Development Institute**
Bus: 459-1256 Alt:
Fax: 459-0366 Res:

383 S. Main St. #234, Willits, CA 95490
Alternate address: , ,

Notes: EV specialist. Organized vehicle events at SEER. Providing research, other services for ZEV Project.

Mike Mullen, Planner, **City of Willits**
Bus: Alt:
Fax: Res:

111 E. Commercial St., Willits, CA 95490
Alternate address: , ,

Notes: City agreed in concept to make city space available to ZEV Project for EV charging station and/or PV net metering demo. Public space qualifies project for PG&E funding of charging station. Need to work out details with staff and get further approval from City.

Stanford Ovshinsky, President & CEO, **Energy Conversion Devices, Inc.**
Bus: 810/280-1900 Alt:
Fax: 810/280-2697 Res:

1675 W. Maple Road, Troy, MI 48084
Alternate address: , ,

Notes: Stan supports ZEV project. Invited Janet to Troy for battery plant tour as his guest, sched Aug 6-8, '97. REDI'95 keynote speaker, REDI Lifetime Achievement Award. Wife, Iris. Secretary, Georgina. In partnership with GM Advanced Vehicle Div. re Ovonic battery dev., many other partners & licencees, including Honda.

Fred Patten, City Clerk, **City of Point Arena**
Bus: Alt:
Fax: Res:

, Point Arena, CA
Alternate address: , ,

Notes: Manages City. Member of MCOG's Technical Advisory Committee. Has not attended any TAC meetings in 96/97. Need to contact re ZEV involvement.

Paul Short, Industrial & EV Battery Dev. Group, **Ovonic Battery Company**
Bus: 313/362-0332 Alt:
Fax: 312/362-1750 Res:

1826 Northwood Dr., Troy, MI 48084
Alternate address: , ,

Notes: Subsidiary of Energy Conversion Devices, Inc. (boss=Ovshinsky). Chris Koveleski met at American Tour de Sol '95. Have not contacted to date re ZEV Project.

John Takes, , **Burkhardt Turbines**
Bus: 961-0459 Alt:
Fax: Res:

1258 North Main St., Fort Bragg, CA 95437
Alternate address: , ,

Notes: Janet contacted, sent info 5/23/97.

Rick Thomas, Owner, **Evergreen Shopping Center**
Bus: Alt:
Fax: Res:

, Willits, CA 95490
Alternate address: , ,

Notes: Keith Rutledge (REDI) contacted. Rick is interested in EV charging station at shopping center.

Steve Turner, Asst. General Manager, **Mendocino Transit Authority**
Bus: 462-5765 Alt:
Fax: 462-1760 Res:

241 Plant Road, Ukiah, CA 95482
Alternate address: , ,

Notes: Long interested in electric buses, problem for MTA is cost. Can provide countywide trip data survey results. Suggests Toyota electric minivan for project study, local dial-a-ride use instead of large intercity buses. Interest in sharing info. 7/23/97: Gen. Mgr. Bruce Richard, TAC member, volunteered himself or Steve to ZEV advisory subcommittee.

Paul Williams, General Manager, **Brooktrails Township C.S.D.**
Bus: 459-2494 Alt:
Fax: Res:

24860 Birch Street, Willits, CA 95490
Alternate address: , ,

Notes: Paul wrote letter of support for project, expressed possible interest in participating, and definite interest in project findings. Attended REDI Conference '93.

TASK 6 - Provide Plan for Outreach and Education to the Community

The following targeted groups and methods are recommended.

- Local government planners and decision makers
- Business owners involved with contracting and delivery-type services
- Ride & Drive trials to collect experience data and drivers evaluations
- Visits to schools countywide, with show & tell vehicle demonstrations
- Countywide public events, fairs, and parades
- Display vehicles at shopping centers and malls
- Press releases to countywide news media
- Flyers, brochures, and other educational literature available through project participants and public facilities, e.g. in Ukiah's electricity bill
- Photo opportunities with public officials and celebrities

APPENDICES

Appendix:

A	ZEV Project Phase I and II Proposals and Approved OWP Work Elements
B	William R. Warf, PE, Pacific Electric Vehicles, "Zero Emission Vehicle (ZEV) Demonstration Project - Technical Report," 10/28/96
C	ETC Fast Tracks, "Two New Reports Highlight Importance of EVs," Electric Transportation Coalition (ETC), 1/6/97
D	Energy-Aware Planning Guide: Energy Facilities, California Energy Commission (CEC), 1993, updated 1997, Appendix B-20, "Alternative Fuel Charging/Fueling"
E	Neighborhood Electric Vehicle (NEV) Draft Plan, City of Davis, 3/13/96
F	"Alternative Fuel Vehicles in California," California Energy Commission (CEC), Internet web site, 2/10/97
G	Jane Hall, Ph.D., "The Economic Cost of Dirty Air - and How to Avoid It," EV California, California Electric Transportation Coalition
H	Selected articles, EV Network Online Today daily news service, 1996-97 --Copied courtesy of Environmental Information Networks, Inc., 119 South Fairfax St., Alexandria, VA 22314, phone 800-825-1672

AMENDED 10/7/96

FINAL

MENDOCINO COUNCIL OF GOVERNMENTS

TRANSPORTATION PLANNING WORK PROGRAM

FY 1996/97

Adopted May 6, 1996
Amended Oct. 7, 1996

Prepared by: Phillip J. Dow, P.E.
DOW & ASSOCIATES
367 N. State St., Ste 209
Ukiah, CA 95482
(707) 463-1806

AMENDED 10/7/96

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AMENDED 10/7/96

WORK ELEMENT (15) ZERO EMISSION VEHICLE (ZEV) COMMUTER DEMONSTRATION PROJECT

PURPOSE

To conduct a feasibility study for Zero Emission Vehicle (ZEV) Commuter Demonstration Project, Phase II. This project, Phase I, would focus on evaluating and comparing ZEV's available on the consumer market, specifically for performance in the Mendocino County region. Study results would determine decision to apply for Phase II, in which the chosen vehicle would be leased and tested on a regional commute route.

PREVIOUS WORK

None.

TASKS

1. Develop route and scope of proposed Phase II.
2. Evaluation of commercial vehicles.
3. Research and evaluation of infrastructure, chargers, instrumentation.
4. Develop documentation and reporting procedures.
5. Conduct fundraising, research partnership opportunities.
6. Provide outreach and education to the community.

PRODUCTS

1. Recommendation on feasibility and application for Phase II.
2. Identification of partners for a "public-private partnership".
3. Identification of funding for Phase II.

FUNDING AND AGENCY RESPONSIBILITIES

			Funding Sources	
Agency	Estimated Person Days	Total Cost	Local LTF	Local STPd(1)
Consultant*	27	$5,000	$3,993	$1,007
MCOG direct costs	--	$ 500	$ 399	$ 101
	27	$5,500	$4,392	$1,108

(*includes REDI, outside consultants, and their direct costs, as needed)

Renewable Energy Revelopment Institute

September 3, 1996

A nonprofit educational and scientific corporation

Mail address:
733 S. Main Street
Suite 234
Willits, CA 95490

(707) 459-1256
Fax 459-0366

Phil Dow, Transportation Planner
Mendocino Council of Governments
215 West Standley Street, Suite 6
Ukiah, CA 95482

Re: OWP Application 1996/97

Dear Phil:

I have enclosed REDI's proposal for the Planning Work Program, ZEV (Zero Emission Vehicle) Commuter Demonstration Project - Phase I.

Also enclosed are supporting materials that show REDI's unique qualifications to conduct this project, as a charitable, nonprofit educational and scientific corporation focusing on renewable energy and clean air transportation. We are asking MCOG to be the lead agency.

This ZEV project proposal is an effort to participate locally in the statewide and nationwide efforts to find solutions to problems of air quality, global warming, and energy use in a rural environment that we all face.

Please let me know if any additional information is required. We will follow with an application for Phase II, 1997/98, by MCOG's deadline of October 31. Note that the Phase I project will identify additional funds available. I have been in contact with several agencies, including the Air Quality Management District, and I can provide letters of support.

Also, I will be glad to answer any questions you or the Technical Advisory Committee might have. Thank you for reviewing this proposal.

Sincerely,

Janet M. Orth, Board Member

cc: Mary Hiatt, MCOG
Keith Rutledge, REDI

enc: application
project timeline
REDI Conference '95 program excerpts
REDI Projects for 1996
Willits News article on REDI (8/8/96)

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The Institute
K-12, undergraduate, graduate and professional programs

The Sun Ranch
Living, learning, demonstration and research

Recycled Paper

OWP Planning Project
Proposed Scope of Work

ZEV Phase One - 1996/97

APPLICANT: Mendocino Council of Governments September 4, 1996

PROJECT ADMINISTRATOR: Renewable Energy Development Institute (REDI)

GOAL / PURPOSE

Conduct a feasibility study for ZEV (Zero Emission Vehicle) Commuter Demonstration Project Phase Two. Phase One would focus on evaluating and comparing ZEV's available on the consumer market, specifically for performance in the Mendocino County region. Study results would determine a decision to apply for Phase Two, in which the chosen vehicle would be leased and tested on a regional commute route. Goals of the study will include the following:

- Conduct an energy-efficiency cost-benefit analysis
- Identify air quality benefits
- Demonstrate photovoltaic charging
- Address rural elements of transportation
- Address challenges of varied terrain

TASKS

The study will include the following areas:

- Route and scope of proposed Phase Two project
- Commercial vehicles evaluation
- Infrastructure / chargers
- Instrumentation
- Documentation / reporting
- Fundraising / partnerships
- Outreach / education

PRODUCTS

- Recommendation on feasibility and application of Phase Two
- Identification of partners for a "public-private partnership"
- Identification of funding for Phase Two

TIME SCHEDULE

November 1996 through June 1997:

Nov. - Identify and contract with project participants
Dec. - Start project
Jan. - Report 2nd Quarter
Apr. - Report 3rd Quarter
- Complete project activity
May - Document and report project
June - Present findings
July - Report 4th Quarter, summarize Phase One

ESTIMATED PERSON DAYS / COST BREAKDOWN

Agency:	Person Days:	Total Cost:	In-Kind	Reimbursable
REDI Staff & overhead	10 days @ av. $15/hr.	$ 1,250	$ 0	$1,250
REDI Directors	24 days @ $20-35/hr.	6,000	6,000	0
MCOG Admin. Consultant	6 days @ $28-56/hr.	1,500	1,500	0
AQMD Staff	8 days @ $35-60/hr.	2,000	2,000	0
Outside Consultants	17 days @ $25-50/hr.	5,000	2,000	3,000
Total Person Days	65 days			
Total Cost		**$15,750**		
Total In-Kind			$11,500	
Total Reimbursable				$4,250

LINE ITEM COST ESTIMATE

Personnel and overhead (above)	15,750	11,500	4,250
REDI and Outside Consultants direct costs - Phone, mailing, copies, Internet, travel	750	0	750
MCOG Admin. Consultant direct costs - Phone, postage, copies, misc.	500	0	500
Total Cost	17,000		
Less In-Kind Contributions		11,500	
Total Request			**$ 5,500**

Note: If reimbursable request exceeds budget, a request for the difference may be filed under next year's OWP for consideration.

Official Program

REDI Conference '95

August 11, 12 & 13

Willits, California
The Heart of the Solar Capital

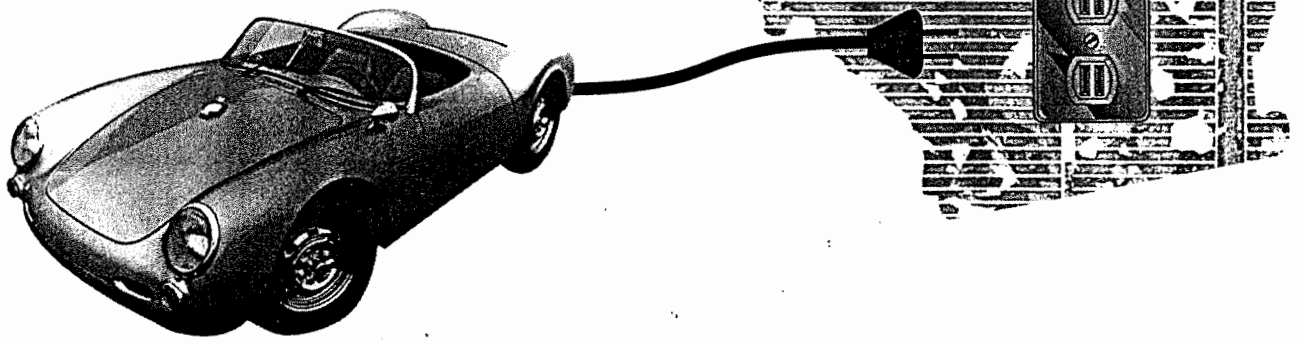
PVs and EVs– California Leads The Way

REDI '93 Followup
–PV and Utilities
–Financing

EV Marketplace
–Fleet Operators Meet EV Manufacturers
–Financing and Insurance

National Labs
–National Technology Transfer Center
–Federal Lab Consortium

Effects of Utility Restructuring and Clean Air Act Mandates on Renewable Energy and Zero-Emission Vehicle Industries



Renewable Energy Development Institute

For Tomorrow's Energy and Transportation Systems Today!

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111 East Commercial Street
August 11, 12, 13, 1995

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Idea to Market

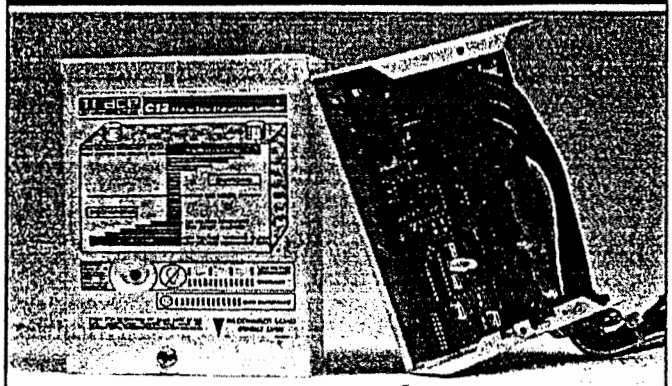
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12 Amp Load / Auto Lighting Controller



12 Amp Solar Charge Controller

Solid-state PWM control with 3 stages (bulk/absorb/float)
Electronic short-circuit/overload/overtemp protection
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Adjustable bulk and float settings with calibrated scale
Designed for 15 amps of PV short circuit current
Automatic or manual battery equalization mode

and... 12 Amp DC Load Controller

Automatic low voltage disconnect with advanced warning at 5 minutes before LVD
Electronic short-circuit/overload/overtemp protection with auto reconnection of loads after fault is cleared
Adjustable LVD/LVR settings with auto or manual reset
Manual switch gives one 10 minute on period after LVD

and... Automatic Lighting Controller

Automatically turns lights on at dusk and off at dawn by using the PV array also as a photocell sensor
Adjustable timer to limit operation from 2 to 10 hours
Light is turned off if voltage reaches LVD setting
Manual on switch allows test of lights during day or LVD
Outdoor rainproof enclosure with conduit knockout

Applications

- Village Power
- Outdoor Area Lighting
- Telecommunications
- Bus Shelters
- Cabin Systems
- Sign Lighting

Suggested List Price $100.00

ETL approval to UL1741 in progress
Contact Your Dealer or Distributor For More Information

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The Sun Ranch
Living, learning, demonstration and research

Welcome to REDI Conference '95. We are proud once again to host such a prestigious group of individuals from the renewable energy and clean-air transportation industries.

The role of REDI is to facilitate the formulation of policies and models that will have a positive impact on energy and transportation worldwide. Our experience over the past five years in producing the Solar Energy Expo & Rally and the REDI Conference has been that one of the most important outcomes is the networking among participants. The relationships established have had long term value in the continued growth of the environmental technologies represented at these events. The lifelong dedication and hard work of each of you and others like you in these fields bring the possibility of a clean, sustainable future for generations to come.

This year's conference features the latest in commercially available products as well as leading edge research. Conference highlights include:

- "Shootout at the PV Corral" module performance demonstration
- Nationwide financing options for off-grid home mortgages and clean air vehicles
- Commercially available clean-air vehicle showcase and test drives
- Updates on utility involvement in off-grid and on-grid power systems
- Report on the California Clean Air Act and ZEV mandate
- Stanford Ovshinsky on the nickel metal hydride battery
- Alvin Marks on the submicron antennae solar electric device
- Videoconference with Amory Lovins on utility restructuring
- Roundtable discussions on the effects of electric utility restructuring on the renewable energy industry
- Research program results from national labs

None of this would be possible without the generous support of our sponsors and volunteers. It takes all of us working together to overcome the challenges we face as we approach the 21st Century.

We hope you will enjoy your visit to "The Heart of the Solar Capital" and that during your stay you will avail yourself of some of the pleasures that Mendocino County has to offer. Come again soon.

The Directors and Staff of REDI

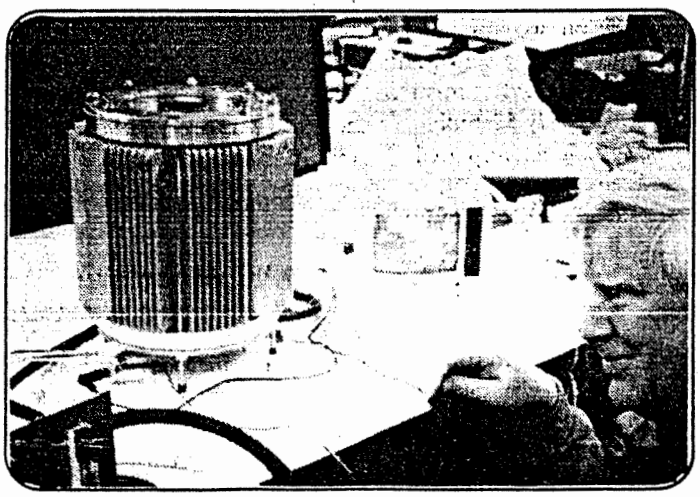
The "Midnight Sun" Generator

Dr. Michael Seal, director of the Vehicle Research Institute (VRI) at Western Washington University, "very possibly the best school in the country for total car design," is well-known for his award-winning Viking electric vehicle series. The most recent of these EVs are Viking 23, which runs on both solar/electric power and compressed natural gas, and Viking 25, a hybrid vehicle being created for the 1995 Hybrid Vehicle Electric Challenge in Detroit.

Dr. Seal is also currently working on the "Midnight Sun" thermophotovoltaic (TPV) generator, so-called because it will operate on demand 24 hours a day, not just when the sun shines. The "Midnight Sun" generates power by burning fuel continuously in a ceramic tube (the emitter) which glows red-hot. The photovoltaic cells that surround the tube receive the infrared (IR) photons from the emitter and convert them to electric power.

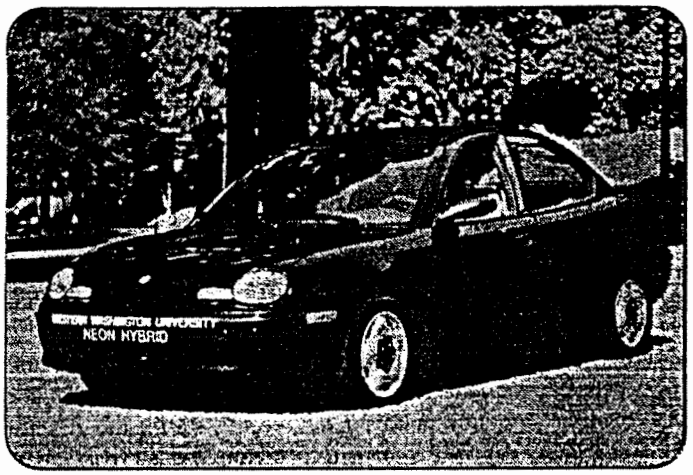
"Solar" cells are used with a small manmade "sun" created by burning methane. However, because this "sun" is only 1 inch away from the cell, IR power intensities at the cell are one thousand times higher than the sunlight on the roof of a car. Unlike an internal combustion engine, fuel is burned continuously without periodic explosions — combustion is complete and clean.

The VRI, along with its development partner, the private firm J.X. Crystals of Issaquah, Washington, has received grants totaling over $5.5 million from the federal Dept. of Energy and Dept. of Defense to develop the technology over the next five years. There are a number of applications for this new technology, including stand-alone generators for cabins, boats, recreational vehicles, etc.; in the home, the generator could provide both heat and electricity.

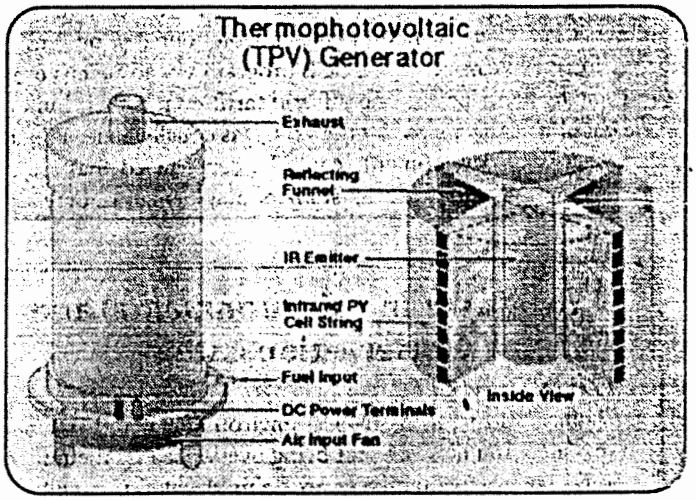


A model of the new thermophotovoltaic (TPV) generator.

One of the projects planned is to develop a TPV generator that will produce 20 kilowatts of electricity which will power a lightweight electric car. The generator will charge the batteries and/or power the electric motors. Such a vehicle would meet the California ultra-low-emission standards, and would also be able to operate in the "zero" emission mode when necessary. Dr. Seal hopes to incorporate a TPV generator into a Viking vehicle by 1996.



Viking 25 – Chrysler Neon hybrid conversion



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The prototype vehicle MSgt Bill Fairbairn and Ron Coomes of the EV Program at McClellan Air Force Base bring with them displays the best of today's technology transfer efforts. The "Horlacher" pickup is a purpose-built light-weight two-passenger electric utility vehicle engineered to transport materials, goods, products, and service personnel and support equipment to enhance industry. With a top speed of 75 mph (120 km/hr), quick acceleration (0 - 30 in 5 seconds), and a range of 80-100 miles, this vehicle is doing today what the auto industry claims cannot be done by 1998. The Sacramento Electric Vehicle Consortium, with McClellan AFB and Sacramento Municipal Utility District (SMUD) the driving forces, plans to refine this vehicle and produce it on a limited basis for continued testing in the upcoming year.

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Essential PV control and safety functions are standard and all else optional. This gives you the flexibility to have your Powercenter designed exactly to meet your individual system needs. You don't have to pay for options you don't need!

Guaranteed Durability

APT uses high quality, industrial grade components exclusively in Powercenter construction. The APT Powercenter is designed to last the life of your PV system, insuring a smart, long-term investment value.

Guaranteed Satisfaction

APT puts customer satisfaction first, with excellent technical support and customer service! Each Powercenter is: • custom built and tested by skilled technicians • delivered with a fast turnaround • easy to install and operate • backed by a five year warranty.

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utility commercialization of PV concentrate on the potential of ramping up volume and decreasing the cost of PV module production. To date this potential cannot be empirically demonstrated, and may be more dream than reality. In fact, what we are experiencing is an unprecedented demand in the private sector for PV. Factories are being expanded to meet this demand. Do we need the utilities to commercialize PV?

Transportation

Clean Air Vehicle Conversion Technology; 1–3pm

An update on the latest in EV conversions by leaders in the field.

Speakers

Mike Brown - Electro Automotive

Michael Brown is the founder and principal of Electro Automotive, the oldest and largest retail supplier of electric conversion components, and he is also the founder and past president of the Electric Vehicle Industry Association. His background is technical, with 28 years of professional experience in the automotive industry and 16 years of professional electric vehicle experience with Electro Automotive. He is co-author of Convert It, the definitive step-by-step conversion manual, and an instructor for electric vehicle conversion training ranging from one-day lectures for hobbyists to week-long hands-on workshops for professional technicians.

Presentation: Many government and private fleets are seeking to convert a portion of their vehicles to clean alternative power sources such as electricity. However, due to lack of information, they often issue Requests For Proposals that are out-of-sync with available technology. Mr. Brown's presentation will cover options currently available, and will discuss issues, including: contract conversions vs. in-house conversions, choice of chassis, appropriate applications, drive train technology, battery technology, costs, time frame, and options.

George Gerth - City of Santa Barbara

George Gerth is the Transportation and Parking Manager for the City of Santa Barbara. He developed the original Downtown Shuttle concept for Santa Barbara in 1986, which has evolved into the Electric Vehicle service being discussed at this conference. George's professional career extends over 24 years, including traffic engineering work for Salt Lake City, Utah, and San Rafael, California.

Presentation: "Evolution of a Downtown Shuttle Bus Service (gasoline to electric)." George will summarize the evolution of Santa Barbara's development of a successful Downtown Shuttle Bus service that began in 1986 with a gasoline-powered mini bus, went to a diesel-powered mini bus, and finally to battery-electric vehicle. Substantial rides in ridership were realized with the electric vehicle. George will comment on a "real-world" application of battery-electric vehicle technology and its ability to capture passengers from the perspective of a City Traffic Engineer.

Stephen Heckeroth - Mendomotive; Homestead Enterprises; Electrac



Stephen Heckeroth is the owner/builder of a self-sufficient homestead in Northern California and the owner of Homestead Enterprises, which has been selling, installing and servicing renewable energy and homestead products, and designing and constructing energy-efficient homes and buildings, for the last 20 years.

Mr. Heckeroth also owns Mendomotive, an electric-car conversion shop in Mendocino, which has started production on '55 Porsche Spyder replicas with a top speed of 95 mph and a range between 80 and 120 miles. A more recent project is Electrac, a company Heckeroth co-founded last year to work on converting used tractors to electric power.

Presentation: Steve Heckeroth and Gary Flo from Mendomotive will discuss their work with EVs, including their conversions of a VW Vanagon, a Karman Ghia, a Fiero, rototillers and tractors, and most recently, the Spyder replicas, which they are producing commercially, built to customer specifications.

Financing for Clean Air Vehicles; 3–5pm

Leasing experts discuss the financing and acquisition of EVs.

Speakers

Russell McDonald - Wymac Capital



Russell W. McDonald is president and co-founder of Sourcetec, Inc., a Walnut Creek-based software company specializing in software for the equipment leasing industry and the real estate lending industry. He is also Treasurer and Co-Founder of Wymac Capital, Inc., a Walnut Creek-based financial services company specializing in real estate debt and equity financing and in equipment lease brokerage.

Presentation: Mr. McDonald will outline various sources for

capital, including real estate financing, equipment leasing, private placements, and business loans.

Kris Nelson - Oregon Roads; Alternate Fuels

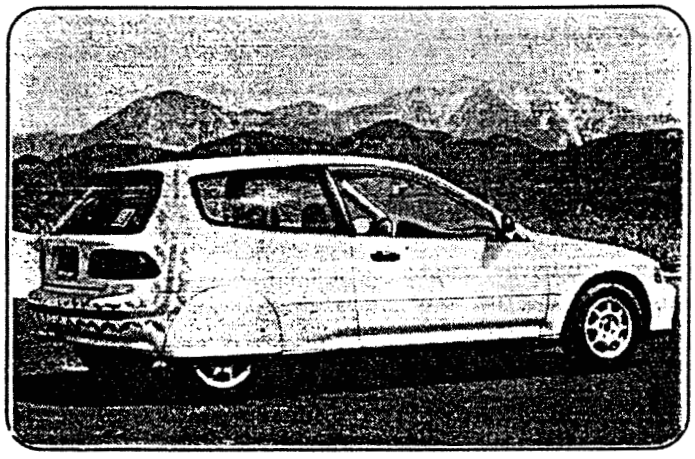


As senior consultant for Alternate Fuels Consulting, Kris Nelson conducted studies for the Oregon Department of Energy and Portland International Airport, comparing lifecycle costs of electric, diesel and natural gas buses and shuttles. He has completed seven EV Savings Audits for utilities and municipalities. As vice president of Oregon Roads Vehicle Leasing's Alternative Fuels Division, he manages lease financing of electric light duty and transit vehicles for public and private fleets and individuals.

Presentation: Mr. Nelson will lead a participatory EV Savings Audit, comparing lifecycle costs of an electric versus a gasoline light-duty fleet vehicle. He will also discuss how public and private fleets can take advantage of tax credits, while reducing risk in EV procurement, finance, and remarketing.

Russ Melbye - Melbye Associates

Russ Melbye is principal of Melbye & Associates, which has provided state and local governments and their agencies with cost-effective equipment/vehicle acquisition financing for 18 years. Mr. Melbye has worked with Capital Syndication and Borg Warner Acceptance Corporation (now Transamerica), as Manager at CitiBank, N.A., and was Regional Campaign Director for the Perot '92 campaign.

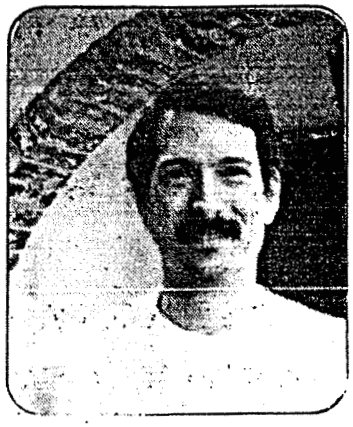


Alan Cocconi AC Propulsion, Inc. Vehicle

SES Hospitality Hour, 5 - 6pm

Dinner with Keynote Speakers, 6–8pm

Steve McCrea, Editor, *Why Wait for Detroit?*



Steve McCrea is Editor of *Why Wait for Detroit? Drive an Electric Car Today!*, the most up-date electric vehicle directory. *Why Wait for Detroit?* gives non-technical consumers information they need to know to buy an electric car for around $20,000 or electric car components for around $10,000.

Steve has worked for the U.S. Department of Energy as an Energy Conservation Specialist, and he helped the Hawaii Natural Energy Institute design a demonstration program of methanol, ethanol and propane vehicles. He is a consultant on transportation issues to the alt-fuel industry.



Presentation: Steve's keynote speech is entitled: "Fleet Managers: Pioneers of the Post-Petroleum Era." With the passage of the Energy Policy Act (EPACT) of 1992, fleet managers have been thrust into the forefront of the alternative fuel movement. Steve will share his views on how fleet managers can implement innovative responses to the mandated requirements of EPACT. He will also share a newly conceived program to reduce global warming. Those who attend the Friday night dinner will receive the "Guide to Alternative Fuel Vehicles for Fleet Managers," a booklet addressing important issues for fleet managers.

Amory Lovins, Rocky Mountain Institute



Amory B. Lovins co-founded and directs research at Rocky Mountain Institute, a 13-year-old nonprofit resource policy center in Old Snowmass, Colorado, and is Principal Technical Consultant to its subsidiary E Source, the premier source of technical information on advanced electric efficiency. A 1993 MacArthur Fellow, Lovins has been active in energy policy in more than

rm others, such as wind power generation and solar-thermal applications.

Peter Caton - Pacific Gas and Electric

Presentation: Mr. Caton will give some background on utility restructuring and offer PG&E's perspective on the wholesale power pool vs. retail wheeling debate.

John Schaefer - Energy Consultant



John Schaefer consults in applications of renewable energy sources, on technical, economic and strategic issues. Recent clients include the Electric Power Research Institute (EPRI), the American Wind Energy Association, Nevada Power Company, the Rockefeller Foundation, and the United Nations. From 1985 until 1991, Schaefer managed EPRI's wind and solar field test activities, where he evaluated successes and failures in photovoltaic, wind, and solar thermal power generation. Before joining EPRI, he spent 10 years as a consultant on power system planning, conservation and load control, and time-of-use electricity pricing.

Presentation: "Can Utility Restructuring Help Commercialize Renewable, Grid-Connected Electricity?" Mr. Schaefer will address such topics as: "Technological options: some are well tested and others are still in R and D"; "Economics and finance establish electricity supply choices"; and "The public repeatedly says it prefers solar and wind, and is willing to pay for it — how to overcome the cost gap?"

Transportation

CA Clean Air Act and the Zero Emission Vehicle Mandate in California and the U.S.; 9am–Noon

The ZEV industry can expect major changes as a result of the nationwide Clean Air Act mandates, soon to go into effect here in California. This panel will address how auto manufacturers are preparing to meet California's 2% of sales in 1998 requirement, and how government agencies plan to enforce the mandate.

Speakers

Ken Barber - U.S. DOE



Kenneth F. Barber is Director of the U.S. Department of Energy's Electric and Hybrid Propulsion Division, and a board member of the Electric Vehicle Association of the Americas. Mr. Barber played a major role in the formation of the U.S. Advanced Battery Consortium, and has served as the Department of Energy representative on the Management Committee since the consortium was formed in 1991. He joined the Federal government in 1971, where he has been responsible for directing research and development programs for a variety of automotive propulsion systems, including EVs.

Presentation: Mr. Barber will give a national perspective on the Clean Air Act mandates.

Juan Osborn - California Air Resources Board



As part of the ARB's Mobile Source Division Alternative Fuels/Advanced Engineering Group, Juan Osborn worked on developing the 1990 Low-Emission Vehicles Clean Fuels regulations, and was the lead staff responsible for the Zero-Emission Vehicle component, as well as the Hybrid Electric Vehicle regulations. Currently Mr. Osborn's responsibilities include testing and evaluation of advanced electric and hybrid vehicles, and developing new programs and regulations to support the ARB's Low-Emission Vehicle implementation plans.

Presentation: "The State Implementation Plan and the ZEV Requirement." The Federal Clean Air Act requires a comprehensive plan from every nonattainment area classified as serious, severe or extreme. Because of its severe air quality status and history of regulatory leadership, California has established a US EPA-approved State Implementation Plan, or SIP, to bring the Golden State into attainment of the National Ambient Air Quality Standards.

An integral part of the SIP is the mobile source element, including the California Air Resources Board Zero-Emissions requirement. While the ZEV regulation has become an emotionally charged issue, technological development of electric vehicles has progressed to a point where today it can be said that ZEVs are here to stay. Once commercialization of ZEVs begins, California will lead the way to a new age of clean and efficient transportation.



As a former Consumer Advocate for the state of Nevada, Jon drafted and assisted in the implementation of the nation's first comprehensive Integrated Resource Planning Act and regulations for both electric and natural gas utilities.

Presentation: "Alternative Models for Delivery of Efficient Sustainable Energy Services." The investor-owned electric utility industry (IOUs) in this country has traditionally provided electric energy service to residential, commercial, and industrial end-users via a vertically integrated system composed of central station generating plants, bulk transmission lines, and local distribution lines.

This presentation examines the IOU electric energy delivery model, and offers an alternative structure that is efficient and sustainable for delivery of energy services. The primary focus of the model is the optimization of the delivery of efficient energy services to existing end-users through a member-owned electric cooperative that would provide not only electricity at the best market price, but would also provide end-use efficiency improvements and energy service delivery options designed to maximize energy and resource efficiency while minimizing total customer bills.

Transportation

Clean Air Vehicle Presentations About Recent Research and Development; 2–5pm

Leaders in EV research present their latest developments.

Stan Ovshinsky - Energy Conversion Devices; Ovonic Battery Co.



Stanford R. Ovshinsky is President and CEO of Energy Conversion Devices, Inc., in Troy, Michigan; Chairman and CEO of the Ovonic Battery Co., a subsidiary of ECD; Chairman of the Institute for Amorphous Studies; and a member of the Board of Managers of GM Ovonic, a joint venture between General Motors and ECD for the production of his nickel metal hydride batteries for EVs. Mr. Ovshinsky has well over 150 U.S. patents in three major areas: energy conversion, including PVs and energy storage; information systems; and synthetic materials. He is the author of numerous scientific papers and has received numerous awards, and is a Fellow of the American Physics Society and the American Assoc. for the Advancement of Science.

Presentation: Mr. Ovshinsky's presentation is entitled: "Ovonic Nickel Metal Hydride Batteries Make Electric Cars Practical."

Michael Seal - Western Washington University



Michael R. Seal is founder and director of the Vehicle Research Institute, a unit of the Department of Engineering Technology at Western Washington University, where he and his students have been designing and building award-winning experimental vehicles known for fuel economy and safety since 1971. Among his current projects are Viking 23, which runs on both solar/electric power and compressed natural gas (CNG), and Viking 25, a hybrid vehicle being created from a Plymouth/Dodge Neon for the 1995 Hybrid Vehicle Electric Challenge in Detroit.

Presentation: Dr. Seal will discuss the thermo-photovoltaic (TPV) generator, which he hopes to incorporate into one of his Viking series vehicles by 1996, and its effects on the EV industry. This "Midnight Sun Generator," so-called because it will operate on demand day or night and not just when the sun is shining, could make solar/electric cars practical while satisfying the demand for vehicles that emit near-zero emissions.

Dr. Seal's Vehicle Research Institute has received grants totaling over 5.5 million from the federal Dept. of Energy and Dept. of Defense to develop this technology.

Alan Cocconi - AC Propulsion, Inc.

Alan G. Cocconi is President of AC Propulsion, a small owner-financed corporation that manufactures state-of-the-art electronics, motors, and instrumentation systems for electric and hybrid vehicles. Mr. Cocconi holds numerous patents on EV drive and recharge electronics and power electronics circuits, and has worked as a self-employed electronics consultant on many projects. Mr. Cocconi designed and built the motor drive and recharge electronics for the prototype GM Impact electric vehicle, and power electronics for the GM Sunraycer.

Presentation: Mr. Cocconi will present the technical highlights of AC Propulsion's electric vehicle drivetrains, instrumentation, and hybrid products. The opening of new areas of the

vehicle performance envelope attainable with this technology will be presented, along with the unique consumer appeal of the performance — economy combinations that are presently unavailable with competing internal combustion and electric vehicle technologies. A summary of AC Propulsion's extensive test program, including the recent round-trip cross-country hybrid drive (6,000 miles), will also be included.

Glenn Rambach - Lawrence Livermore Lab



Glenn Rambach is a Project Leader in the Hydrogen Energy Program of Lawrence Livermore National Laboratory (LLNL). He has been active in advanced energy research and development since 1974, and has served as a member of DOE's Hydrogen Program Surface Vehicles Committee for the Hydrogen Technology Advisory Panel. Mr. Rambach is currently working on the development of a fuel cell vehicle fleet powered by renewable produced hydrogen.

Presentation: A realistic look at the technical and economic issues for transitions to large-scale use of hydrogen as an energy carrier show that it makes sense to consider an evolution through small-scale distributed sources of hydrogen. Mr. Rambach will describe LLNL's work in hydrogen energy and fuel cells, along with its relationship to the National Hydrogen Program administered by the DOE. A key feature to the work at LLNL is the participation in a renewable hydrogen, fuel-cell-powered vehicle fleet project in Palm Desert, Calif. The presentation will also include some near-term, practical, PEM (proton exchange membrane) fuel cell applications, and their market entry issues. A concept for near-term use of hydrogen in distributed, renewable energy production will also be described. Other topics will include flywheel energy storage for hybrid vehicles, and a zinc-air battery design.

CalSEIA Hospitality Hour, 5–6pm

Dinner with Keynote Speakers and Presentation of REDI Lifetime Achievement Awards, 6–8pm

Stanford Ovshinsky, Energy Conversion Devices, Ovonic Battery Co.

Mr. Ovshinsky's keynote address is entitled: "There *Is* A Solution to Environmental Problems."

Alvin Marks, Advanced Research Development, Inc.

Dr. Marks will give a keynote address on the progress on his ".

Dance with the Ford Brothers Blues Band, 9pm–1am

Sunday, August 13

Breakfast at the Main Conference Hall, 7–8:30am

⚙ Energy

Federal Labs' Role in Developing Renewable Energy Technologies; 9am–Noon

Hundreds of national labs are working to "transfer" the results of federally funded research to the private sector; panelists will discuss how this technology transfer can benefit the renewable energy industry.

Speakers

Jerry Miller - Federal Technology Transfer Center

As Marketing Manager for the National Technology Transfer Center, Jerry is responsible for the marketing outreach activities of the NTTC training programs and National Gateway services. The NTTC, headquartered at Wheeling Jesuit College in Wheeling, West Virginia, contains the most comprehensive data on federal research and development in the U.S. The NTTC provides private sector industry with accurate and expedient investigations into the federal laboratory system, with education and training programs, and with technology-based economic development alliance-building.

Presentation: Mr. Miller will describe the NTTC's general mission and detail some NTTC programs. For example, NTTC's free Gateway Service provides callers access to the technology, expertise, and facilities of more than 700 federal laboratories and hundreds of other federally funded research facilities. Another NTTC program is "Business Gold," an online service/bulletin board with information on federally funded research, patents available for licensing, Small Business Innovation Research (SBIR) solicitations, conferences, and other technology transfer information.

AGENDA

George Linsteadt - Federal Labs Consortium



George F. Linsteadt began a career in physics in 1959 at the Naval Weapons Center, China Lake, California, where his emphasis was on applied research in optics. In 1970, he was instrumental in the development of the initial design of the original DOD Technology Transfer Laboratory Consortium. As the first Chairman and Executive Director of the FLC, he managed the activities of the organization from 1971 to 1980. Mr. Linsteadt currently serves as the Director of the Federal Labs Consortium Management Support Office.

Presentation: Mr. Linsteadt will discuss the role of the Federal Laboratory Consortium for Technology Transfer (FLC), which was organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986 to promote and strengthen technology transfer nationwide. All major federal laboratories and centers and their parent agencies are members. The Consortium creates an environment that adds value to and supports the efforts of its members and their potential technology transfer partners. The Consortium operates a network of representatives, develops and tests transfer methods, addresses barriers to the process, and emphasizes national initiatives where technology transfer has a role.

Alvin Marks - Advanced Research Development, Inc.



Alvin Marks, President of Advanced Research Development, Inc., is a scientist, inventor, consultant, and executive who holds several hundred patents in the fields of Optics, Chemistry, and Electronics. Dr. Marks received the 1974 Gano Dunn Medal for outstanding professional achievement in Engineering and Science from the Cooper Union Institute of Technology. Dr. Marks has been President of the Polalite Corp., 1936-53; Lt. USN 1944-45, Office of Naval Research 1949; President, Chairman of the Board, Marks Polarized Corp., 1953-81; and Principal Investigator on Lumeloid™ Project, Electric Power Research Institute, Palo Alto, Calif.

Presentation: Dr. Marks is currently working with Argonne National Lab on a 3-year joint research project to develop the "solar cell on a roll," a new solar energy technology that uses a film instead of layers of semiconductors to convert light into electric power.

Laxmi Mrig - NREL

Laxmi Mrig is a Senior Engineer and Team Leader responsible for PV Module and System Performance at the National Renewable Energy Laboratory. He has been with NREL for the past 16 years testing, monitoring and analyzing the performance of emerging technology PV modules and arrays.

Presentation: Mr. Mrig will discuss his work at the National Renewable Energy Laboratory (NREL), developing a photovoltaic Module Energy Rating (MER) methodology, and will present an overview of the procedures required to generate an MER for any particular PV module type.

Marjorie Tatro - Sandia National Labs



Margie Tatro is a department manager at Sandia, where she manages the $16 million Photovoltaics (PV) Program in the Applied Energy Center. Activities in the PV Program are based on collaborative work with photovoltaic hardware manufacturers and design assistance work with agencies interested in using renewable energy technologies to meet an energy need.

Presentation: Ms. Tatro's presentation will describe Sandia's renewable energy efforts, particularly as they pertain to the manufacturing issues associated with wind, geothermal, photovoltaic, and solar thermal technologies.

Transportation

ZEV Fleet Operators Performance Review; 9am–Noon

This panel is intended to help leasing companies and fleet operators find out where to purchase and finance appropriate ZEVs to meet California's soon-to-be-implemented Clean Air mandates.

Speakers

Joseph LaStella - Battery Automated Transportation

Joe LaStella is President of BAT, which has just announced a joint development agreement with Acme Electric Corporation, a major manufacturer of aerospace batteries, to produce a "Common Vessel Monoblock Fiber Nickel Battery," which will have a 200,000+ mile life, 100-150 mile range, and quick charge capability.

AGENDA

Sgt. Bill Fairbairn - McClellan Air Force Base

Bill Fairbairn is the Alternative Fuels Fleet Manager at McClellan Air Force Base, California, where he manages one of the largest and most successful EV fleets in the world. When not working fleet management issues, Sgt. Fairbairn's other responsibilities include ensuring the proper infrastructure is in place to support this growing fleet, implementing procedures for using Dept. of Defense capabilities to accelerate EV commercialization, and public relation efforts.

Presentation: "McClellan Air Force Base's EV Program — Past, Present and Future": McClellan Air Force base provides an excellent environment for the use of electric vehicles. The light-duty fleet travels almost 2 million miles per year, most of these miles on the base's self-contained road system. This presentation will include success stories from McClellan's demonstration and test program, dual-use and technology transfer, hands-on operator comments and concerns, innovative solutions, and plans for the future after it was announced last month that McClellan AFB has been added to the base closure list.

Ruth MacDougall - SMUD



Ruth MacDougall has been working in the electric vehicle field for more than 4 years at Sacramento Municipal Utility District (SMUD), which has one of the most aggressive electric vehicle programs in the country. Ruth has been involved in a number of activities at SMUD, including fleet purchases, and is presently managing a program of field testing batteries, developing advanced energy storage devices such as flywheels, and promoting electric buses. She has been active in helping start a chapter of the Electric Auto Association of Sacramento. Ruth has been driving electric for the past two years and presently converting a Geo Metro.

Presentation: Ruth will address fleet management and technical issues.

ZEV "Ride and Drive" and Showcase

Solectria
Barry Pearson, Regional Sales
'95 Force

AC Propulsion
Alan Cocconi
EV/hybrid conversion

Western Washington University
Michael Seal, Ph.D., Vehicle Research Dept.
Viking 25 - Chrysler Neon hybrid

Pacific Gas & Electric
Shawn Considine and Kent Harris
Honda EV prototype

Battery Automated Transportation
Bob Martino
Geo Metro EV conversion

McClelland Air Force Base
MSgt. Bill Fairbairn
Horlacher EV

WE'RE IT - Women's Electric Racing & Information Team - Clare Bell
Porsche EV conversion

Sacramento Municipal Utility District
Ruth MacDougall
Horlacher EV

Mendomotive
Steve Heckeroth and Gary Flo
Porsche Spyder conversion

Electro Automotive
Mike Brown and Shari Prang
EV conversion

Sports Tech (USA)
Stuart Shim
Electric scooter prototype

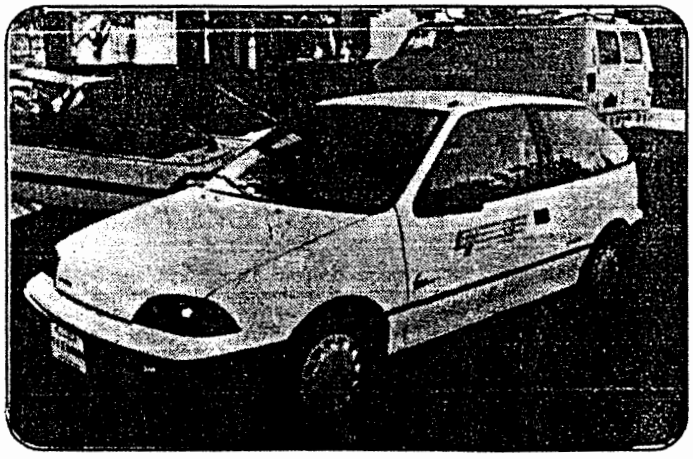


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Barry Pearson of Solectria will discuss the latest developments in their vehicle line including the recent record breaking distance performance of the "Sunbird" in the American Tour de Sol

"Ovonic Batteries: Making Electric Cars Practical"

By Stanford Ovshinsky, ECD/Ovonic

Why are our Ovonic batteries so important? Because they make electric cars practical, and start the process of building a new, more adaptive and responsive form of automotive transportation that addresses the problems of pollution and dependence on foreign oil.

The latter is a volatile commodity because its control is a potential source of warfare between nations. The cost of oil adds to inflationary pressures and our balance of payments deficit. Without the generation of new industries, quality jobs that are needed for the country's advancement will not be available. Without a prosperous country based on solid scientific and technological advances, we cannot produce well-educated citizens who will be able to compete in the global marketplace during the next century.

While all of the above is needed to understand the dynamic that is pushing the development of this new industry, I feel that the success of the electric car will be based on market demand, because the cars that we will be driving — both purpose-built and converted — are exciting and fun to drive.

There are many reasons that will fuel the market for electric vehicles, ranging from concerns about the environment and global warming to young people who are members of the electronic/computer generation that takes conventional automobiles for granted and looks forward to the electric car as a mode of transportation that fits its life-style.

All of you have heard the familiar litany of "who would want a car that goes only 40 to 50 miles on a charge; is slow, with poor acceleration, a long recharge time, requires replacing its batteries every 15,000 miles; and is expensive?" This would be a persuasive argument against electric vehicles except that it does not describe electric vehicles powered by Ovonic batteries.

A watershed event occurred in late 1993, when we delivered a battery pack to General Motors for evaluation. The pack was easily and quickly installed in a GM Impact car. The Impact, which was unusually heavy because it was loaded down with test equipment, traveled 201 miles on a single charge, and we believe the car would have gone more than 240 miles if it had not carried so much extra weight. As we have demonstrated previously with other battery packs, the Impact's nickel metal hydride battery was recharged to 60 percent of capacity in 15 minutes.



Stanford Ovshinsky, President and CEO of Ovonic Battery Company, in front of one of Ovonic's manufacturing plants in Troy, Michigan.

In a May 26 article on the American Tour de Sol race, the New York Times reported that a converted Geo Metro — the Solectria Force RS — used Ovonic batteries to travel more than 214 miles on a single charge. The Times called the first-place Ovonic battery-powered Solectria "an electric car [that] goes more than an extra mile."

Earlier, on March 20 in Phoenix, an Ovonic battery-powered Solectria Force RS driven by James Worden, president of Solectria, dramatically won the 1994 Arizona Public Service Electric 500 stock car race, setting new world records.

Solectria reported that Worden's incredible win was made possible not only by the car's advanced power management system,

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but also by "the remarkable capabilities of Ovonic's advanced nickel metal hydride batteries."

Tests on the batteries by independent laboratories and in several different automobiles indicate that Ovonic batteries will last the lifetime of the car. These batteries provide high speed and power. For example, acceleration from 0 to 60 miles per hour takes less than eight seconds in an Ovonic battery-powered Impact. The battery is robust, maintenance-free, environmentally benign, and is fully recyclable.

In 1992, the Ovonic battery became the first to receive funding ($18.5 million cost-sharing contract) from the U.S. Advanced Battery Consortium (USABC). Since then ECD/Ovonic has received another $5.5 million cost-sharing contract from USABC. One of USABC's primary objectives is the development of a battery pack that costs approximately $4,000 per vehicle, which would put it in a cost-competitive position. We are confident that based on our continuing proprietary advances and volume manufacturing cost-reduction measures, we can meet this goal and have realistic plans to make it even cheaper. The fully-developed electric car can be less expensive than a conventional gasoline engine car and will have a similar driving range on a single battery charge.

The race to develop a vehicle that can dominate the electric car market is both international and heated. We would be much happier if there were less secrecy and less heat generated by this race, and perhaps a little more light for the public to understand what is truly going on.

It should be understood that while our battery production partner is General Motors, GM Ovonic [formed in June 1994 as a manufacturing joint venture, with plans to start mass production of EV batteries by the end of 1995] will be producing batteries for everyone, as specified in the USABC commercial development contract. Prior to forming our relationship with General Motors, we already had licensed Hyundai, and we are very pleased with that company's progress and test results. Honda displayed the Ovonic battery at the Tokyo Auto Show, and we are working with other companies worldwide, because there are huge markets in Europe, Japan and Asia.

It is my opinion that although the State of California has been steadfast in holding to its mandates for zero-emission vehicles, once electric vehicles are introduced, they will make the debate about mandates irrelevant, and the business will be propelled by market forces. It is the process that counts, and I believe that sales of electric vehicles will follow the sales curve of fax machines, cellular telephones and portable computers. I believe that the auto industry, which has been an important and gratifying part of my life since my youth, will adapt to change — just as the mainframe computer industry had to — and will be advertising and selling electric cars just as they now advertise and sell the benefits of seat belts, air bags, catalytic converters and antilock brakes.

The Green Battery

Performance comparison between Ovonic nickel metal hydride and current battery technologies

	Proprietary ECD/OBC	Current Battery Technology
Energy density (watt hours/kg)	80	30-35
Energy density (watt hours/liter)	245	100-110
Power density (watts/kg)	245	90-100
Rapid charge	15 minutes	2-8 hours
Cycle life	>1,000	200-300
Materials	Non-toxic Recyclable	Toxic

Demonstrated in large size battery. ECD/OBC's proprietary approach and ongoing advancement will permit electric vehicles to exceed the present range of gasoline engine automobiles.

The Green Battery

Fuel cost comparison of conventional car with EV using an Ovonic Battery

	Gasoline Engine Car	Electric Vehicle with Ovonic Battery
Fuel Capacity	14 Gallons	24 kWh
Fuel Cost	$15.40 @ $1.10 per gallon	$1.92 @ 8 cents/kWh and 88% efficiency
Range (Miles)	300-350	200-300
No. of Miles per Dollar of Fuel	19-23	100-150

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Presidential Invitation

Soon after this Presidential note of thanks, Janet Orth was invited by President Clinton to represent REDI at The White House Pacific Rim Economic Conference, where she was one of about 200 participants from a diverse cross section of business and communities from California, Oregon, Washington, Alaska and Hawaii.

The President, Vice President Gore and seven Cabinet members were all present at the conference in Portland, Oregon, on June 27. Janet met in a closed breakout session with the U.S. Department of Energy's Deputy Secretary Bill White and about twenty heads of national laboratories, utility companies, oil companies, environmental groups, law firms and business entities. The DOE is working with nations around the world such as Russia and Mexico to restructure utility monopolies and develop clean energy resources. The Deputy Secretary also expressed the DOE's deep concern with protecting the nation's research and development investment in science and technology by continuing to support the work of the national labs.

The Pacific Rim Conference focused on an approach to the economy through innovation and trade, education and training, and environmental technologies. Clinton pointed out the importance of education in sustainable economic development by maintaining a highly trained work force and promoting cutting-edge technology. REDI has been working toward the same ends, beginning with its annual consortium of the renewable energy and clean-air transportation industries at the Solar Energy Expo & Rally and the REDI Conference, and with the ultimate goal of establishing a vocational university specializing in environmental techologies.

THE WHITE HOUSE
WASHINGTON

May 16, 1995

Ms. Janet M. Orth
Chief Administrative Officer
Renewable Energy Development Institute
Suite 234
733 South Main Street
Willits, California 95490

Dear Janet:

Thank you for getting in touch with me during my visit to California. I appreciate the information about the Renewable Energy Development Institute (REDI), the Solar Energy Expo and Rally, and the kind invitation to attend REDI's upcoming conference.

Although I do not know what my schedule will hold, I have passed along your letter to my scheduler, Billy Webster, and to other members of my staff. I look forward to your continuing involvement as we work to protect our nation's precious resources.

Sincerely,

Bill Clinton



Tony and Janet Orth with City-el from Pacific Electric Vehicles at REDI Conference '93

Oregon Roads: Bringing EVs to Market

By Dawn Vlahandreas
The Statesman Journal, Salem Ore.

A Eugene-based company is hoping to bring more electric vehicles to Oregon through leasing. Oregon Roads Vehicle Leasing, which also has offices in two other Oregon cities, leases hard-to-finance vehicles, such as catering trucks, commercial trailers, motor homes and alternative-fuel vehicles. Electric vehicles fit in the alternative-fuel category.

Oregon Roads is the Northwest representative for Battery Automated Transportation (B.A.T.) International, a Burbank, Calif-company that guts Geo Metro cars and Ford Ranger pick-ups and replaces the engines with an electric motors and 800 pounds of batteries. Oregon Roads leases both vehicles.

"It's fun to be in a zippy vehicle where 100 percent of torque is from 0 rpm," said Kris Nelson, vice president of the alternative fuel division of Oregon Roads. Nelson "is convinced" the smartest way to get into an electric car is to lease it. "Payments are 20 percent to 30 percent less than financing," he said.

One drawback to electric vehicles is their cost. Electric vehicles designed from the ground up, such as GM's Impact and Ford's Ecostar minivan, cost many times more than their gasoline equivalents.

B.A.T.'s converted Geo Metro costs $18,900, whereas the same gasoline-powered Metro costs about $9,000. The four-seater comes with dual airbags and anti-lock brakes and a choice of either a five-speed or automatic transmission.

A typical five-year lease payment on the Geo Metro is $320 a month. Also, electric vehicles are eligible for state and federal tax credits.

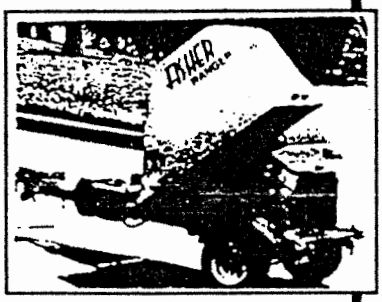
Leasing the cars can take the sting out of the purchase price, along with offering other benefits:

- No need to take the plunge into the somewhat risky technology.
- No hassle of reselling the vehicle.
- No down payment required.

Nelson is also senior consultant for Alternate Fuels Consulting, where he performs EV Savings Audits for utilities and municipalities. Nelson says the state is "a ripe place for an electric vehicle industry to take root," noting Oregon's growing high-tech industry and cheap electric rates.

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This converted electric Geo Metro costs about a penny a mile in electricity, one-third the fuel cost of the gas-powered Metro, the most efficient mass-produced car on the road.

Electric Vehicle Savings Audit

BAT Ford Ranger Pickup vs. Gasoline Ranger Pickup

- 90,000 mile replacement schedule for gasoline pickup
- Gasoline pickup acquisition cost: $10,500
- Gasoline $1.00/gal., maint. $1,500/12,000 miles, 11.3 mpg
- Gasoline pickup operational cost: $.2135/mile
- BAT Ford Ranger acquisition cost: $24,100 (no tax credits)
- 70 miles avg./charge
- New motor brushes every 100,000 miles @ $150 parts and labor
- Electricity cost: $.0398/kwh

Estimated EV Savings

Vehicle Model	At 90,000 Miles		At 180,000 miles	
	Total Cost Cost/Mile	Savings Savings/Mile	Total Cost Cost/Mile	Savings Savings/Mile
'94 Gas Ranger	29,715		59,430	
	0.3302		0.3302	
'94 BAT EV Ranger*	27,077	2,638	31,806	27,624
	0.3008	0.0293	0.1767	0.1534

**Figures are based on 90,000 mile replacement schedule for gasoline models and 180,000 mile replacement for electric models, given average life of Advanced DC motors is 35-40 years, or 300,000+ miles.*

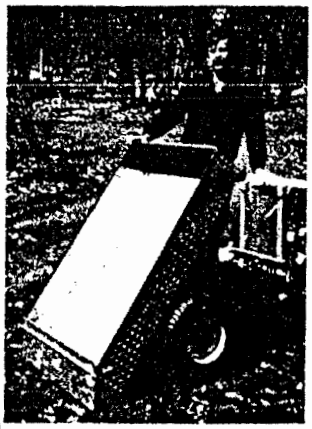
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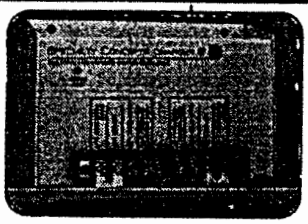


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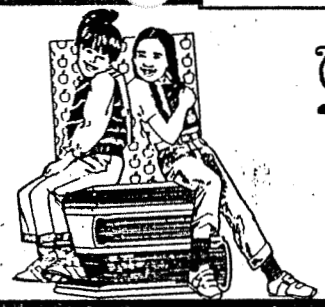
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The
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Volume 93 — Number 67 | Wednesday, August 28, 1996 | 50 Cents (tax included)

SEER has served its purpose —

REDI goes on-line with network of 10,000 industry leaders

by Carrie Switzer

The Solar Energy Exposition and Rally (SEER) fulfilled its purpose over a four-year period beginning in 1990, and, according to one of its founders, has outlived its usefulness.

"We've decided not to do events because there is no ongoing nature to them," explained Keith Rutledge, a member of the Renewable Energy Development Institute's (REDI) board of directors, the non-profit outgrowth of the original SEER organization. "Events are a one-time, three-day affair that take all year to plan and build. We had no time or energy left to develop ongoing programs for environmental technology."

The REDI group is made up of about eight core volunteers and a half-dozen others who come in to assist with specific projects. And the Willits-based group is anything but inactive. Its members have met weekly for six years, and are closer than ever to realizing a dream of offering a four-year degree in environmental technology through a full-time university planned for construction in Mendocino County.

Although the idea for the university was conceived in 1993, getting where the group is today — in possession of 100 acres of land and with students waiting in the wings — has evolved incrementally.

"We incorporated in 1992 and decided we couldn't do the expo every year because we wanted to do something with an industry focus," Rutledge said. "That's when the REDI conference was born, and the first one was held in 1993."

The conference was a success, attracting to Willits representatives from large utility companies and the California Public Utilities Commission to discuss alternative energy with leaders in the alternative energy field. For the first time, industry leaders had the attention of lawmakers and energy monopolies, and concrete discussions over sharing power, both on and off the grid, began.

During the conference, financial institutions were introduced to the idea of financing homes "off-the-grid," in addition to the ongoing promotion of electric vehicles the Solar Energy Exposition and Rally made widely known during its earlier events, which included competitions between electric- and gas-powered vehicles.

With the birth of the conferences, REDI opted to do a solar fair every other year, alternating with the industry-based conferences.

(See SEER, page 9)



Committee stalls overhead power project

by Carrie Switzer

The Committee to Retain Underground Electricity, comprised of a group of Spring Creek residents, is trying to buy time from PG&E to block the installation of overhead power lines, a move opposed by a majority of Spring Creek Road Association members, and a right won in court by three Spring Creek residents who filed suit against the road association. Tuesday a judge agreed to a preOhearing conference on the issue set for Sept. 17.

At issue is a popular mandate voted for by 95 percent of association members who cast ballots to require the installation of underground utility lines in the rural subdivision northwest of Willits. The vote was taken in 1981 by 75 percent of the property owners there, and the mandate was written into the subdivision's Codes, Covenants and Restrictions (CC&Rs), which govern certain aspects of construction and development of large, unincorporated subdivisions.

Three Spring Creek property owners successfully challenged the rule in Superior Court, how-

SEER fulfills purpose

(Continued from page 1)

That lasted through a move of SEER in 1994 from Willits, where all of the infrastructure for exhibitors had to be rebuilt for each event, to the Redwood Empire Fairgrounds, and came to a sort of natural close with the most recent REDI conference, held at the Willits Community Center last year.

"It worked out great," Rutledge said last week, acknowledging that some business owners in Willits are disappointed and even irritated by the discontinuance of the events. "But we never promised to do this forever, and we realized that although people were coming from all over the country to participate, we sensed the enthusiasm to continue doing so was waning.

"Weren't we defeating our purpose by flying in and driving in to get to SEER? We need to practice what we preach."

The waning interest of exhibitors to travel long distances to the events, coupled with the advancement of World Wide Web technology and the Internet, prompted REDI to turn its focus to fund-raising, development of a university, and getting all of the contacts made during previous events "on-line."

"We thought maybe SEER had fulfilled its purpose," Rutledge said. "We built a network, and now we can expose it to the world and connect with a world-wide population. SEER and the REDI conferences began to look like family reunions, and you don't have a family reunion every year."

By building a Web page, REDI plans to interconnect over 10,000 businesses, utilities, banks and individuals as well as offering "The Best of SEER," an entertaining tour through a "virtual" solar fair, with photographs, video and audio tapes of past events, updated by new technology each of the participants makes available on the Internet. The page will include a text listing for alternative technology resources in addition to the Cyber-SEER fair, for those who want access to the listings but don't care to cruise through the virtual fair.

"The listings will include everything from permaculture resources to photovoltaic manufacturers," Rutledge said. "The whole spectrum of environmental technology will be available so anyone with access to the Internet can get a list of who is doing what."

As an example, Willits alternative energy pioneers at Solar Electric Specialties will have their displays at Cyber-SEER, and because SES has its own Web page, anyone interested in investigating the company's products further can click on to the SES Web site for more information.

"We are trying to get information out and network people," he said. "For us it's gratifying because we've built this incredible network of people and consciousness, and we are ready to leap off into a new direction."

In addition to the alternative technology listings, REDI has obtained funding through the San Francisco Foundation, the Utility Photovoltaic Group and the Solar Energy Industry Association to provide a Web site listing for Off-Grid Home Mortgage Loans, a directory of financial institutions already lending to individuals building grid-independent residential energy systems.

"We are finding lenders who will loan money for alternative homes," Rutledge said. "Most of the barrier to this has been strictly numbers; finance companies haven't seen enough data to show them it is worth lending for off-the-grid building projects."

But as more people want to build solar homes, Rutledge pointed out, the market is growing.

"The initial cost for a solar energy home system might be $20,000, which is really prohibitive if you, as a home owner or builder, are having to come up with it in advance," Rutledge said. "But if you can roll it into a mortgage loan, which might bump it up from $100,000 to $120,000, it's a monthly payment, amortized over 30 years, and it becomes more comparable to the cost of a utility bill."

Publishing the names of institutions already offering such loans, Rutledge added, is likely to attract the attention of more lenders.

"The listing will be available for builders, buyers, real estate agents and lenders," he said. "It's an education process at the same time for other lenders."

Preparation to go on-line, which is expected to happen in the very near future, has occurred simultaneously with efforts to obtain land in Mendocino County for an alternative energy university which would offer a four-year degree. REDI put out the word three years ago that the group was looking for a site to build a facility for hands-on projects and education, and hoped to locate the institute on timberlands just west of Willits off of Highway 20.

"We didn't get any solid offers until Larry Spring, one of our physics experts and past SEER participants, donated 100 acres on the Noyo Harbor," Rutledge said. "We were hoping to locate in Willits, but what we have is an ideal, pristine ranch with river and ocean frontage, a 60-foot waterfall, timber and open space. It is ideal in that it will provide environmental challenges to growing food and using solar energy. But those challenges will help us study and develop ways to make alternative energy a viable thing for challenging climates."

The property is called the Noyo Harbor Ranch, and title will be transferred after REDI's tax-exempt status is confirmed and the paperwork clears. REDI is also required to have a program ready for implementation as soon as the title is transferred, with the express purpose of being a living-learning center for environmental research.

"For environmental studies, it is a good location," Rutledge said. "We have engaged the interest of the College of the Redwoods and UC Davis, which is prepared to send students for specific projects as soon as we are in.

"It will operate a lot like the UC Cooperative Extension at the Hopland Field Station, providing a place for students to study and obtain a four-year degree."

Rutledge said getting the materials and equipment for the university is the easy part, as research centers across the country donate unused or slightly used materials to REDI on a regular basis.

"The thing we have needed for a long time is a home," Rutledge said. "We have so much stuff in our personal storage places, we have virtual warehouses in our homes. Getting the materials is the easy part."

> ***"Weren't we defeating our purpose by flying in and driving in to get to SEER? We need to practice what we preach."***
>
> **— Keith Rutledge**

An endowment fund has been set up for the ranch, which will be formally called "The Larry Spring Center for Common Sense Physics," and contributions may be made by calling the REDI office at 459-1256. Rutledge said the university will be better able to facilitate projects, such as the in-process Forest Fire Risk Reduction and Materials Utilization Plan, and expand on them.

"That was the idea of Ed Burton, who wanted to do a pilot project to reduce the fire hazard in Brooktrails and Pine Mountain," he said. "We did small plots to see if we could market the materials we removed and pay for the labor it took to do the work. It was a success; we broke even."

The products are patented as "FIRESAFE," and sold to companies who make small picture frames and to manufacturers of surveyor stakes, and given to local Boy Scout troops to sell as kindling and firewood.

The program has guidelines for harvesting in fire risk areas, including limiting the size of materials removed to under 9 inches and paths to remove the materials to less than 4 feet wide.

"Phase II will include using solar electric chain saws and electric carts for removing the material," he said. "There is a market for small wood pieces.

We have a checklist that qualifies property owners and public entities for the risk reduction work without having to do a formal timber harvest plan. And there are safeguards to guard against this method being used for major, commercial hardwood removal."

The demonstration project is being conducted by REDI in partnership with Ed Burton, the U.S. Forest Service, local timber workers and Boy Scout Troupe 88.

Phase I was conducted last fall in Brooktrails and Pine Mountain on a couple of plots less than one acre in size.

"The project fit with our pattern of supporting ecologically sound environmental practices," Rutledge said. "We're hoping to sponsor and provide a facility and materials to support more projects with the same intent. We'll start small, and grow."

1997

REPORT FROM THE SOLAR CAPITAL

by Janet Orth, Board of Directors, Renewable Energy Development Institute (REDI)

Many people ask, "Will there ever be another Solar Energy Expo & Rally?" Organized by a grassroots group based in Willits, California, SEER was a popular event for both families and business in the early '90s.

In 1989, a small group of inventors, enthusiasts, and small business owners planned a solar fair in Willits. Their goals were to reduce reliance on foreign oil and to improve the environment through the use of renewable energy and clean-air transportation.

The first SEER was held in 1990, as the U.S. sent troops into the Gulf War. This dramatically illustrated the need for SEER, which instantly became the largest event of its kind and helped establish Northern California as the "Solar Capital of the World," with Willits "The Heart of the Solar Capital." The organizers then joined with the local Chamber of Commerce, the utility company, and local solar businesses to plan SEER '91 and '92, which were held in a park setting with more exhibitors and attendees.

SEER organizers then saw the need to create an ongoing structure to operate the event, while providing a foundation for year-round educational and scientific activities. As a result, REDI was formed in 1992; by 1994 it had gained tax-exempt status as a charitable, nonprofit corporation. SEER '94 moved to the larger Redwood Empire Fairgrounds in Ukiah.

Meanwhile, the first REDI Conference in 1993 addressed breakthrough issues of utility involvement in solar photovoltaic systems, standards in electric vehicle manufacturing, and consumer financing and insurance. REDI provided a forum for all parties to be involved in decision-making on an equal footing. Small businesses and contractors had not had input in these areas before. REDI Conference '95 expanded on these themes, with more networking among industry, government, and research labs.

In 1996, REDI began focusing on year-round programs. The directors decided not to hold the annual events for which REDI had become so well-known. It was time to disemminate to the public the educational information compiled from organizing those events.

Several projects have advanced over the past year. The most visionary of these is the creation of a university degree program specializing in renewable energy research and occupations, drawing together and expanding on existing community educational resources. A generous land donation from a local physicist has begun the realization of that dream. This beautiful 100-acre site in Fort Bragg, California, is at a confluence of forest, river, and ocean. The permanent facility there will be a living/learning center: "The Larry Spring Center for Common Sense Physics."

Much development has gone into Cyber SEER—"The Virtual Solar Energy Expo & Rally"—and REDI.Net, an online resource directory of renewable energy, clean-air vehicles, energy conservation, recycling, healthy buildings, green products, permaculture, and new energy. Cyber SEER will offer an entertaining visual tour of "cyberbooths," while REDI.Net will allow browsers to skip the tour and search its listings.

REDI's "OHM Loans" project is a nationwide directory of Off-grid Home Mortgage lenders, for consumers seeking to finance independent residential energy systems. Financing has long been a barrier to widespread use of solar and renewable energy systems. REDI plans to publish the OHM Loans directory in both electronic and print media.

The "Forest Fire Risk Reduction and Materials Utilization Plan" is developing "FIRESAFE" (TM) wood products harvested during fire-risk-reduction projects. Small-diameter manzanita, madrone, tan oak, and other woods are processed into marketable products to cover the costs of the work while providing new jobs for underemployed timber workers. This program creates a model of environmentally sound, self-sustaining, small-scale fire abatement methods. Ultimately, a training curriculum and materials will be developed for use in offering classes through the California Community Colleges in timber communities.

The Zero Emission Vehicle Demonstration, or "ZEV Project," is funded by Mendocino Council of Governments, the regional transportation planning agency. This technology-assessment study will lay the groundwork for rural transportation planning in anticipation of a new generation of vehicles.

A science club in the spirit of Larry Spring is being born, developing educational kits for hands-on experiments and learning by doing. His theory of energy "magnespheres" and magnetic solar motors is gaining momentum with curious thinkers far and wide.

And finally, REDI's vision of a permanent environmental research center is growing from a seed and taking shape. To join in this effort, please call (707) 459-1256. By making a tax-deductible contribution to REDI's endowment fund, donors can become cofounders of the Noyo Harbor Ranch.

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FINAL

MENDOCINO COUNCIL OF GOVERNMENTS

TRANSPORTATION PLANNING WORK PROGRAM

FY 1997/98

Adopted May 5, 1997

Prepared by: Phillip J. Dow, P.E.
DOW & ASSOCIATES
367 N. State St., Ste 209
Ukiah, CA 95482
(707) 463-1806

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WORK ELEMENT (13) **ZERO EMISSION VEHICLE (ZEV) DEMONSTRATION PROJECT, PHASE II**

PURPOSE: The purpose of this project is to generate a report of findings related to local use of one or more ZEVs (and/or Low Emission Vehicles), specifically in the rural setting of Mendocino County. The project will initiate informed electric vehicle/alternate fuel infrastructure planning efforts by providing hands-on experience for local government agency and planning personnel. This project will participate in statewide clean-air strategies.

PREVIOUS WORK: Phase I of this project was funded in the 1996/97 Work Program.

TASKS:

1. Install vehicle charging/fueling stations.
2. Acquire vehicles (lease and/or borrow).
3. Set up instrumentation for data collection.
4. Test vehicles.
5. Train/orient drivers in MCOG member governments.
6. Schedule shared vehicle use.
7. Conduct Ride & Drives.
8. Install photovoltaic net-metering demonstration.
9. Document and present findings.

PRODUCTS:

1. Report on rural ZEV/LEV trial performances with terrain/climate effects and driver experience/evaluations.
2. Forecast of power/fueling requirements with summary of standards and safety issues.
3. Data for ZEV/LEV air quality and transportation elements to County General Plan.
4. Photovoltaic Net Metering demonstration/report.

REGIONAL PRIORITIES: This project will **Create Effective Partnerships**; and utilize **New Technology**.

FUNDING AND AGENCY RESPONSIBILITIES

Agency	Estimated Person Days	Total Cost	Funding Sources: Local LTF	Local STP d(1)	State
Consultants*	10	$ 5,000	$ 5,000	$ 0	$ 0
Direct Costs		$10,000	$10,000	$ 0	$ 0
Total	10	$15,000	$15,000	$ 0	$ 0

(* includes REDI, outside consultants)

OWP Planning Project
Proposed Scope of Work

ZEV Phase Two - 1997/98

APPLICANT: Mendocino Council of Governments October 31, 1996

PROJECT ADMINISTRATOR: Renewable Energy Development Institute (REDI)

GOAL / PURPOSE

Conduct ZEV (Zero Emission Vehicle) Demonstration Project Phase Two. This second phase will test several commercial ZEVs entering the consumer market, specifically for performance in a rural setting, specifically Mendocino County. ZEVs (and possibly LEVs--Low Emission Vehicles--such as an electric/natural-gas hybrid if necessary to achieve goals) will be borrowed and/or leased and test driven in both "regional commute" and "in-town" modes. Goals of the study will include the following:

- Participate in statewide clean-air strategies
- Evaluate practicality of ZEV/LEV use in rural transportation
- Collect data for future ZEV/LEV infrastructure planning
- Evaluate public response to ZEV/LEV Ride & Drive
- Demonstrate "net metering" by feeding photovoltaic remotely-generated electricity into the utility grid to offset ZEV energy use

PREVIOUS WORK

Phase One, during 1996/97, is currently identifying project partners and funding sources, and will make recommendations for Phase Two.

TASKS

The project will include the following areas:

- Schedule commute and town modes of use
- Test commercial vehicles
- Identify and test charging infrastructure
- Install and monitor vehicle instrumentation
- Train ZEV/LEV drivers, compile experience data
- Install and demonstrate solar-electric "net metering"
- Publicize program and educate the public
- Document and report findings

PRODUCTS

- Report on rural ZEV/LEV trial performances
- Report on charging infrastructure requirements
- Data for ZEV/LEV air quality component to County General Plan revision
- ZEV/LEV Ride & Drive consumer orientation program
- Photovoltaic Net Metering demonstration

TIME SCHEDULE

July 1, 1997 through June 30, 1998:

July - Sep.	- Start project, get first car/s and test drive, install PV solar modules
Oct.	- Report 1st Quarter
Nov. - Dec.	- Start Ride & Drive and publicity
Jan.	- Report 2nd Quarter
Apr.	- Report 3rd Quarter, complete project activity
May	- Document and report project
June	- Present findings
July	- Report 4th Quarter, summarize Phase 2

ESTIMATED PERSON DAYS / COST BREAKDOWN

REDI	30 days	$ 5,000	
Technical Consultants	20	7,000	
Air Quality Management District	20	5,000	
Media/Education Consultant	25	4,000	
MCOG	5	1,000	
Totals	100	22,000	Personnel and contracts
		23,000	Direct costs
		$45,000	Total Budget

LINE ITEM COST ESTIMATE

Vehicles: Leases, insurance, registration, taxes, transportation	$15,000
Instrumentation: Equipment rental, monitoring labor	4,000
Charging Equipment: Hardware and installation	1,200
Technical Consultant: Maintenance, oversight, reporting, direct costs	5,000
Photovoltaic Charging: Mounting, wiring, direct costs, and inkind value	4,000
Outreach and Education: Consultant, videotaping, printing, displays, etc.	10,000
Administration and Documentation: Office staff, overhead, direct costs	5,800
Total Project	45,000
Less in-kind and grants	15,000 *
Total request	**$30,000 ****

* **Note:** In-kind donations of time and materials, as well as grants, are anticipated and/or sought from REDI, AQMD, PG&E, car manufacturers, utility companies, California Energy Commission, and PUC. REDI Directors' donated time is additional to this amount.

** **Note:** REDI will continue to seek outside funding and contributions for this project. Final scope of work and budget requirements will reflect total committed project funds from all sources.

Budget: Three options/levels have been discussed, as follows:

$15,000 — If local MCOG funding **($15,000)** were the only funds available, the project would have a minimized scope and duration, i.e., cars would be leased/borrowed for less time during the year, only two electric charging stations would be installed, and education/outreach would be limited to exhibiting at local fairs and parades.

$25,000 — With in-kind contributions of professional time and materials in addition to local funds, **($15,000 + $10,000)** we can install more charging locations, publicize the effort more, and produce a more thorough report and model orientation program.

$45,000 — With the state/federal funds in addition to the above **($15,000 + $10,000 + $20,000)**, the project would be fully funded. We would be able to lease/borrow vehicles for the entire fiscal year, evaluate more different models and associated fueling infrastructure as available, hire a vocational consultant to design the model education program, compile more driver experience data, and other goals.

To date, we have a commitment for the $15,000 in local funds. In August we will have determination of federal/state PVEA funding. Additional contributions are needed to further project goals and success.

We encourage any agencies or businesses interested in participating in the ZEV Project to contact us at the phones listed above.

Prep. by J. Orth

Zero Emission Vehicle (ZEV) Demonstration Project - Technical Report

Prepared by: William R. Warf, PE; Pacific EV
28 October, 1996

Prepared For: REDI/MCOG

1.0 Scope:
This report provides research results to support the Zero Emission Vehicle (ZEV) Demonstration Project proposal to MCOG. I was asked to research vehicles which may be commercially available for a one year project commencing on July 1, 1997. Paragraph 3.0 provides evaluation and ranking of the nine vehicles. Cost information and product literature has been obtained. This report also provides information and recommendations for infrastructure, chargers, and instrumentation. Finally, comments on the scope of the proposed project and proposed project budget are provided.

2.0 Project Summary:
The evaluation in this report assumes the vehicle(s) acquired for the project would be driven on a daily basis from Ukiah to Janet Orth's house at approximately 2000' elevation in Brooktrails. In addition, the vehicles would be used during the day by local agency personnel for demonstrations and short errands. Demonstrations and loans of the vehicle to fleet operators and other agencies in the four Cities associated with MCOG is also assumed, as this maximizes the benefit of the project by maximizing the exposure of County and City personnel to a state of the art EV.

2.1 Project Benefits:
The benefits of the project are envisioned to be as follows:
a) Quantify the benefits (including Air Quality benefits) of ZEV/LEV use for commuting in Mendocino County
b) Provide a basis to forecast infrastructure needs (and costs) for the local Cities and Counties
c) Provide data for use in preparing State and Federal EPA and AQMD reports prepared by the local agencies
d) Provide a basis for Mendocino County AQMD to justify a "buy down" incentive to encourage EV purchase and use in Mendocino County
e) Provide public information regarding real world ZEV use (and a charging station list)

f) Assist manufacturer and utilities(s) by providing consumer response and vehicle performance data.

3.0 Technical Study:
Nine EV's were evaluated for commuter use as described in paragraph 2.0. Five of the nine vehicles are probably capable of the commute (EV1, EV1 Ni-M-H, RAV4, Honda EV, and Pivco CityBee). Two of these capable vehicles would require charging at both ends of the commute if speeds of 55 mph average are to be maintained. Because of the elevation change, only Ni-M-Hydride equipped EV1, Honda EV, or a RAV4 is likely to be capable of the 52 mile round trip at normal driving speeds, without recharging. Recharge capability is required in Ukiah if local loans and demonstrations are needed. Recharge services need to be established at demonstration sites in each of the Cities.

The other four vehicles evaluated are capable of the trip from Ukiah to Willits at freeway speed, but would probably require recharge in Willits before proceeding very far into Brook trails.

3.1 Availability:
Originally we thought we would lease an EV1, a Honda, or a Toyota EV for the project, for a one year term. In initial discussions with these manufacturers, only Toyota indicated they would entertain allowing us to use a vehicle. Both GM(Saturn) and Honda have carefully chosen market areas, and appear to be focused on providing only enough vehicles to satisfy their Memorandum of Agreement with CARB. Saturn and Honda personnel are quite negative about our chances of obtaining a vehicle here. GM (but not Saturn) might be persuaded to allow us to use an EV1, if we have a well crafted demonstration proposal. Toyota indicated a preliminary willingness to allow us to use a vehicle for a several month period, however they have not considered a lease so far, and are more focused on selling their RAV4's to fleets. I think they would consider leasing the vehicle to us if we have a well crafted demonstration proposal. In summary, we will have to compete for one of the advanced EV's.

With this in mind I broadened the scope of our search to include TDM's Ranger, GM's S10 Electric pick-up, Solectria products, and the Pivco CityBee. Of these, only the CityBee is likely to be able to reliably make the one way commute to Janet's house at something close to normal highway speed. The CityBee is supposed to be available in Federal Motor Vehicle Safety Standards (FMVSS) compliant form in October, 1997. Bill Meurer of Green Motorworks is the importer, and he indicated he thought we might rent one for $500 per month. Solectria does not offer a lease, and the availability of leases for the others is so far not known.

Please see the attached spreadsheet for the comparative ranking of the vehicles. I did a calculation to see what percentage of the battery pack energy would be used to commute to Janet's, and recommend this number as the ranking.

3.2. Recommendation:
With the above availability in mind, I think we should assume we can pursued the major manufacturers GM and Toyota to allow us to use one of their vehicles for a shorter term from one week to 3 months without charge to us. We can probably borrow EV's from PG&E, SMUD, and possibly BART for short terms also. Their willingness to loan us the vehicle will depend on our having the *supporting infrastructure in place*, and having a large public/agency exposure for the demonstration planned out. I also think we should assume a leasing/renting budget of about $12,000 (possibly another $3000 for delivery and return of vehicles) for the year, and continue to work on leasing according to the original concept, complimented by vehicle loans.

3.3 Infrastructure/Chargers
There are basically two types of charging service schemes on the market, inductive and conductive. If we adopt the multiple vehicle demonstration scheme based on vehicle loans, we get the most coverage by putting our money into a conductive scheme, and using some of the lease budget for an inductive system if we arrange to lease/borrow a GM product. In budgeting this task don't forget the cost/time for building department plan checks and a licensed electrical contractor to do the installation. I would bet on an indoor

service at Janet's house, and include money for a ventilation system. An outdoor service should be obtained for the Ukiah end of the trip.

3.3.1 Inductive Charger Services:
The inductive scheme is produced by Magne-Charge and is used on the GM products. This system includes an electric service and a charger. It has been successfully used on other products, but apparently requires the use of the Magne-Charge charger since this charger is capable of receiving power from the inductive coupling scheme. Bill Meurer has installed a couple of inductive paddle systems in Pivco City-Bees with good results. Solectria has incorporated the paddle system into their cars before, but only with some whining and sniveling.

The Magne-Charge system comes two ways, one with an indoor service wall mount for $1995, and an outdoor system Pedestal mount for $3200. I obtained the owners and installers manuals from Edison EV. These stress the need for a ventilation system if the charge station is installed in-doors. The requirement is a minimum of 197 cfm according to the 1996 National Electric Code (ANSI/NFPA 70) article 625 and 725. At present I would recommend budgeting for the brick and mortar (trenching, conduit) part of the installation of one of the outdoor systems even though they are only useful for the GM products. Apparently the Magne-Charge system will also be leased, and I think the fee is on the order of $50-$100 per month. I would not recommend assuming we could get the other cars with the inductive coupling scheme. Inductive chargers are part the scope of SAE recommended practice J-1773.

3.3.2 Conductive Charge Services:
All of the other products use conductive chargers, either on board or off board. Conductive chargers use a conventional plug, usually a 14-50R twist and lock. An on-board charger is preferable, since it is available for charging at both ends of the commute, and makes the vehicle more useful. An off-board charger can be quite heavy, and require two people to lift it into the vehicle (maybe the case with the TDM ranger.)

Conductive chargers require an electric service which complies with the applicable codes and standards. Electric Vehicle Infrastructure Inc. of Auburn Ca. has installed many systems in California and across the country. They have three systems, the MCS100 (indoor), the MCS 600 (pedestal), and a new system to be unveiled in San Diego in December called the ICS-200. This newest system utilizes a conductive pin and socket connector according to SAE-J1772, and provides for an electronic handshake between the service and the charger before the power comes on. I would recommend one of their older systems I think, since the other EV's may not yet have adopted the pin and socket connector. The MCS 100 costs $1100 and the MCS 600 costs $3300. The ICS 200 charge station will be available in January at a cost of $1500 - $2000 each.

Both MCS services provide a 14-50R plug, and a 110 V 20 A outlet. These would provide a capability of charging all conductive charge service vehicles. They are UL listed, and comply with UL and FCC requirements. They have an interesting active ground fault interrupter which minimizes "nuisance tripping" of Ground Fault Interrupters (GFI's) which is common with MOSFET switch type chargers. This is not a trivial problem, and many chargers work fine on non-GFI services but will trip less sophisticated GFI's. We need good GFI services for a successful, safe project. I think other suppliers exist, but have not had time to research further.

3.4 Data Acquisition:
I recommend we utilize an AC kW-h meter system set up on each of the services. Data recorded should include mileage, AC energy use, and other operator notes and comments. Additional information collected will depend on the instrumentation available on the vehicle. With the advanced EV's, installing a computer based Data Acquisition system and making it work, interpreting the data etc. would cost a minimum of $25,000 for a one year project, if we had complete schematics from the manufacturer. I don't think these manufacturers will let us install this type of system, but they might share the data they are acquiring with their systems with us.

I think we can get all the basic data to support the project benefits section from AC energy use per mile. I would budget a minimum of three hours per

week for 52 weeks at $50 per hour for system design, data collection, and analysis ($7800). Hardware cost for an AC kW-h meter using an Ohio Semitronics counter and associated hardware is about $500 per service, and at least two are required.

4.0 Other Notes:
It would be beneficial to have a cellular phone in the vehicle.
Transportation costs for demonstrating the vehicle in Fort Bragg, etc.
Insurance?
Maintenance, Parts,
Towing?
recommend more budget for reports, analysis, press releases etc... in the documentation area.

5.0 List of Contacts, phone conversations:

Mark Amstock, toyota 310-618-4484 10/21/96 Action: Send a proposal

Mike Rodgers, EV Infrastructure, Inc. 916-823-8077 10/25/96

Beth Young: GM, 916-498-0943 Formal consideration of a lease/project possible, send proposal... also Beth will see if a one year lease is possible.

Patric Kennedy, SMUD, Got phone for Beth Young, Gunnar Lindstrom 10/22/96

Gunnar Lindstrom, Honda... No chance for a Honda in our project, almost all of 300 MOA vehicles committed, suggests Solectria

Alfred Gloddeck, Hyundai...909-627-3525 send project description

Kent Harris, PG&E, 415-973-6981 left phone message 10/25, no call back yet

Barry Pearson, Solectria, 916-381-3509, latest Solectria Quote

Richard Simon, Fleet Manager, Santa Clara Cty. 408-299-2409
Likes Toyota, best value, will probably buy some rangers.
Gave TDM Contact: Doc Watson 313-458-9100

Necole Merrit, Saturn, Secretary forwarded press package on EV1...805-373-9748

Peter Michalski, Edison EV 213-452-4628 forwarded manuals on Magne-Charge charger

Ina Joffi Edison EV 213-452-4627 information on dealing with government councils, sounds like a good contact for us, but haven't talked to her yet.

Dave Polletto, Doc Watsons office at TDM 313-458-9100

Dave Barthmuss Chevy.... 810-492-7668 Press guy, gave the following for marketing contacts at Chevy for S10 EV...
Bob Hayes 810-492-9241 (twist this arm for an Ni-M-H pickup.)
Ron Dickson 810-492-1985

Bill Meurer Green Motorworks, 818-508-2249 Pivco CityBee

Maria Peavy CalStart 510-864-3000 Info on other infrastructure suppliers, the only other she has is Aerovironment

Characteristic	EV1	EV1	RAV4	Honda EV	Force	GMS10	RangerEV	City-Bee
manufacturer	Saturn	GM	Toyota	mini-van	Solectria	GM	TDM/Ford	Pivco
type	car	car	sport ute	car	car	pick-up	pick-up	small car
availability	1Q97(1)	note (3)	3Q97 (4)	2Q97 (2)	4 months	1Q97	?	Oct-97
battery	VRLA	NiM-H	NiM-H	NiM-H	lead acid	VRLA	VRLA	NiCd
batt. pack voltage	312	312	288	288	156	312	312	144
batt. Capacity(kW-h)	12.96	30	30	30	9	16.2	16.2	12
passengers	2	2	4	4	4	2	2	2
GVWR (kg)	1550	1550	?	?	1272.73	2341.00		?
Curb Wt. (kg)	1350	1350	1468.181818	1630	1200	1955		750
Payload (kg)	200	200	?	?	72.73	386		?
Driving Mass (kg)	1500	1500	1618.181818	1780	1350	2104.55	150.00	900.00
Charger	ind. (off board)	ind. (off board)	cond. on board	cond. on board	cond. on board	ind. (off board)	off board	cond/on board
Service Req'm't	220/40A	220/40A	220/40A	110/220 30Acond.	220/20A	220/40A		220/20A
Charging Time (hours)	5.3	5.3	6	8	6	5		7
Charging Speed (miles/h)	13.21	13.21	19.67	12.50	7.50	12.00	#DIV/0!	5.71
FMVSS	yes	?	yes	yes	yes	yes		no
Motor	async AC, 102 kW	async AC, 102 kW	syncAC, 45kW	syncAC, 45kW	async AC, 42 kW	asynch AC, 85 kW		async AC 35 kW
Top Speed (mph)	80	80	79	80 mph	70	70		55
Mfg range @45	135	135	?	?	49	60		65
Mfg Fuds range (mi)	70	70	118	100	45	40		40
Cd*A	0.428	0.428	1.067	0.998	0.763	1.369		0.878
Energy to Janet's (kW-h) (5	8.21	8.21	13.96	14.26	10.85	18.04		9.54
elevatn change only (kW-h	3.08	3.08	3.33	3.66	2.77	4.33		1.85
Trip Capable	one way	yes	yes	yes	no	no		one way
% batt cap used	63%	27%	47%	48%	121%	111%		79%
Price:	$33,995	$60k?	$42,000	?	$35k	$33,500		
Special Charger, indoor	$2,000	$2,000	no	no	no	$2,000	yes	no
Special Charger, outdoor	$3,200	$3,200	no	no	no	$3,200		no
Lease Lump sum	$26,328		no			may lease		$500/month
Lease Term	3 yr, 30,000 ,mi.		no			min order 10 units		
Capitalized cost	$33,995							
Heater/AC	heat pump		heat pump			fuel fired heater		
Notes:								
1. Saturn marketing only in South CA. and Arizona. Approx $400 per month with charger								
2. Honda vehicles are all committed, approx 300 units. , Honda states not available to us, Approx $399 per month.								
3. Prototype possibly available from GM Advanced Technology Vehicles, Especially with Ovonic's help.								
4. Toyota demonstrator available sooner. (for weeks to a few months) No lease yet.								
5. 55 mph on grade								

ETC FAST TRACKS

January 6, 1997

Two New Reports Highlight Importance of EVs

How many alternative fuel vehicles are on our nation's roadways? How many of these are electric? How many electric vehicles are projected to be on the road by the year 2015? These questions and more are addressed in two recent reports published in December by the Energy Information Administration (EIA), the independent statistical and analytical agency within the U.S. Department of Energy.

Alternatives to Traditional Transportation Fuels 1995

This document (DOE/EIA-0585(95)) provides information on transportation fuels other than gasoline and diesel. The report contains historical and year-ahead estimates on the number and type of alternative fuel vehicles (AFVs) in use; the consumption of alternative transportation fuels and "replacement fuels"; and the number and type of AFVs made available in the current and following years. The report also includes listings of AFV suppliers, state taxes on alternative and traditional transportation fuels, and state and industry incentives for AFVs. Some statistics from the report include:

- ✗ More than 333,000 AFVs were in use in 1995, a 6 percent increase since 1993.
- ✗ The number of AFVs in use in the U.S. is expected to increase at an average annual rate of 7.5 percent between 1995 and 1997.
- ✗ Electric on-road AFVs are expected to show both the largest absolute and percentage increase in vehicles made available, projected to grow at 767 percent between 1995 and 1996.

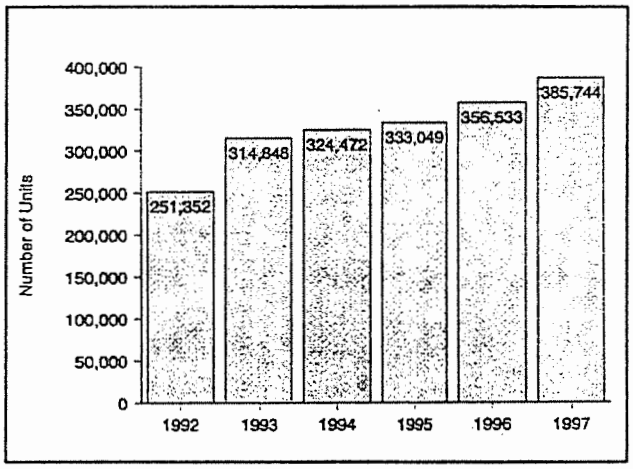


Figure 1. Estimated Number of Alternative-Fueled Vehicles in Use in the United States, 1992-1997

- ✗ Between 1995 and 1997, the number of AFVs is expected to grow most rapidly in the West, where AFVs are anticipated to increase by 20 percent, compared to a nationwide growth of 16 percent. The South is expected to experience the slowest growth (13 percent).

Annual Energy Outlook 1997 With Projections to 2015

This report (DOE/EIA-0383(97)) presents midterm forecasts of energy supply, demand and prices through 2015. The results are based on EIA's National Energy Modeling System

(Over)

Electric Transportation Coalition
701 Pennsylvania Avenue, N.W. ▪ Washington, D.C. 20004-2696 ▪ 202/508-5995

(NEMS). The report discusses emerging energy issues such as electricity deregulation, the viability of an electricity futures market, building sector issues, the effects of oil and gas supply technology on natural gas and renewable markets, and the **transportation sector's impact on worldwide oil supplies**. Some of the projections include:

- The transportation sector continues to dominate our nation's growth in domestic oil use. About 80 percent of the increase in annual oil consumption between 1995 and 2015 will be directly attributable to transportation vehicles, the report projects. Beyond 2000, it is projected that transportation oil use alone will roughly equal total U.S. oil imports.

- Sales of AFVs as a result of federal and state legislative mandates are expected to reach about 700,000 units in 2015.

- Implementation of the Low Emission Vehicles Program (LEVP) regulations (ZEV mandates) is assumed to begin in New York in 1998, with California and Massachusetts mandates to follow in 2003. LEVP-regulated sales are expected to total approximately 291,000 units in 2015, boosting electric and electric hybrid vehicles to about 33 percent of AFV sales.

Technology	Market share	Technology	Market share
Dedicated internal combustion		Flex fuel internal combustion	
Alcohol	8.9	Alcohol	17.4
CNG	15.7	CNG	6.1
LPG	12.2	LPG	6.4
Electric	14.4	Electric hybrid	18.8
Fuel cell	0.0	Gas turbine	0.1

Table 4. Market shares of alternative-fuel light-duty vehicles by technology type, 2015 (percent)

- With relatively low gasoline prices and the lack of an infrastructure to support AFVs, mandated sales will outpace market-driven sales of AFVs until 2005. Total AFV sales are expected to reach approximately 1.6 million units, or 8.9 percent of all vehicle sales, by 2015.

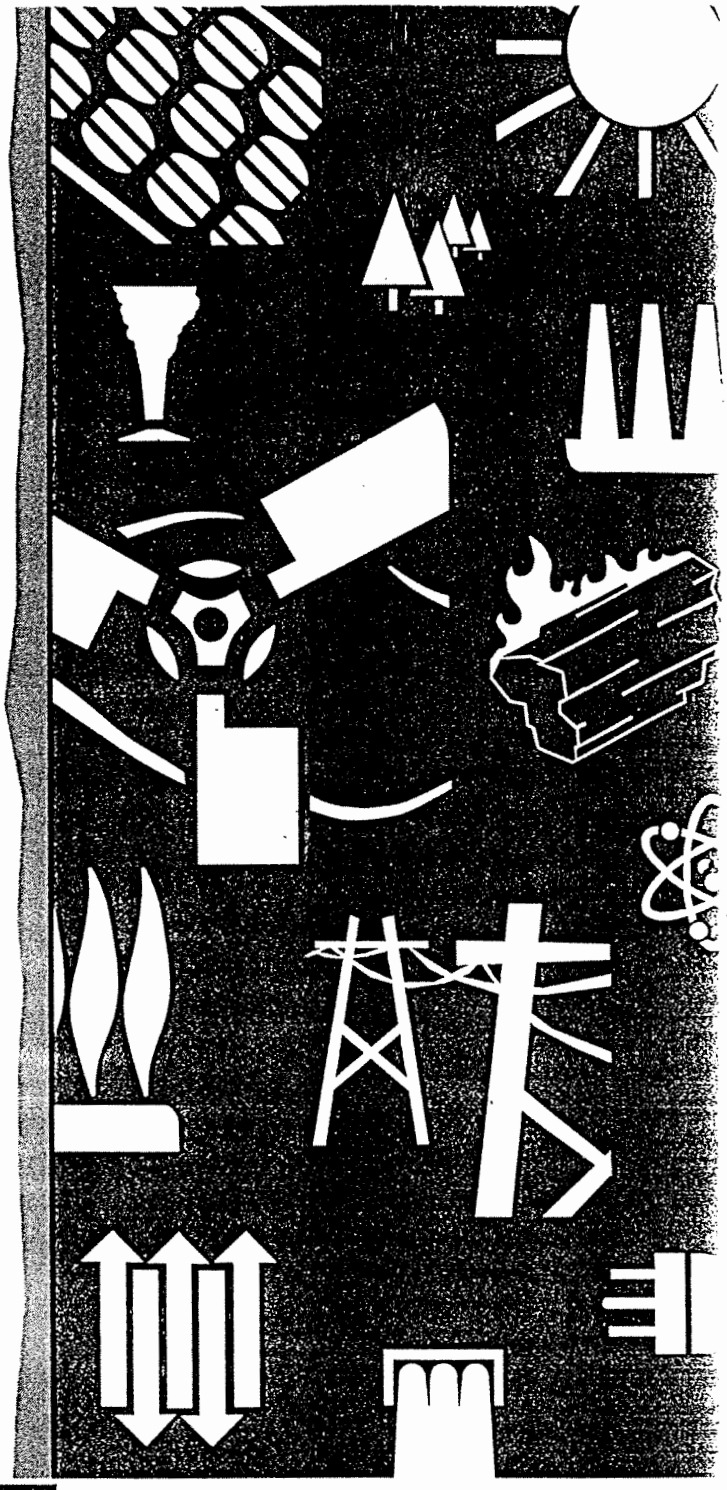
- The use of light-duty AFVs is expected to displace 389,000 barrels of oil per day in 2015, reducing transportation sector carbon emissions by 5.2 million metric tons.

- In recent years, improvement in vehicle efficiency has slowed while reliance on mass transit has diminished. Consequently, transportation sector oil consumption has increasingly contributed to higher demand for oil products and rising emissions of greenhouse gases.

- Vehicle miles traveled for personal transportation are projected to increase by nearly 25 percent between 1995 and 2015. One-third of the increase relates to more drivers being on the road. The balance relates to increased travel intensity for all drivers.

If you would like copies of either of these two reports, please contact the Electric Transportation Coalition at (202) 508-5995.

ENERGY AWARE



PLANNING GUIDE

ENERGY FACILITIES

CALIFORNIA ENERGY COMMISSION

Pete Wilson, *Governor*

P700-96-006

B-20. ALTERNATIVE FUEL CHARGING/FUELING STATION

In the near future, local planners will see a new kind of energy facility to be integrated into community plans: vehicle energy stations that dispense alternative fuels and/or electricity for a new generation of low and no-emission autos and trucks. Alternate fuel vehicles (AFV) will need special fueling and/or charging facilities that are only now being conceptualized and planned at the state level. The following pages contain descriptions of:

a) Electric Vehicle Charging Stations

b) Liquified Petroleum Gas Fueling Stations

c) Methanol and Ethanol Fueling Stations

d) Natural Gas Fueling Stations

The Energy Commission has prepared the Calfuels plan that outlines future needs for AFV commercialization. According to the Energy Commission, the timing and extent of commercialization for various AFVs is uncertain, with the exception of electric vehicles (EVs). The California Air Resources Board (CARB) will contract with original equipment manfacturers to produce a minimum number of EVs over three years, beginning in 1998. In 2003, CARB has a mandate that ten percent of all vehicles sold in California must be zero-emission vehicles.

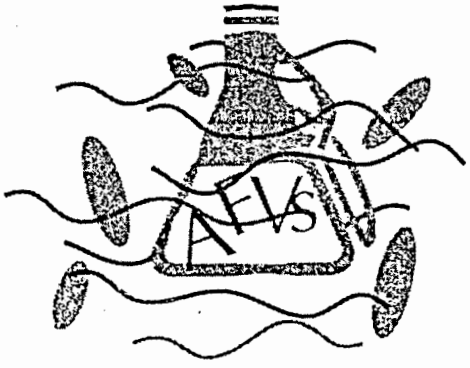
Currently, the existing refueling network for AFVs is extremely limited. Customer service and training have been minimal, and work in the areas of technology standardization and code revisions is in the early stages. Key barriers that need to be eliminated, in part through local planning, were identified as follows in the Energy Commission Calfuels plan:

- All AFVs
  - a) Lack of training for vehicle technicians and emergency personnel
  - b) Need for increased public awareness about AFVs
- Electric vehicles
  - a) Lack of standard charging connector
  - b) Need for the state to adopt national code revisions and to disseminate code information to local enforcement agencies

(Note: The State Building Standards Commission adopted the new codes in 1995. The codes take effect August 1996.)

- Methanol vehicles
  - a) Limited fuel supplies
  - b) Cost of production facilities
  - c) Limited fueling network
- Ethanol vehicles
  - a) High fuel prices
  - b) Limited fueling network
- Natural gas vehicles
  - a) Limited fueling network
  - b) Cost of natural gas compression and fueling systems.
  - c) Need for the state to adopt national code revisions and to disseminate code information to local enforcement agencies
- Hydrogen vehicles
  - a) Need for additional research, development, and demonstration
  - b) Perception of high safety risks

Local governments can help reduce or eliminate many of these barriers by considering AFV fueling and/or charging needs when updating local transportation plans and land-use development standards. For technical assistance, interested community planners should contact their local natural gas and electric utilities, or the Energy Commission's Energy Technology Development Division.



b .a ELECTRIC VEHICLE CHARGING STATIONS

Electric vehicles (EVs) are an emerging technology with approximately 2900 EVs currently in use in California. The adoption of the Low Emission Vehicle and Clean Fuel Regulations by the California Air Resources Board has accelerated EV development in recent years. Beginning in 2003, the regulations require that ten percent of the new vehicles sold in California must be zero-emission vehicles.

EVs are expected to be charged predominantly at private home base locations, such as residential or company garages. Because EVs currently have limited driving ranges, the availability of public charging facilities for full or partial charges away from the home base — called "opportunity" charging — will help build consumer confidence and increase use of, and the early market for, EVs. Likely locations for opportunity charging include parking facilities for shopping areas, the workplace, park and ride lots, and airports. Fleet or commercial users may also need access to public charging facilities away from their home base.

The EV Industry has developed three standard energy levels for charging EVs:

Level 1:
Charging that can be done from a standard, grounded 120 Volt, three-pronged outlet available in all homes.

Level 2:
Charging at a 240 Volt/40 Amp EV charging station functioning at 240 Volt/40 Amps with special consumer features to make it easy and convenient to plug in and charge EVs at home or at an EV charging station on a daily basis.

Level 3:
A high-powered charging technology currently under development that will provide a charge in five-10 minutes, making it analogous to filling the tank of an internal combustion engine at a local gasoline station.

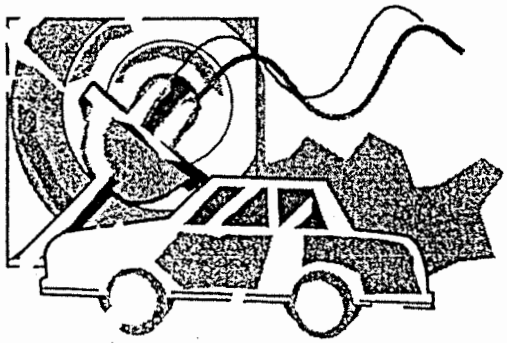
Of the three charging levels established, Level 2, a 240 Volt/40 Amp circuit is expected to be the consumers' preference at both private and public facilities. Operating at a rate up to five times faster than Level 1, Level 2 will meet the typical driver's daily needs in three-five hours of charging — at home, work, or special public charging facilities.

The EV Industry is developing two different kinds of systems to charge vehicles. One system, conductive charging, uses standard plug technology. The other, inductive charging, allows AC power to pass magnetically from the power source to the vehicle. The industry has nearly completed standardization of both charging interfaces.

California's five major utilities have extensive electricity generating capacity. Augmenting this capacity, each utility has access to, and routinely uses, power generated by other utilities to meet their customers' demands. Through the use of load management and on-line system capacity, California's utilities can meet the incremental demand for electricity needed to serve EVs without adding generation capacity. Some upgrades are expected on local distribution systems to meet EV demand.

Permitting Issues. The EV Industry is working to revise model electrical codes to adequately address the safety needs of EV charging sites without creating overly burdensome restrictions. Additional work is being focused on model building codes that will address issues related to both batteries and charging. To ensure that codes will be in place in California in time to prepare for the 1998 introduction of EVs, the state is initiating a revision to its building codes. The revised state code will be consistent with industry efforts to change the model codes.

Throughout this process, the state is supporting the transfer of information between local regulatory officials and industry to ensure that safety concerns are adequately addressed. Some cities such as Los Angeles, West Hollywood, and Sacramento are already moving forward to include EV charging facilities in their city plans. For instance, they are setting goals for providing EV charging ports at parking facilities and developing local building code requirements.



REFERENCES

a) *Calfuels Plan: Developing an Infrastructure Plan for Alternative Fuel Vehicles,* California Energy Commission, September 1994, Publication No. P500-94-002. The Calfuels Plan was prepared in compliance with AB 3052 (Chapter 762 of 1992 statutes, Public Resources Code Section 25326) to explore infrastructure barriers to the deployment of alternative transportation fuels in California.

b) *The ABCs of AFVs: A Guide to Alternative Fuel Vehicles,* January 1995, California Energy Commission, Publication No. P180-95-001.

c) *Alternative Fuel Information,* U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 1994.

d) NFPA 58, *Standard for the Storage and Handling of Liquified Petroleum Gases,* National Fire Protection Association, Quincy, MA.

e) *Industrial Fire Safety,* "Addressing the Fire Hazards of Alternative Fuels for Public Transit Buses," Parts 1 and 2, (September/October and November/December 1993) by Ralph Kerwin.

f) *Fuel Facts: Liquified Petroleum Gas Motor Fuel (LPG)/Propane,* Western Liquid Gas Association, Fair Oaks, CA, May 1992.

g) *Natural Gas Fuels Magazine* "Construction of NGV Facilities: A Practical Guide to Working with the Fire Department," March 1994, by Ralph Kerwin, Gage-Babcock & Associates.

DRAFT

City of Davis

NEIGHBORHOOD ELECTRIC VEHICLE PLAN

March 13, 1996



ATTACHMENT IV

I. INTRODUCTION

Since the 1970s, the city's policies have encouraged environmentally friendly transportation. Air pollution and energy concerns on the national level prompted passage of the Clean Air Act Amendments in 1990 and the Energy Policy Act shortly thereafter. The state of California took a progressive approach to the Clean Air Act by adopting stringent emissions standards and a zero-emission vehicle mandate, which requires an increasing percentage of cars sold in California to have zero emissions. Reinforcing these policies, the Energy Policy Act requires increased utilization of alternative fuels in order to reduce the nation's dependency on foreign energy sources.

Consistent with these policies, the State of California passed a law (Assembly Bill 110) permitting electric transportation for vehicles defined as golf carts. Prior to adoption of this law, golf carts had a legally defined top speed of 15 mph and were only permitted to travel on roadways within one mile of a golf course. The new law, which became effective in January of 1996, permits cities and counties to adopt plans that provide for expanded golf cart travel and to increase the top speed of a golf cart to 25 mph.

Because air quality in the Davis area continues to worsen, clean transportation is an important element of maintaining a high quality of life. Pollutants emitted from automobile combustion engines account for 70% of our air pollution. Furthermore, the short trips in town cause the most emissions per mile. Therefore, the utilization of electric vehicles for these neighborhood trips could eliminate a major source of pollution.

II. DEFINITIONS

Golf Cart is a motor vehicle having not less than three wheels in contact with the ground and unladen weight less than 1,300 pounds which is designed to be and is operated at not more than 25 miles per hour and is designated to carry golf equipment and not more than two persons, including the driver.

Neighborhood Electric Vehicle (NEV) is any type of vehicle that fits the legal definition of a golf cart and is powered by electricity.

Critical Connector is a specific segment of a bike path that may be utilized by NEVs. These are defined on the route map and listed in this plan in Section V. A critical connector is also defined as a Class I NEV facility.

III. GOALS AND POLICIES

Goal 1. Improve air quality by replacing internal combustion engine vehicle trips with trips made by zero emission golf carts.

Policy 1.1 All vehicles certified in the program must be powered by electricity;

Policy 1.2 25 NEVs shall be certified in first year of the program;

Policy 1.3 25,000 miles shall be driven by NEVs in first year (1,000 vehicle miles traveled per year per NEV was assumed, based on Palm Desert data of 1,248 average annual Vehicle Miles Travelled.

Goal 2. Provide for as many trip types as possible, including both commute and non-commute trips.

Policy 2.1 Design the routes for access to major employers, schools, shopping areas, and recreational facilities.

Policy 2.2 Allow NEVs to travel on all roadways of 25 mph or less (Class II facilities) and on bike paths defined as "critical connectors" (Class I facilities).

Policy 2.3 Add NEV parking to commercial and public parking areas, where appropriate, and create NEV parking incentives, such as free charging.

Goal 3. Maintain safety as a high priority.

Policy 3.1 Require minimum design criteria for permitted neighborhood electric vehicles to ensure maximum safety of drivers, bicyclists and pedestrians.

Policy 3.2 Provide adequate public education and safety training to ensure that neighborhood electric vehicle drivers of every legal age and range of skills can be accommodated.

Policy 3.3 Collect data relating to use and accidents involving neighborhood electric vehicles and evaluate program on an annual basis. Report annually to Caltrans and the California Highway Patrol.

IV. VEHICLES

The state legislation that authorizes this plan relates to a specific type of vehicle: a golf cart. This term fails to communicate the most important feature of the Davis plan: that all vehicles must be powered by electricity. Furthermore, the Davis plan seeks to be as progressive as possible, and to include all electric vehicles that legally fit the definition of a golf cart; even those not marketed as such. Therefore the plan is titled "Neighborhood Electric Vehicle" plan in order to encourage the greatest variety of electric vehicles.

As electric transportation gains acceptance, manufacturers are designing vehicles that fit the definition of golf carts but are made for neighborhood transportation. Examples include the trans2, and the city-el (with a speed governor). Other vehicles are in the prototype stages.

In order to meet the safety goals of this plan, vehicles in the Davis program must include the following features (the first six items are required in AB 110):

1. Covered passenger compartment;
2. Full time headlights;
3. Turn signals;
4. Mirrors;
5. Brake lights;
6. Seatbelts for each passenger space;
7. Electric power system (no combustion engines allowed);
8. Minimum top speed not less than 20 mph; maximum top speed not more than 25 mph;
9. Reverse lights;
10. Windshield wipers;
11. A "non-startle" horn for signalling to bicyclists and pedestrians.

V. ROUTES

In pilot golf cart communities such as Palm Desert and Roseville, special golf cart lanes have been created using bike lanes on the roadway network. However, because Davis has such a large cycling population, bike lanes (and paths) are not readily available for use by motorized vehicles. Therefore, an integrated approach is being taken by allowing neighborhood electric vehicles to mix with automobile traffic on streets of 25 mph or less.

The Davis Neighborhood Electric Vehicle Route System. The proposed NEV route system is shown in the route map enclosed with this report. It provides for NEV travel on all roads of 25 mph or less, plus very limited travel on bike paths when a critical connection is needed in the network to connect one part of the city to another. For example, the Highway 113 bike crossing bridge adjacent to Sycamore Park is part of the NEV network because all other roadway crossings of Highway 113 are in speed zones of at least 30 mph. The other critical connectors, called "Limited Access Bike Paths" on the route map, are listed below:

West Davis

1. Arlington Blvd. between Lake Blvd. and Shasta St.;
2. Village Homes central bike path;
3. Bike path connecting Shasta and Imperial Streets adjacent to Patwin;

North Davis

4. Covell Blvd. between Catalina and F Streets;
5. Bike path connecting North Davis Farms Road and Kestrel St.;
6. H Street bike path between Covell and Amapola St.;

East Davis

7. Pole Line Road between Covell Blvd. and Donner St.;
8. Should the newly constructed Pole Line Road overcrossing be in a speed zone of over 25 mph, NEV travel would be allowed on the bike path.

Central Davis

9. Bike path between F and H Streets adjacent to the Little League Park;

South Davis

10. Bike path along Putah Creek between Washoe and Sierramadre Streets.

The proposed NEV routes in Davis are classified as follows:

Class I NEV lanes provide a right-of-way completely separated from any highway (street), designated for use by NEVs, bicyclists and pedestrians, with cross traffic by other motorists minimized. *All of the critical connectors listed above are class I facilities.*

Class II NEV lanes are lanes on local streets with speed limits of 25 miles per hour or less that are shared with pedestrians, bicyclists and other motorists. *Except for the critical connectors, all routes in the Davis network are class II facilities.*

VI. IMPLEMENTATION

The following tasks are required for plan implementation:

Adoption of design criteria. NEV lane design criteria similar to the following examples from the Palm Desert program need to be adopted:

> Minimum General Design Criteria for Class I NEV Lanes: Class I lanes shall be a minimum of six (6) feet in width in each direction, have a minimum clearance of seven (7) feet, improved hardened surface capable of weights of up to 1,300 pounds, totally separated from vehicle traffic or separated by a minimum six-inch vertical and six-inch horizontal curbing, designed with a minimum grade of 10%, radius of curvature may not be less than fifteen (15) feet, shall be designated for NEVs to be safely operated at speeds of 15 miles per hour unless posted with speeds of less than 15 miles per hour, and clearly designating all transitions to other NEV routes.
>
> Minimum General Design Criteria for Class II NEV Lanes: Class II lanes shall be designated NEV routes on local streets with a maximum posted speed limit of 25 miles per hour. All NEV route transitions shall be clearly marked. It is the intent of Class II NEV routes to be shared with pedestrians, bicyclists and motorists.

Bollard design standards need to be modified in order to provide adequate spacing for NEVs.

Route Construction Creating the NEV routes will involve placement of general "NEV-awareness signs" at the main entries to the city and marking the Class I facilities. In addition, several sets of bollards will require modification to allow adequate space for NEV passage. An NEV symbol needs to be selected for the program.

Safety Certification and Operator Training Since vehicles defined as golf carts are exempt from registration at the Department of Motor Vehicles, the City of Davis will be obligated

to conduct the safety inspection certifying that the vehicle meets all city and state requirements. In addition, the city will need to design an operator education program to ensure that drivers are familiar with the routes and with vehicle operation and maintenance. The following are recommended NEV operator safety criteria (modelled after the Palm Desert plan):

1. An NEV operator must have a valid driver's license issued by the State of California or an acceptable foreign jurisdiction or be physically disabled and determined to be able to operate an NEV by their physician (in writing) and by the City.

2. NEV operators must have financial responsibility for their actions. In the event of an incident on a public street, golf cart operators must show proof of financial responsibility to all parties affected by the incidents by exchanging insurance information.

3. NEV operators must maintain vehicle in a safe condition.

4. NEV operators may only operate vehicle on public streets after one hour prior to sunrise and prior to one hour after sunset.

5. NEV operators may only travel on designated routes with a City NEV permit.

Permit Process The permit process should include the following elements (modeled after the Palm Desert program):

1. An inspection process completed by the City;

2. A permit decal showing proof of compliance. The decal shall be visibly posted in a location to be determined by the police department;

3. A permit fee of $50 for a two-year period to allow the City to recover a portion of the cost of inspection, enforcement and NEV lane maintenance.

4. Consider selling batches of pre-approved permits to vehicle manufacturers to reduce "red tape" for purchasers of NEVs.

5. An education and information package describing the requirements of the Davis Neighborhood Electric Vehicle Transportation Program.

Attachment: Assembly Bill 110

nevplan.doc/h

http://www.energy.ca.gov/cectext/19AFV.html

Alternative Fuel Vehicles in California

California...A Leader in Clean, Alternative Transportation Fuels

The California Energy Commission is the state's primary energy planning agency. As part of its mandate, the Commission encourages the development and use of alternative fuels to help ensure energy diversity and to improve air quality.

California is nearly 100 percent dependent on petroleum in its transportation sector. Nearly 75 percent of all the oil used in California goes to fuel the state's 23 million registered cars, trucks and motorcycles. This dependency makes the state vulnerable to petroleum supply disruptions and pricing uncertainties. To diversify our transportation fuels, the Commission began to explore alternatives in 1978. It is currently involved in a number of demonstration programs with the long-range goal of moving efficient vehicle technologies and clean, alternative fuels toward commercialization and large-scale use in California.

As part of the state's Drive Clean California Campaign, the Commission is supporting demonstration of various clean, alternative fuels (electricity, ethanol, methanol and natural gas) to be used in light-, medium- and heavy-duty vehicles.

The testing and demonstration of pre-commercial vehicle and clean fuel technologies can benefit both manufacturers and consumers as we move toward a more fuel-diverse transportation sector.

Alternative fuels offer two other benefits -- greater air quality improvements that are good for all Californians and job opportunities in the new and expanding field of advanced transportation technologies.

The Energy Commission is committed to increased energy efficiency and energy diversity to maintain California's competitive edge and improve our environment. Clean, alternative fuels offer ways to improve the state's air quality while reducing our dependence on petroleum.

ELECTRIC VEHICLE DEMONSTRATION PROGRAMS

Electric vehicles (EVs) have the lowest emissions of any clean, alternative fuel vehicle -- zero tailpipe emissions. Regulations by the California Air Resources Board require that in 1998 two percent of vehicles offered for sale by major auto companies must be zero emission vehicles, rising to 10 percent in 2003 -- a total of about 200,000 vehicles a year. Auto-makers are working hard to meet those goals.

As part of the Energy Commission's first EV Demonstration Program, the Commission and Pacific Gas and Electric Company formed a partnership to demonstrate three electric-powered Conceptor G-Vans at three locations in PG&E's service territory. One of the three vans was placed in Yosemite National Park as a shuttle bus transporting park workers. The other two vans are used for mail and package delivery by the Cities of Santa Rosa and Oakland.

http://www.energy.ca.gov/cectext/19AFV.html

The Commission funded three manufacturers to build vehicles for the Advanced Technology Electric Vehicle Demonstration Program in public and private fleets. The purpose is to evaluate new and advanced technologies in real life applications and to assist in the determination of electric and hybrid electric vehicle infrastructure needs.

The program is funded by $750,000 in Petroleum Violation Escrow Account funds, with an additional $500,000 to augment the original amount. The projects include:

* Ford's high-performance, two-passenger electric mini-van, called the Ecostar, based on its European-built Escort small van was placed into service with the Post Office and UPS. It uses sodium-sulfur batteries.

* Chrysler produced its TEVan, an electric mini-van with both nickel-iron and nickel-cadmium batteries. The vehicle is being used in utility company fleets.

* Solectria converts new gasoline-powered Geo Metros to EVs using state-of-the-art motors and controllers and conventional lead-acid batteries.

* The Energy Commission committed $500,000 toward the General Motors Impact PrEView Program to loan 50 vehicles to 1,000 people nationwide who will test drive the car for two to four weeks. Four cities in California -- Los Angeles, Sacramento, San Diego and San Francisco -- are among the 12 cities around the country taking part in the test drive program.

* $500,000 goes to a $1.47 million program to replace diesel buses with quiet, advanced electric buses in Yosemite National Park.

ETHANOL DEMONSTRATION PROGRAMS IN CALIFORNIA

In the early 1980s, the Commission ran side-by-side tests of identical vehicles running on ethanol, methanol and gasoline. Ethanol proved to be a good transportation fuel. In 1994, the Commission approved the siting of a cogeneration power plant that will annually produce 12 million gallons of ethanol from rice straw and other agricultural waste. The renewable fuel will be used in gasoline/ethanol blends. Ethanol is being supported by the California Renewable Fuels Council. Contact them at (714) 990-3333 for additional information about ethanol and its use in California.

METHANOL/FLEXIBLE FUEL VEHICLE COMMERCIALIZATION PROGRAM

Fuel-flexible vehicles (FFVs) operate on methanol, unleaded gasoline or any combination of the two fuels from a single tank. Methanol (methyl or "wood alcohol") is primarily produced from abundant North American supplies of natural gas.

After more than 15 years of testing and demonstration programs in California, and more than 50 million miles on the road, FFVs are available to fleets and the public at the same price as gasoline-only vehicles.

http://www.energy.ca.gov/cectext/19AFV.html

Through 1994, more than 10,500 methanol-powered vehicles were placed on the road throughout California. Ford and Chrysler produced 1994 FFVs and plan to offer 1995 FFVs.

Methanol is a clean-burning liquid fuel. FFVs can meet stringent California Air Resources Board (CARB) transitional low-emission and even low-emission vehicle standards when operating on methanol. Using M85 (85 percent methanol and 15 percent unleaded regular gasoline), an FFV produces 30 to 50 percent less of the smog-forming emissions than comparable gasoline-powered vehicles. Improvements in the vehicles should lower emissions even further in the future.

Concerns over formaldehyde emissions have been met with advanced catalytic converter technology. Current FFVs meet the CARB standards for formaldehyde emissions set for all internal combustion engines using all fuels.

At 102 octane, M85 offers superior performance with an additional seven to ten percent or more horsepower, when compared to 87 octane regular unleaded and 92 octane premium unleaded gasoline.

Methanol has a lower energy content than gasoline; it takes 1.6 gallons of M85 to "equal" a gallon of gasoline. While M85 is slightly more expensive today, the Energy Commission estimates that in 2010, the price for M85 will be $1.27 per equivalent gallon, compared to a projected $1.48 for a gallon of gasoline. Because of the lower energy content or M85, automakers are equipping FFVs with larger fuel tanks to improve vehicle range. Testing of various FFV models shows ranges of 200 to 400 miles, depending on size of fuel tank.

M85 is available at designated service stations strategically placed around the state. Seven oil companies -- Arco, Chevron, Exxon, Mobil, Shell, Texaco and Ultramar (Beacon) -- have signed 10-year agreements with the California Energy Commission to locate the initial 83 methanol fueling facilities in California. The number will increase as more FFVs are produced by the automakers and independent fuel retailers join the M85 program.

NATURAL GAS VEHICLES

In cooperation with the state's natural gas utility companies, the Energy Commission is conducting demonstration programs of natural gas vehicles (NGVs). Natural gas is compressed into cylinders mounted on or in the vehicles. Because it burns cleanly, natural gas offers some of the lowest emissions of any alternative fuel.

The Commission paid the differential cost of building 100, 1992 model year GMC Sierra 3/4-ton pickup trucks to run on natural gas. A total of $382,500 in Petroleum Violation Escrow Account funds was used in this program. The natural gas utility companies provided technical support and some natural gas refueling stations for the program. Total combined project costs exceed $1.5 million. The trucks were placed at locations throughout California.

The Commission asked engine and vehicle manufacturers in January 1994 to demonstrate the use of natural gas in medium-duty vehicles Ð such as larger delivery vans. A total of $600,000 of Petroleum Violation Escrow Account (PVEA) funds was allocated for this medium-duty demonstration program.

http://www.energy.ca.gov/cectext/19AFV.html

The Commission committed $100,000 in PVEA funds to the compressed natural gas (CNG) segment of the demonstration program to provide extensive information regarding the use of CNG, electricity, methanol, propane and reformulated gasoline in 113 Federal Express delivery vans operating in the Los Angeles area.

In 1994/95, the Commission offers a $1,000 incentive toward fleets that purchase a natural gas vehicle certified by CARB as a Low Emission Vehicle. The Commission also offers a $1,500 incentive toward a certified Ultra-Low Emission Vehicle. Additional incentives may be offered in the future.

HEAVY-DUTY METHANOL AND NATURAL GAS VEHICLE

DEMONSTRATION PROGRAMS

Methanol and compressed natural gas are being used in a number of heavy-duty vehicles around the state. Methanol and CNG power transit and school buses, tractor trailer rigs and various other heavy-duty equipment. The Energy Commission, in cooperation with various state and local agencies, has forged the way by funding the use of methanol and CNG in these vehicles.

Tests on alternative fuel heavy-duty engines show that carbon monoxide, particulate and nitrogen oxide emissions are lower than the 1994 U.S. Environmental Protection Agency truck emission standards.

The Energy Commission, along with the South Coast Air Quality Management District, brought together engine manufacturers with host demonstration sites to test methanol in various engines and vehicles. Five engine companies (Caterpillar, Cummins, Detroit Diesel, Ford and Navistar) and eight host sites have placed heavy-duty vehicles into regular operation to gather test data.

The Commission also funded work on demonstrating natural gas in heavy-duty truck rigs. Von's Grocery in Southern California used a natural gas tractor to pull a trailer from El Monte over the 4,138-foot Tejon Pass to Bakersfield.

Another portion of the Heavy-Duty Demonstration Program is the Katz Safe School Bus Clean Fuel Efficiency Demonstration Program. A total of 563 school buses were purchased with $100 million in Petroleum Violation Escrow Account funds to replace buses built prior to the 1977 Federal Motor Vehicle Safety Standards. As part of the demonstration program, at least 35 percent of the replacement buses must be powered by clean, alternative fuels.

Since 1991, 150 methanol-powered school buses have been put into in service in various school districts throughout California. Additionally, the Commission is demonstrating the use of compressed natural gas in 110 school buses as part of the program. The remaining 303 school buses in the program are powered by low-polluting and high-efficiency, advanced diesel engines. A third phase of the program will place additional buses on the road in 1995/96, including electric-powered school buses.

Alternative fuel buses are also being used by transit districts. In the early-1980s, the Energy Commission helped fund a demonstration program of the country's first two methanol-powered transit buses in the

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Golden Gate Transit District in Marin County. Those buses subsequently have been transferred to Ventura County and Los Angeles Metropolitan Transportation Authority.

Other transit districts have added alternative fuel buses to their fleets. Los Angeles MTA expanded its fleet to include 333 methanol buses and is also buying natural gas buses. Sacramento's Regional Transit purchased 95 natural gas-powered buses. Other transit districts recognize that alternative fuels will help them meet the air quality/emission challenges.

The Commission also manages the Diesel Emission Reduction Fund which uses fines levied against trucks that are heavy polluters. The program funds research and development efforts into production of a cleaner generation of diesel engines, and methods and add-on equipment to lower emissions on vehicles currently on the road.

ADVANCED TECHNOLOGIES

To support further research and development of advanced technologies for transportation, and to create jobs and economic benefits, the Commission supports CALSTART and operates the Transportation Energy Technologies Advancement Program, or TETAP.

The Commission is a member of CALSTART, a consortium of more than 80 members, which is working to bring an advanced transportation industry to California. Already CALSTART has developed a showcase electric vehicle (offering manufacturers a demonstration of California-built EV components), a running chassis electric vehicle (a chassis upon which auto companies can mount their own vehicle bodies), and advanced electric buses.

Begun in 1993, TETAP is creating jobs for many displaced aerospace and defense workers. In its first two years, the program has leveraged $3.5 million dollars in state money with millions of dollars from private industry. The R&D projects TETAP has funded in 1993 and 1994

* SMUD's advanced flywheel project

* CALSTART's electric school bus project and EV/natural gas hybrid bus project

* Hughes Aircraft's electric shuttle bus project

* Cummins' advanced diesel engine turbocharger

* Baytech's advanced CNG medium-duty vehicle

* Pinnacle Research Institute's ultracapacitor for EVs

* Amerigon's advanced EV heating/cooling system

* U.S. Electricar's Postal Service EV conversions

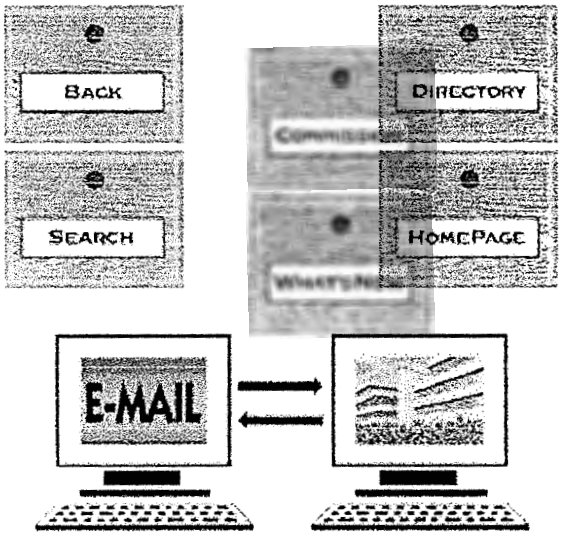
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* APS System's advanced electric buses

* Dyna-Cam's advanced CNG engine

The Commission is also funding our future through support for the students and researchers at the University of California Riverside's College of Engineering Center for Environmental Research and Technology (CE-CERT). CE-CERT is carrying on advanced transportation research and analysis and recently was awarded a $10 million grant from the Ford Motor Company.

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"Energia" means ENERGY in Latin.

Page Updated: March 26, 1996

EV California

Electric Vehicle California *is a publication of the California Electric Transportation Coalition* Winter 1997

The Economic Cost of Dirty Air– and How to Avoid It

Cars burn more than gasoline – that's your money going up in smoke.

Short-term economic incentives for EVs are a sensible and important investment that will improve health and save billions of dollars in the long run for all Californians.

by Jane Hall, PhD

Most Californians don't even know it, but we spend billions of dollars every year trying to undo the damage done by air pollution. We pay in many ways: higher health insurance premiums; more doctor and hospital visits; time off work and school for illness; lower job productivity; higher prices at the grocery store; and much more.

For example, taking just the direct health costs in the Los Angeles region, conservative estimates place the cost of *not* meeting federal air quality standards at over $5 billion a year. Since these standards are known to be inadequate to protect health, real costs could exceed $20 billion! And this is just Los Angeles. Consider that nearly all Californians live in places where federal or state air quality standards are not met, statewide annual health costs easily exceed $10 billion.

Chevrolet, Ford, Honda, Toyota Join the EV Ranks

Chevrolet, Ford, Honda, and Toyota have followed the lead of General Motors (GM) and officially announced they will offer their electric vehicles (EVs) in California in 1997 and early 1998.

1997 Chevy S Pickup Electric



The Chevrolet division of GM will market a compact electric pickup during the 1997 calendar year, targeting a fleet market of private companies and government agencies. The S Pickup Electric will initially be offered using lead-acid batteries, providing a 55-mile range. The S Pickup Electric is the second electric offering from GM, following their 2-passenger EV1 coup.



1998 Ford Ranger EV

Ford unveiled its Ranger EV this January at the Greater Los Angeles Auto Show, in their effort to electrify Ford Motor Company's tradition of being "Built Ford Tough." Powered by advanced lead-acid batteries and featuring a convenient on-board charger, the Ranger EV's initial target customers include electric utilities, government fleets and key commercial

ru[illegible]or all Californians.

nearly all Californians live in plac[illegible] where federal or state air quality standards are no[illegible]t, statewide annual health costs easily exceed $10 billion.

Where do these costs come from? Fine particles of pollution in the air are widely recognized to contribute to increased respiratory and cardiac hospital and emergency room admissions, chronic bronchitis, asthma attacks, and even early death. Ozone (smog) is also linked with increased hospitalizations, asthma, acute breathing discomfort, itchy eyes and scratchy throats. The cost of a single case of chronic bronchitis runs between $140,000 and $380,000. Every day of hospitalization for respiratory care runs $920, and the average stay is 7 days. Emergency room visits average $161, and over $100 of work time is lost to the economy every day a parent stays home ill or with a sick child. Anyone who has cared for a child who can't catch their breath knows that medical treatment is a small part of the cost.

More shocking, unhealthy air is responsible for over 5,000 preventable deaths in Los Angeles each year, and as many as 13,000 statewide (with nearly 300 in and around Visalia). Most of us wouldn't want to put a number on it, but experts say that reducing these deaths is worth more than $3.5 million for *each* life preserved.

Everything described above can be avoided – billions of dollars spent unnecessarily and the human suffering. Simply by meeting federal and state air quality standards, we can stop this wasteful spending, put money back in our pockets, and use these resources more

continued on back cover

Jane Hall is a professor of economics at the Institute for Economic and Environmental Studies, California State University, Fullerton. She has written numerous studies on the economic impacts of air pollution and other related issues.

being "Built Ford Tough." Powered by advanced lead-acid batteries and featuring a convenient [illegible]oard charger, the Ranger EV's initial target customers include electric utilities, government fleets and key commercial fleets, which generally have shorter, more predictable driving patterns than retail customers and more suitable to the vehicle's 60 mile range. Production begins at the end of 1997 and will be delivered to customers shortly thereafter.

1997 Honda EV Plus



Honda also announced that the Honda EV Plus will be available for lease to both fleets and individual consumers in four California cities, beginning in the spring of 1997. The most appealing features of this 4-passenger, purpose-built vehicle is its 125 mile range which is powered by nickel-metal hydride batteries (NiMH), and its compact on-board charger. The lease will cover maintenance, insurance, roadside assistance, and battery replacement.



1998 Toyota RAV4-EV

Toyota plans to market 320 electric-powered RAV4 sport utility vehicles to fleet buyers beginning in Fall 1997. The 4-passenger, 4-door RAV4-EV will be powered by NiMH batteries providing a range of 120 miles per charge. The on-board charger incorporates a timer function allowing the vehicle to be charged during off-peak hours when electricity is least expensive, and automatically turns off when charging is complete. ◆

Also In this issue...

- *Sacramento Legislators describe steps to be a model "EV-Ready" Community, pg. 2*
- *How clean are EVs? We run the numbers, pg. 3*
- *Update on EV emergency response curriculum and training, pg. 3*
- *CalETC profiles its newest member: A-Z Bus Sales, pg. 3*
- *Kudos to Assemblyman Bill Leonard (R-Upland), pg. 3*

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A non-profit association promoting cleaner, healthier air through the development and use of zero-emission electric vehicles, hybrid electric vehicles, electric mass transit buses and rail

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The Economic Cost of Dirty Air

continued from front page

productively. Remember the old saying, "An ounce of prevention is worth a pound of cure." If we spent a fraction of the money we now spend to "repair" the damage done by air pollution, and put it toward preventing or reducing pollution, Californians could have clean healthy air and save billions of dollars (and lives) long into the future.

Pollution prevention is an *investment*, as roads, schools, and reservoirs are investments. They are expensive, but pay back for many decades. There are State and local plans that lay out a "roadmap" to healthy air and identify investments to get there, but it is sometimes difficult for elected officials to commit scarce financial resources to invest in air quality solutions that pay back tomorrow, regardless of the rewards. Zero-emission electric vehicles are a key component of the investments essential to sustainably clean transportation. Electric vehicles (EVs) in California are at least 97% cleaner than the cleanest gasoline vehicle available, even when all emissions are accounted for, including powerplant emissions for EVs and "upstream" emissions from gasoline vehicles.

How do we move ahead? Many would agree that using incentives to achieve clean air goals is preferable to regulation. Temporary economic incentives to boost EVs over the initial price threshold is just common sense. Most major automakers have announced plans to lease or sell EVs this year. Incentives can help them and other EV-stakeholders to bridge the gap from initial low production volumes to higher volumes, significantly lowering prices while accelerating improvements in technology.

Are economic incentives a good investment when early improvements in air quality may be small? Yes. EV incentives need only be temporary to get us over the initial barriers. Long after incentives are gone, EVs will continue to provide major economic benefits to all Californians. More than a dozen other states make this investment and provide substantial incentives for EVs. California is not one of them. This is our loss, since the direct economic benefits will be far greater here than any other state.

What if we don't invest in EVs? Over 70% of our urban air pollution comes from the transportation sector. Either we continue to pay billions for air pollution damages, or we regulate businesses which have already borne substantial expenses to reduce emissions. For example, the cost to an employer to reduce one ton of hydrocarbons by "inducing" employee ride-sharing is over $300,000. This is not only costly, it is unfair, but an alternative to short-term EV incentives.

In addition to direct local economic benefits, EVs provide other benefits that should not be ignored. To the health-related costs we should add the cost for protecting access to foreign oil, about 30 cents per gallon, or $4 billion annually for California. Add to that approximately $1 billion for the cost of greenhouse gas emissions. This does not include the costs of used motor oil in street run-off fouling our beaches and bays, tanker spills, and other ways in which the environment on which California prides itself (and on which our tourism industry depends) is diminished. Adding these costs to the direct health costs, shows that Californians now pay a minimum of $15 billion – and up to $35 billion – every year on avoidable costs associated with air pollution and on our dependence on petroleum for transportation.

The only way to avoid these costs, while maintaining individual choice offered by the private vehicle, is an orderly and sustained transition to cleaner technology. Short-term economic incentives for EVs are a sensible and important investment that will improve health and save billions of dollars in the long run for all Californians. ◆

ELECTRIC VEHICLE TODAY

A Daily Executive Summary Covering EVs, Hybrids and Fuel Cell Vehicles

INDUSTRY REPORT

Tour de Sol Attracting Many Sponsors

Sponsors have been lining up recently to help support the 1997 Tour de Sol U.S. Road Rally Championship for Electric Vehicles. The event, organized by the Northeast Sustainable Energy Association (NESEA), will take place May 17 through 24, on a route that will take participants from Waterbury, CT to Portland, ME.

The event's title sponsors are the Department of Energy (DOE) and the Goodyear Tire and Rubber Company. Money in the DOE budget earmarked for student competitions was eliminated last year, but reinstated as a result of strong reaction to Congress.

Among the supporting sponsors are the Waterbury Region Convention and Visitors Bureau, which will use the event to attract tourism, and the Connecticut Department of Transportation, which has created a video document of the entire rally route.

The New Hampshire Governor's Office of Energy and Community Relations, Maine's department of transportation and environmental protection, and several of Vermont's state agencies also are sponsoring the event.

Additionally, local utility companies are involved. Companies such as Northeast Utilities, Connecticut Light and Power, the New England Electric System, Central Maine Power, the New Hampshire Electric Cooperative Green Mountain Power, Central Vermont Public Service and others will help by providing charging hookups along the route as well as publicity for the event. **Contact: NESEA, phone 413-774-6051, World Wide Web http://www.solstice.crest.org/nesea.**
(TOUR DE SOL NEWS: FEBRUARY 1997)

Electrosource Advances With HORIZON Batteries

As electric vehicles (EVs) become more of a reality, advances in batteries continue to be made. Improvements in the HORIZON battery, relating to specific energy, shelf life, cycle life and production capacity, were the topic of discussion by Bill Craven, director of Electrosource EV programs, at the 12th Annual Battery Conference on Applications and Advances in Long Beach, CA earlier this month.

Craven pointed out that in 1994, the HORIZON battery was being tested in only five EVs, with just one pre-production battery model available. In comparison, HORIZON batteries last year were installed in hundreds of different products.

Furthermore, two production models and seven prototypes are now available, with three more in design phases, Craven said.

In addition to electric-powered automobiles, trucks and minivans, HORIZON products include hybrid EVs, cordless lawn mowers, fixed-wing aircraft and helicopters (for starting power), scooters, golf carts, industrial lift trucks and wheelchairs.

Electrosource, Inc., headquartered in San Marcos, TX, designs, develops and markets the HORIZON battery. **Contact: Electrosource, phone 512-753-6500.**
(NEWS ON THE HORIZON: JANUARY 1997)

Honda Previews EV PLUS at Four CA Dealerships

American Honda Motor Company recently announced that its electric vehicle (EV), the first to use advanced nickel-metal hydride battery technology, is now available at four Honda dealerships in Southern California and Sacramento.

The four dealerships previewing the EV PLUS are Costa Mesa Honda (Costa Mesa), Mel Rapton Honda (Sacramento), Miller Honda (Van Nuys) and Scott Robinson Honda (Torrance). While the vehicle will not be officially offered for lease until May, consumers may conduct test drives and pick up lease applications and product education materials.

"California residents are the first consumers in the nation to test this advanced battery technology, and at the same time will be among the first to bring the environmental benefits of clean, zero-emissions driving to the state," said Tom Elliott, executive vice president for American Honda.

The four-passenger EV PLUS features all the amenities of a gasoline-powered car such as power windows, door locks and mirrors, AM/FM/CD stereo system with four speakers, anti-lock brakes, a climate control systems, electric power steering and a versatile cargo area.

"And the EV PLUS offers the added value and convenience of an all-inclusive pricing package. For $499 a month, the EV PLUS includes roadside assistance, all maintenance, an unlimited mileage warranty and comprehensive and collision insurance coverage -- not to mention the cost savings from no more gas station visits and no more oil changes," said Elliott.

The dealerships selected for the EV lease program have specially trained, on-staff sales personnel and service technicians to field consumers' questions.

"These dealerships' loyal customer base, their commitment to keeping their customers happy in both sales and service, and their attention to detail are qualities which make them ideal for Honda's newest and one of our most complex products," Elliott said. **Contact: American Honda, Art Garner, phone 310-783-3163; Andy Boyd, phone 313-567-7770; Mike Ackerman, phone 212-765-3804.**
(HONDA NEWS: 1/29)

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ELECTRIC VEHICLE TODAY

A Daily News Summary Covering EVs, Hybrids and Fuel Cell Vehicles

LEGISLATIVE & POLITICAL REPORT

Big Three Sue NY Over EV Mandates

The Big Three U.S automakers have filed a suit against the state of New York in an effort to defeat the state's mandate for the sale of zero-emissions -- or electric -- vehicles, set to be enacted with the 1998 model year. The suit, filed by the American Automobile Manufacturers Association (AAMA), claims that New York cannot adopt mandates that are stricter than those in California.

While California eliminated its electric vehicle mandates until early next century, New York opted to stay put. The AAMA maintains that New York is prohibited by the Clean Air Act from adopting emissions requirements that are, in effect, stricter than California's.

"We are disappointed that the State of New York is continuing to take a stand that ignores technological realities and the marketplace," said the AAMA's Andrew Card. "An independent panel of experts (selected by California) has already determined that even in a state like California with a favorable climate, similar proposed production mandates for electric vehicles would be ill-advised at this time...The technology and free market should determine when electric vehicles will be ready for the marketplace, not government mandates."

AAMA, which represents, General Motors, Ford and Chrysler, named the acting commissioner of the New York Department of Environmental Conservation, as well as the state's attorney general, as defendants in the suit. **Contact: Laura Armstrong, AAMA, phone 202-326-5538.**
(UPI: 2/11)

SCIENCE & TECHNOLOGY REPORT

Major Automakers in Electric Competition

The major automakers in the U.S. and Japan are now in a full-fledged race to develop competing versions of electric and hybrid electric vehicles. The gauntlet was thrown down late last year when General Motors (GM) unleashed the EV1, the first production-scale electric vehicle of the modern era.

Not to be outdone, Honda announced earlier this year that it will lease its EV PLUS in California beginning this May, and Ford showed off it electric version of the popular Ranger compact truck.

Chrysler also recently made waves with its announcement of the development of a prototype fuel cell vehicle that converts gasoline into hydrogen. The technology is expected to be twice as efficient as conventional gasoline engines.

Vehicles from Ford, GM, Chrysler, Honda and Toyota will all be on display at this week's Chicago Auto Show, to be held through Sunday at McCormick Place.
AGENCE FRANCE PRESSE: 2/10)

GM Charging System Evaluated and Tested by UL

The first 100 owners of General Motors' (GM) EV1 electric vehicle (EV) have the comfort of knowing that their EV1's charging system, located in their own garages, was evaluated by Underwriters Laboratories Inc. (UL).

When California mandated auto makers to produce "zero-emission" cars by 1998, building inspectors concerned about the advent of charging systems installed in consumers' homes and public buildings were spurred into action. They wanted the confidence that the EV charging systems would not create new hazards within the home.

"That's how UL fit into the picture. Outlets, charging systems, plugs and cords have to be safe, easy-to-use and compatible with typical home wiring systems," said Pete Boden, chairman of UL's electric vehicle committee. "UL developed safety standards and aided in the development of national codes to help govern the use of these EV components and systems."

Representatives from the auto industry, the Electric Power Research Institute (EPRI), the Society of Automotive Engineers (SAE) and building inspectors worked with UL to develop new standards that would reduce the risk to persons and property from electric shock and fire.

The battery pack in GM's EV1, comprised of 26 valve-regulated sealed lead-acid batteries, is designed to prevent leakage and electric shock.

With EPRI funding, UL developed substantiation for a 1996 NEC code article for EV battery hydrogen emissions during charging.

UL explained that when a lead-acid battery starts to reach full charge, it begins to "outgas," or release hydrogen. If the outgasing were to reach a high threshold, the amount of hydrogen released could create an explosion or fire hazard.

UL's work with the NEC also was used as the framework for the development of SAEJ1718, Standard for Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Cars and Light Trucks during Battery Charging.

UL engineers also looked at how the battery pack interacted with GM's EV1 electric system during real-world simulations. As a result, GM incorporated sensors into the electrical system that detect if the battery has reached full charge. Once it reaches full charge the charger is automatically disengaged to prevent the release of hydrogen.

Another safety standard, UL 2202, EV Charging System Equipment, was developed and used by UL to investigate the EV1 charging system. The standard and resulting testing program focus on such real-life failure situations as an EV1 motorist driving off before detaching the charge paddle or operating the charger during inclement weather. GM designed the EV1 with a series of sensors that respond to such potential hazards. **Contact: UL, phone 847-272-8800.**
(UL RELEASE: 2/10)

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ELECTRIC VEHICLE TODAY

A Daily News Summary Covering EVs, Hybrids and Fuel Cell Vehicles

REGULATORY REPORT

Golf Carts Could Become New Class of Vehicles

Golf carts that travel at a speed of more than 15 miles per hour (mph) and can reach speeds of up to 25 mph should include seat belts, windshields, turn signals, mirrors and a parking brake, according to a proposal from the National Highway Transportation Safety Administration (NHTSA).

These vehicles, NHTSA proposed, would be called "low-speed vehicles," (LSVs), a new category of motor vehicles that would essentially describe an on-road golf cart.

Retirees in Sunbelt states are increasingly using souped-up golf carts to get around town. The electric-powered vehicles are considered energy-efficient, non-polluting, economic forms of transportation. Some people even use the golf carts as their second car.

A Canadian company, Bombardier Inc., has designed the "neighborhood electric vehicle," (NEV) retailing at about $6,700. While it has a roof, it is open at the sides and back. Bombardier said about 50 NEVs are in use in the United States. When Bombardier approached NHTSA about whether the NEV could be treated like a golf cart -- meaning no regulation as long as it didn't exceed 20 mph -- NHTSA instead decided to impose minimum safety standards.

"We want to facilitate transportation in neighborhoods for older Americans and improve the environment, but we also want to improve their safety and ease congestion," said Philip Recht, NHTSA deputy administrator. When NHTSA looked at cities such as Palm Desert, CA, it was able to document only one serious accident. Palm Desert restricts golf cart speeds to 25 mph and doesn't allow the vehicles on the street an hour before dusk and an hour after dawn.

Auto insurers and safety advocates say that creating a new vehicle class will cause the number of LSVs to balloon, putting these vehicles into heavier traffic mixes unless states restrict use. Florida and Arizona already allow them on public roads.

According to Gerald Donaldson, senior research director for Advocates for Highway and Auto Safety, LSVs are the equivalent of snowmobiles, jet skis and all-terrain vehicles in that they pose real safety hazards. He said by imposing only the minimum safety standards, NHTSA is abdicating its role as a safety regulator. **Contact: NHTSA's Auto Safety Hotline, phone 202-366-0123; Advocates for Highway and Auto Safety, phone 202-408-1711.**
(WASHINGTON POST: 2/28)

INDUSTRY REPORT

Costco Stores to Feature EV Charging Facilities

An agreement announced yesterday between Edison International and Costco Companies, Inc. will create the nation's first network of retailer-based electric vehicle (EV) charging stations. The stations will be located at Costco warehouse outlets in southern California and Arizona.

Costco will work with Edison EV and Southern California Edison to install charging facilities at its locations. The first site, the Costco warehouse outlet in Westlake Village, CA, will feature the MagneCharger T charging station.

The MagneCharger will be installed at Costco sites in Simi Valley and Oxnard, and conductive charging systems will be added to these locations in the future.

"By making EV charging conveniently accessible, Costco is promoting consumer acceptance of electric vehicles in an extraordinary way," said Edison EV president Diane Wittenberg.

"Beyond the customer convenience factor, Costco is advancing the important environmental cause of cleaner transportation and cleaner air in California."

Others involved in the venture include San Diego Gas and Electric, the Sacramento Municipal Utility District, General Motors, Honda, Delco Propulsion Systems and utility companies in Arizona. **Contact: Edison EV, phone 818-302-2255.**
(COSTCO RELEASE: 3/4)

EDITORIALS, REVIEWS & ASIDES

APS to Host Electric Vehicle Competition

MARCH 7-9 -- PHOENIX, AZ

APS ELECTRICS COMPETITION

Arizona Public Service will host its seventh annual electric vehicle (EV) competition, the APS Electrics, this weekend at Firebird International Raceway in Phoenix, AZ.

The APS Electrics will feature the latest EV technologies of over 89 professional and student entries from 17 states, Canada and Japan.

Among the vehicles to be showcased are the Toyota RAV4, Chevrolet's S-10 pickup, the Ford Ranger pickup and General Motors' EV1.

High school teams from the U.S. and Canada will race stock conversions with direct current drives and lead-acid batteries, while teams from top research schools such as the University of Notre Dame, Arizona State University and Indiana University will showcase their EVs during the ABB University Spec Series.

"Once considered only a novelty, electric cars are now a tangible reality," said APS Electric transportation program manager Ted Hidinger.

"As the title event sponsor, we fell an obligation to educate commuters in Phoenix and across the country about the alternative that will improve air quality globally."

Contact: Moses Anshell or Victoria Welch, phone 602-254-7312.
(AUTOMOTIVE WIRE: 2/24)

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ELECTRIC VEHICLE TODAY

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INDUSTRY REPORT

ECD NiMH Batteries Gaining in EV Industry

Energy Conversion Devices (ECD) recently announced that its patented and proprietary Ovonic Nickel Metal Hydride (NiMH) battery has demonstrated positive results in electric vehicles. The battery was developed by ECD subsidiary, Ovonic Battery Company.

The NiMH battery has exceeded the standards for electric vehicle batteries under the United States Advanced Battery Consortium (USABC) guidelines, according to the company. ECD also announced that is producing first generation NiMH batteries at its Troy, MI plant in a joint venture with General Motors after three years of collaboration.

"We are pleased that the Ovonic NiMH battery makes EVs practical. With its robust, maintenance-free design, long life and total recyclability, the NiMH battery is ideally suited to power EVs," said Robert Stempel, chairman of ECD.

"The Ovonic NiMH battery is an engineered battery with characteristics that make it useful in applications ranging from consumer electronics to EVs and hybrid EVs."

ECD develops products and technology based on amorphous, disordered and related materials, with a focus on alternative energy and advanced information technologies. **Contact: Ovonic Battery, phone 810-280-1900.**
(ECD RELEASE: 4/3)

Hawthorne Financial Leases EV1 as Company Car

Hawthorne Financial Corporation of El Segundo, CA recently announced that it has leased a General Motors EV1 as an official company vehicle to deliver documents and other bank business.

The company also hopes the move will create positive publicity and differentiate themselves from other financial institutions.

The thrift has also unveiled free public electric vehicle charging stations at its headquarters and at another branch. According to Dave Hardin, executive vice president, the use of EV1 with the Hawthorne logo on the side has proven to be a cheap and effective form of advertising.

"For my $6,000 a year, I've gotten a lot of mileage out of the advertising vehicle, as we like to call it," said Hardin. "You pull into a parking lot, and people ask you questions, and the bank's logo is right there. It takes time, but that's what getting yourself known in the community is all about."

"It's a new marketing tool, and a great service to provide, and something that the public is very receptive toward," said Julie Goldstein, manager of charging infrastructure at Edison EV, a subsidiary of Edison International.

"Many organizations are starting to be more interested in providing public charging because they see the value it can bring to their organization."

Contact: Edison EV, phone 213-452-4629.
(AMERICAN BANKER: 4/5)

SCIENCE & TECHNOLOGY REPORT

DTI Develops EV Stations for Demo Programs

Bedford, MA-based Diversified Technologies, Inc. (DTI) recently announced that has been collaborating with Massachusetts, New York and New Jersey to develop electric vehicle (EV) charging stations for their demonstration programs.

The company has a five-year contract with the Commonwealth of Massachusetts to develop, produce and install seven EV charging stations and a 12-kilowatt (kW) photovoltaic grid-tied array at the Alewife MBTA station, six charging stations and a four-kW grid-tied photovoltaic array at the Braintree MBTA station, and 20 home charging stations compatible with Solectria and other EVs.

DTI has also installed dual charging stations at the commuter rail station in White Plains, NY and at the New Jersey Department of Transportation facilities in Trenton, NJ. Its charging stations feature two side-by-side locking enclosures, including power indicator lights on the front panel, motion/light sensitive illumination on the top, and ground fault circuit interrupters for personal protection.

DTI develops power electronics, electromagnetics, analog design, and power system integration for commercial and government applications. **Contact: Diversified Technologies, 35 Wiggins Ave., Bedford, MA 01730, phone 617-275-9444, fax 617-275-6081, e-mail info@divtecs.com.**
(DIVERSIFIED TECHNOLOGIES: APRIL 1997)

GRANTS & CONTRACTS

DUETS Consortium Seeks Phase II Funding

The DUETS (Demonstration of Universal Electric Transportation Subsystems) Consortium has completed its Phase I activities, and is seeking new sources of funding for testing and functional optimization activities to be carried out during Phase II. The consortium includes Nova BUS, Inc., Kaman Electronics, Honeywell, Inc., Davis Technologies International, Inc. and Sandia National Laboratories.

Phase I activities are to be followed by extensive testing and design activities focused on cost and production. The consortium intends to continue using the DUETS bus as a mobile laboratory for the investigation and optimization of hybrid vehicle drive technologies.

The DUETS bus can be used for research needed to address a range of issues associated with the commercialization of hybrid technologies. **Contact: Nova BUS, Inc., phone 505-347-7288.**
(NOVA BUS, INC. AERG: MARCH 1997)

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INDUSTRY REPORT

Southwall Licenses Technology from ECD

Southwall Technologies, Inc. has licensed thin-film coating technology from Energy Conversion Devices, Inc. (ECD) and entered into a joint development program with ECD. Southwall designs and manufactures thin-film coatings, used to reflect or absorb electromagnetic radiation, to the energy conservation and electronics markets.

"We are pleased to be working with Southwall Technologies," said ECD president and CEO Stanford Ovshinsky.

"Southwall is a recognized global leader and preferred supplier of high performance coatings on flexible substrates, and our two companies have a common commitment to developing new products and process in the rapidly growing fields of energy and electronics applications."

ECD develops products based on amorphous, disordered and related materials, with an emphasis on alternative energy and information technology. Southwall licensed the ECD technology on a royalty-bearing basis. **Contact: Stanford Ovshinsky, ECD, phone 810-280-1900; Martin Schwartz, Southwall Technologies, phone 415-962-9111.**
(ECD RELEASE: 4/15)

Costco, Edison Unveil New EV Charging Sites

Earlier this week electric vehicle (EV) owners in California drove from Oxnard to Simi Valley as part of a ceremony to unveil a network of EV charging stations throughout the state, which were developed by Costco Companies, Inc. and Edison International.

The 25-mile journey began at Costco's facility in Oxnard and ended at a Costco warehouse in Simi Valley. Currently, three public EV charging stations are operating in Ventura County, all of which are offered free of charge to Costco customers.

Edison EV (EEV) and Southern California Edison (SCE) will provide the charging systems at other Costco locations in California. EEV will install inductive charging units produced by Delco, and SCE will supply the electric power to support the units.

"We applaud Costco for its pioneering effort as the first major retailer to make electric vehicle charging available to customers," said Pam Bass, vice president at SCE. "EV consumers are asking for public charging and will patronize businesses that provide this service.

"Edison is delighted to have initiated this project with Costco, which typifies our efforts to inform our commercial customers about efficient energy use and how new technologies can benefit their operations and their customers."

Contact: Paul Klein or Steve Conroy, Southern California Edison, phone 818-302-2255.
(SOUTHERN CALIFORNIA EDISON RELEASE: 4/15)

INTERNATIONAL REPORT

Hydrogen Delegation to Visit China

A delegation of U.S. scientists, educators, engineers and corporate representatives involved in the use of hydrogen have been invited to visit the People's Republic of China by the China Hydrogen Energy Association and the China Association of Science and Technology.

The purpose of the visit is to foster discussion on zero-emission energy technology, the role of industrialized nations in fostering the development of this technology, hydride storage technology, and U.S.-China cooperation in the research of hydrogen and fuel cells.

The delegation will depart from San Francisco on August 30 and return September 12. During the visit the delegation will tour the General Research Institute for Non-Ferrous Metals in Beijing and Fudan University in Shanghai, as well as make side trips to farms using alternative energy sources, the Great Wall and the Ming Tombs.

Participation in the delegation is limited on a first-come, first-served basis. The total cost for each participant has been estimated at $4,350. The delegation will be sponsored by the American People Ambassador Program of People to People International, and will be led by *Hydrogen and Fuel Cell Letter* editor and publisher Peter Hoffmann. **Contact: Kathleen Sieler, program coordinator, phone 509-534-0430, extension 422.**
(EIN STAFF: 4/21)

WORLD CONFERENCE REPORT

Ford to Present Vehicles in Sacramento

The Ford Motor Company will unveil its 1998 Ranger model electric truck this morning at a news conference in Sacramento, CA. The ceremony is part of the automaker's strategy to sell alternative fuel vehicles in the entire state of California, without limiting its focus to the Los Angeles area.

In addition to the electric Ranger, Ford will also present its natural gas-powered F-250 pickup, a super ultra-low emission vehicle. The company's alternative fuel vehicle program director John Wallace will answer questions at the ceremony.

The unveiling will take place at 10:00 a.m. on the south steps of the State Capitol building. **Contact: William T. George, Jr., phone 714-939-3695.**
(BUSINESS WIRE: 4/18)

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INDUSTRY REPORT

Washington EV Program Hits Rocky Road

Despite mild winters, expensive gasoline and environmentally-minded residents, electric vehicles (EVs) in the San Juan Islands in Washington state seem to have hit the same wall encountered by EV proponents around the country.

"There's a long way to go until we see a large number of cars like this coming down the road," said Doug Bechtel, driver of a Solectria Force EV and general manager of the Orcas Power and Light Company, which in 1991 volunteered to become part of a federal program to field test EVs and spread information about them.

With one EV for every 750 non-commercial vehicles powered by fossil fuels -- or 12 EVs in all -- San Juan County has the highest ratio of EVs to traditional cars in the country, according to local officials.

Residents who have participated in the program say the cars have a short range and, at double or triple the price of a similar gasoline-powered car, are too expensive. Basically, they say the technology is not quite there, which means EVs are still a thing of the future. However, the islanders have not complained about the performance of the EVs.

For example, gasoline on the island costs about $1.60 a gallon, or about four cents a mile, said Bechtel. However, it costs as little as a penny per mile to operate an EV, he said, adding that the need for maintenance is reduced. On the other hand, the car's batteries, which cost between $500 and $700, need to be replaced every 5,000 to 7,000 miles, adding another 10 cents per mile to the overall cost.

The utility has lent out two of its EVs to San Juan officials and residents with hopes of winning them over. The EVs make sense in the San Juans where many residents have an "island" car for short trips around home and a "mainland" car for longer trips. But despite their initial excitement over the novelty, most drivers are reluctant to purchase an EV.

"Those who turned down the opportunity were probably smart to do so," said John Castagna with the Edison Electric Institute in Washington, D.C. But he added that the technology continues to improve and that "there's really good stuff in the pipeline."

For instance, Honda plans to introduce its new EV next month, Toyota will introduce an EV this fall, and Nissan plans to introduce an electric-powered minivan. **Contact: Orcas Power, phone 306-376-2252.**

(NEW YORK TIMES: 4/23)

SCIENCE & TECHNOLOGY REPORT

Glacier Bay Developing EV AC System

Engineers at San Mateo, CA-based Glacier Bay, Inc. are working on the development of an environmental control system (ECS) that can be put to use in electric vehicles (EVs) and hybrid electric vehicles (HEVs). One major stumbling block to mass acceptance of EVs and HEVs has been the lack of success in adapting conventional automobile air conditioning systems for these vehicles.

In developing a prototype ECS, Glacier Bay made modifications to its existing marine heating, ventilation and air conditioning (HVAC) system.

These included a much smaller and lighter compressor, evaporator and condenser, in addition to the development of a compressor able to produce greater speeds than the marine HVAC unit. The new system also had to be configured to handle variable input voltages supplied by EV and HEV motors.

Glacier Bay put its prototype system to the test by placing it into a Pivco City Bee EV delivered to the California Air Resources Board Northern California office. The City Bee was used in a station car program in the San Francisco area.

The company is conducting further tests on the ECS system to determine the unit's operation efficiencies. **Contact: Kevin Alston, Glacier Bay, phone 415-578-0871.**

(CALSTART TECH NOTES: FEBRUARY 1997)

Educational Institutions Try Out EVs

Educational institutions throughout the United States in the past few years have been taking advantage of advanced vehicle technology to contribute to a cleaner environment. A recent issue of *Energy Ideas* details these efforts in its case study reports.

Fullerton Joint Union High School in La Habra, CA has purchased two electric buses, which are zero-emission vehicles and make virtually no noise. The school district already operates a number of methanol and advanced diesel buses in its fleet.

Students who took a test ride on the electric bus "couldn't get over how quiet the bus was and they didn't have to raise their voices to speak to one another," said Jerry Hart, director of transportation and operations for the district.

Meanwhile, the Clean Energy and Vehicle Research Center at the University of South Florida has been operating a solar electric vehicle since 1991. The university, in collaboration with state utilities and other organizations, oversees an EV solar-powered charging station and test facility.

The station features a 12-bay parking and charging facility that can generate up to 20 kilowatts of peak power. The research center plans to assess the feasibility of solar electric vehicles for fleet use in Florida. **Contact: Jerry Hart, Division of Transportation and Operations, Fullerton Joint Union High School District, phone 714-870-3590, fax 714-870-6015; George Moore, Clean Energy and Vehicle Research Center, University of South Florida, phone 813-974-4771, fax 813-974-5250.**

(ENERGY IDEAS: FALL/WINTER 1997)

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ELECTRIC VEHICLE TODAY

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INTERNATIONAL REPORT

NiH Battery Development from Japan

Scientists in Japan have made a development breakthrough that could make the use of nickel hydrogen (NiH) battery technology applicable for electric vehicles (EVs).

Researchers from the Government Industrial Research Institute in Osaka, working with nonwoven fabric manufacturer Kanei Juyo Kogyo Company, have developed a method for coating the separators between negative and positive electrodes that can help to eliminate battery discharge at high temperatures.

The method involves treating the nonwoven fabric normally used for the separators with a synthetic, acid- and base-resistant rubber, that has been mixed with a powder to facilitate ion exchange. Conventional separator materials have failed to yield both high strength and enhanced ion exchange.

Using the new process, researchers were able to limit the self-discharge of the battery to two-thirds the normal amount. The new material boasts an ion exchange capacity 10 times greater than materials currently is use, in addition to greater strength and ability to maintain the battery's electrolyte.
(NIKKEI ENGLISH NEWS: 4/23)

ZAP Electric Bikes Have Bright Future in China

Tired of all the smog and noise caused by the more than 470,000 gas-powered mopeds and motorized bicycles in Shanghai, government officials say they will no longer issue new moped licenses in an effort to reduce the number of mopeds by 80 percent over the next three years.

"We thought there was a market for electric bikes before the Chinese government imposed this regulation," said Gary Starr, managing director for ZAP Power Systems. "Now, it's virtually a mandated market."

ZAP announced in February that ZAP China had entered into an agreement with the Shanghai Forever Company Ltd. to work together to produce and market electric bicycles in China.

"This contract is not only a milestone for ZAP, it is an historic moment in transportation," Starr said. "With this relationship, ZAP can be one of the leaders in low-cost electric vehicles. Additionally, as its economy prospers, China is in the unique position to leapfrog fossil fuel technology altogether, going directly from millions of human-powered bikes to clean electric vehicles. The pollution savings and growth possibilities are staggering."

The ZAP Forever Bicycles will be distributed through 1,400 Forever Company sales outlets around China. The Forever Company, which now manufactures more than three million bicycles a year, has produced more than 90 million bicycles.

Under the agreement between the two companies, ZAP can provide Forever with up to 5,000 ZAP motors for a six-month sales test program.

When the test program is completed, the two companies say they will form a joint venture to develop, manufacture, and distribute the electric bicycle along with other electric vehicle products, such as electric tricycles, scooters, motorcycles and wheel chairs.

"Forever looked at many electric bicycle companies around the world before they decided to go with ZAP," said Margaret Wong, president of McWong International, a partner in the ZAP China venture.

"They went with ZAP because of its adaptability to the Chinese market, its low cost, and the management's experience in all kinds of electric vehicles."

Contact: ZAP, phone 707-824-4150, fax 707-824-4159.
(ZAP NEWS: SPRING 1997)

EDITORIALS, REVIEWS & ASIDES

Editorial Notes Addition of Fuel Cells to Mix

The following are excerpts from an editorial titled "Beyond batteries," which appeared in the April 28 issue of the *Boston Globe*:

"...Calls for a zero emission vehicle have been based on hope that battery-powered electric cars will become economically practical. Now it appears that another technology -- the fuel cell -- has considerable potential. Both are worth pursuing despite formidable technical and economic problems.

"Major auto makers have made varying commitments to the fuel cell in recent weeks, including Ford's announcement last Monday that it would have a prototype by the year 2000 and Daimler-Benz's commitment to sell 100,000 fuel cell cars by 2005...

"If the problems can be overcome, fuel cell vehicles will be capable of much greater range than existing electric cars, which depend on batteries that are penalized heavily by cold weather, hilly terrains, and slow recharge rates. But battery technology is also open to breakthroughs.

"Policy makers will have to remain flexible in their approach to the emissions question to avoid locking into one technology before its economic viability has been demonstrated.

"In the meantime, partial gains in emission reductions in conventional vehicles remain desirable pending the more exotic technologies that show increased promise -- but are still short of fulfilling it."
(BOSTON GLOBE: 4/28)

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ELECTRIC VEHICLE TODAY

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INDUSTRY REPORT

GM Cuts Prices on EV1 Due to Poor Sales

General Motors Corporation (GM) last week announced plans to cut the price of its EV1 electric car by 25 percent with the hope of expanding the market for the vehicles. The company will decrease the monthly lease rate for the $34,000 EV1 from $530 to $399, including the lease of a home-charging station, as well as pay for 50 more charging stations.

GM officials cited a high price tag and a 70 mile-per-charge city driving range as the drawbacks of the electric vehicle, which was introduced in December on a lease-only basis.

Since then, only 176 two-seat EV1s have been leased at Saturn dealerships in Los Angeles, San Diego, Phoenix and Tucson, AZ.. Though GM had anticipated the lease of 100 the electric cars per month, the company expects to strive to establish a market niche for the vehicle.

"There is no lack of commitment," said John Campbell, owner of three Saturn dealerships in Orange County that have sold 23 EV1s so far. "Everybody thought it would be an instant success. That didn't happen. It's just going to take some time."
(LOS ANGELES TIMES: 5/2)

SCIENCE & TECHNOLOGY REPORT

GM to Use Nickel Metal Hydride Batteries

A recent decision by General Motors (GM) to use nickel metal hydride (NiMH) battery technology in the company's EV1 electric vehicle and the coming electric version of the S10 pickup truck is seen as a sign that lead-acid battery technology may be losing ground to more advanced options. So far, GM has only used NiMH batteries in test vehicles.

"We have not said when that battery will be in the market, but it will be soon," said GM spokesman Dick Thompson. "It will probably be offered as an uplevel option. If the customer wants the extra range, he pays the extra money for it, but that's not official. We are finding the lead-acid battery satisfactory for most people."

The substitution of the NiMH battery for the lead-acid battery is expected to double the range of the EV1 between charges.

Owners of the vehicles say they get between 70 and 80 miles between charges, although some have reported going as far as 100 miles.

The cost of the NiMH battery technology is still relatively high, a fact not overlooked by lead-acid battery proponents.

"It's a very sensible thing for them to do, but I don't think the market for lead-acid batteries in electric vehicles is in any way different from what it has been," said Advanced Lead Acid Battery Consortium project manager Patrick Moseley.

Contact: GM, phone 800-25-ELECTRIC.
(REUTER: 4/28)

INTERNATIONAL REPORT

Fuji Working on Larger EV

Fuji Heavy Industries recently announced that it is developing an electric vehicle (EV) based on the Subaru Forester model, which the company also manufactures. The new EV will be the first in Fuji's compact class, though it already markets EVs in Japan based on a light car model. Fuji has sold about 40 electric cars.

The company selected the Forester for the project because larger Subaru models such as Legacy and Impressa are not equipped with sufficient battery space below the floor. The Forester EV will most likely use nickel hydroxide or lithium-ion batteries, according to Fuji.
(COMLINE TRANSPORTATION WIRE: 4/30)

Cobalt Demand Expected to Rise With Use of EVs

Though cobalt is not traded on any market like gold or silver and its uses are not widely known, mining companies are willing to risk war in Zaire to get the metal, a key ingredient in compact batteries used to power cellular phones and the next generation of electric cars.

Demand for cobalt is expected to surge in the coming years with the help of the American automobile industry. Cobalt is a key ingredient in nickel and lithium batteries that would give electric vehicles (EVs) a greater range.

"The market for electric vehicles is in its infancy stage," said Robert Hayden, executive director of the Electric Vehicle Association of the Americas. "The basic point is this: Cobalt will be in growing demand."

While Zaire probably holds as much as two-thirds of the world's cobalt reserves, the country has accounted for only a fifth of the world's cobalt production. That's because of the political turmoil in Zaire, which has put mining on the decline.

Many mining companies interested in extracting Zaire's riches already have signed deals with the rebels.

According to Kenneth MacLeod, president of International Panorama Resource Corporation, worldwide cobalt consumption should rise from about 25,000 tons a year now to some 29,000 tons by 2000.

Some entrepreneurs say cobalt could be a better investment than gold. Cobalt already is more lucrative than many other precious metals because of its relatively low production costs.

"It's probably one of the most profitable commodities in the world," said Alan Crawford, director of corporate planning and an International Panorama shareholder. But because there is not cobalt exchange, no daily price quote or listing on any of the world's various commodity exchanges, the price of cobalt is largely determined by the players.
(AP: 5/1)

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ELECTRIC VEHICLE TODAY

A Daily News Summary Covering EVs, Hybrids and Fuel Cell Vehicles

SCIENCE & TECHNOLOGY REPORT

Lead-Acid Batteries Continue to Vie for Spot in EVs

A new three-year, $17.5 million research program that will try to determine how to best speedily recharge batteries used in new electric vehicles (EVs) has been unveiled by the Advanced Lead-Acid Battery Consortium (ALABC).

Though most EVs today use lead-acid batteries, rival metals continue to advance in the EV field. For example, General Motors (GM) earlier this month said it will start using nickel-metal hydride batteries in some of its EV1 vehicles because they offer better range than the lead-acid batteries. In addition, another car maker has said it will use lithium ion batteries in its EVs.

Cominco Limited has received the first contract from the ALABC to look at the best way to charge batteries and limit overcharging.

The ALABC, a program of the International Lead Zinc Research Organization based in North Carolina, is working to make lead-acid batteries more attractive for use in EVs.
(REUTER: 4/30)

INTERNATIONAL REPORT

Suzuki Introduces Two Electric Bicycles

Japan's Suzuki Motor Company has added two new electric-assisted bicycles to its Suzuki Love model line. The new models are a 20-inch and a 22-inch version.

The addition to the two new models brings the Love offerings to four, including the 24- and 26-inch styles. The new models feature a supplemental electric motor that will power the bicycles for about 31 kilometers (just over 19 miles) on a single charge. The company says the motor can be recharged in about three hours, but a one-hour charge can restore the motor to about 80 percent capacity.

The new Love models sell for 99,500 yen (a little more than $785). Suzuki plans to sell about 30,000 bicycles annually from the entire Love model line.
(COMLINE TRANSPORTATION WIRE: 4/30)

EDITORIALS, REVIEWS & ASIDES

Cleveland to Host Electric Formula Classic

JULY 12 -- CLEVELAND, OH

1997 CLEVELAND ELECTRIC FORMULA CLASSIC

Cleveland's Burke Lakefront Airport will be the site of this year's Cleveland Electric Formula Classic Indy style car race. The event is sponsored by the Cleveland Electric Illuminating Company, and will be held during the Medic Drug Grand Prix of Cleveland.

The 50-kilometer race will feature a dozen electric Indy race cars entered by student and faculty teams from U.S. universities. The teams will vie for the Cleveland Electric Cup, as well as over $35,000 in scholarship funds.

Last year's winner, the Indiana University/Purdue University team, will return to defend its title. The field will also include a first-time entrant from Florida A&M/Florida State University. **Contact: Todd Schneider, Cleveland Electric Illuminating Company, phone 216-447-3200.**
(EIN STAFF: 5/6)

Impact Designer Says EV1 Has Major Flaw

Alan Cocconi, an electrical engineer specializing in power electronics who worked on creating the General Motors (GM) Impact electric vehicle (EV), could arguably be called the best at what he does.

In addition to his work on the Impact, unveiled in 1990, Cocconi developed the circuitry for the successful SunRaycer GM solar-powered EV that won the landmark 1987 race across Australia. The engineer designs circuits in which tens of kilowatts course through transistors the size of jacket buttons. In the Impact EV, his circuitry converted direct current from the vehicle's batteries to the alternating current that ran its motor. Also, it converted AC to DC to charge the batteries.

This circuitry, called an inverter, was considered to be an incredible piece of engineering for its time. With significant electrical modifications, the Impact has now become the GM EV1, which is now for lease in California and Arizona.

However, Cocconi has not been a part of the EV1 project by choice and, instead, runs his own company, called AC Propulsion in San Dimas, CA. In fact, Cocconi said the EV1 has a major flaw: the use of an inductive charger, rather than a conductive one that used in the Impact.

This inductive system requires EV1 drivers to have a $2,000 charger installed by a local utility, Cocconi pointed out. While GM said the system is safer, Cocconi disagreed, saying the inductive charger "worked as a very effective sponge to soak up all the federal and state dollars that could have gone into creating a much cheaper and pervasive infrastructure" for EVs.

With its seven employees, Cocconi's company spends most of its time converting gasoline-powered cars to run on battery power at a cost of between $75,000 and $120,000. Cocconi claims that one of his converted 1993 Honda Civics can outperform GM's highly aerodynamic EV1 in range and battery charging time. So far, the company has converted 11 vehicles. It also has sold 45 electric drivetrains to do-it-yourself converters.

Recently, he built a flashy electric sports car, called the Tzero, that Cocconi said he wants to market soon. "If you pay $75,000 for a car, you just don't want to come back and show the neighbors a Honda," he said.
(SCIENTIFIC AMERICAN: MAY 1997)

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INDUSTRY REPORT

EVs Not Far Away in Alabama

Malls, restaurants, night clubs, parking garages and other places where vehicles are left for more than a couple of hours are prime locations for electric vehicle (EV) recharging stations. Already, Alabama Power Company has installed public charging stations in Birmingham at such locations. The utility said it plans to install similar stations in Montgomery and Mobile during the next year or so.

"As we see this market growing, we see a need developing," said Bob Hawkins, manager of electric transportation for Alabama Power. "We're not only going to put in some charging stations now, but we're going to put in the infrastructure -- the wiring and other needs -- for future use." He added that this will allow the utility to install chargers as particular locations warrant.

While it takes about eight hours for an EV's batteries to be recharged by a plug-in charger in an owner's garage, two hours at a public EV charging station is enough to boost depleted batteries. And though there are EV chargers on the market that can recharge an EV in about 15 minutes, they cost much more.

"Once that technology is cost-effective, we might put those fast-chargers in service stations or central locations of cities," id Hawkins.

Hawkins said the utility plans to install four EV charging stations at a new Summit Shopping Center under construction near Birmingham. Utilities and other alternative fuel providers are required under the Energy Policy Act of 1992 to find alternative power sources for their vehicle fleets.

Alabama Power owns about 15 EVs itself, Hawkins noted. "We're going to add 10 new Chevy S-10 electric pickup trucks to our fleet by early summer," he added. "Later on this year, we'll add some Ford Rangers and some Toyota RAV4s."

Hawkins also noted that Chevy's S-10 electric-powered pickup will soon be sold at a Chevrolet dealership in Birmingham. Despite their limited range and other drawbacks, Hawkins said EVs will become fixture for most families in the next decade or two.

"The nickel metal hydride battery will change the entire market because of the greater range. Even though electric vehicles are relatively expensive on the front end, you're operating costs decrease somewhere in the range of 60 to 70 percent," Hawkins said. He added that the big savings will come in fuel costs. **Contact: Alabama Power, phone 334-223-5003.**

(THE MOBILE REGISTER: 5/2)

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ncubator Group Honors Bolder Technologies

The National Business Incubation Association (NBIA) named Wheat Ridge, CO-based Bolder Technologies Corporation the 1997 Incubator Graduate of the Year at its 11th Annual Conference on Business Incubation held in Milwaukee, WI earlier this week.

Bolder, which develops advanced rechargeable battery system based on its patented thin metal film (TMF) technology, was a former client of the Boulder (CO) Technology Incubator (BTI).

When it entered the incubator program in 1991, Bolder had no working capital. Since then, the company has raised $13 million in venture capital and an additional $21 million through an initial public offering.

A demonstration of the TMF battery technology to BTI helped convince the incubator to invest seed money in Bolder. BTI also helped Bolder make contacts with venture capitalists, develop a business plan and assemble a management team.

"Our company would have had great difficulties in realizing success had we not had access to the incubator and all the resources there," said Bolder's president and CEO Daniel Lankford.

Bolder has used its TMF technology to develop a battery with a higher power density than any commercially available rechargeable battery.

The company expects to relocate to a new, larger manufacturing facility in June. **Contact: Tracy Corrigan, NBIA, phone 614-593-4331.**

(NBIA RELEASE: 5/5)

SCIENCE & TECHNOLOGY REPORT

Lotus Unveils Electric Elise With Zytek Motors

Lotus recently introduced its two-seat electric Elise at the Society of Automotive Engineers Congress and Exposition in Detroit. The electric version has already earned several European awards for design and technology.

The Lotus Elise electric car is equipped with a lightweight extruded aluminum chassis, two Zytek Systems Ltd. motors and nickel-cadmium batteries.

The EV boasts 200 horsepower, a range of 120 miles, an acceleration rate from zero to 90 of about 11.2 seconds, and a total weight of less than 2,000 pounds.

The company is currently testing the Lotus Elise for ride and handling with the hope of marketing it to another manufacturer as an experimental vehicle.

"Our aim is to make electric vehicles desirable, not just necessary through government mandate," said Bill Gibson, Zytek's managing director. "The Lotus Elise forms an ideal test bed for high-performance EV technology."

Contact: Lotus Cars USA, phone 313-438-8017.

(CHICAGO TRIBUNE: 5/4)

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SCIENCE & TECHNOLOGY REPORT

Toyota, Honda Develop Small EVs

Toyota Motor Corporation and Honda Motor Company have each developed different versions of small electrically-powered vehicles on a trial basis, according to the *Nihon Keizai Shimbun*.

Toyota's two-seat "commuter" car travels at a maximum speed of 80 kilometers (km) per hour and has a range of 100 km on a single charge of electricity. The vehicle will be displayed at the Tokyo Motor Show this fall.

Meanwhile, Honda has unveiled a one-seater called the ICV-1 which can run on either gasoline or electricity. The auto maker has also developed a electricity-powered two-seat car, known as the ICV-2.

The ICV-1, which is 2.5 meters long and 1.1 meters wide, is designed for use around the community, while the ICV-2 is suited more for recreational use. Honda said that it would partner with Waseda University to devise practical applications for the vehicles.
(KYODO: 5/4)

ERC CEO Presents Fuel Cell Paper

Energy Research Corporation (ERC) president and CEO Bernard Baker presented a keynote paper on carbonate fuel cells at a meeting of the Electrochemical Society in Montreal, Canada earlier this week. Baker, who co-authored the paper with ERC chief operating officer Hans Maru, outlined ERC's activities in development, testing and demonstration of fuel cells in the U.S., Japan and Europe.

Baker's paper began with a comparison of carbonate fuel cells to other fuel cell systems, and moved on to a discussion of different design approaches for carbonate fuel cells.

"ERC uses the direct fuel cell in which a fuel such as natural gas is supplied directly to the cell, avoiding external processing equipment commonly used by other types of fuel cells to generate hydrogen," said Baker in his presentation. "We can minimize the amount of peripheral equipment and parasitic power required."

Copies of Baker's paper are available upon request from ERC. **Contact: Peter Voyentzie, ERC, phone 203-792-1460.**
(BUSINESS WIRE: 5/5)

INTERNATIONAL REPORT

Secretive Toyota Reveals AFV Line

The traditionally closed-mouthed Toyota Motor Company recently revealed its lineup of alternative fuel vehicles (AFVs) at a remote 12,000-acre test track in Arizona's Sonoran desert.

The automaker showed off its RAV4 electric sport-utility vehicle, a natural gas sedan, a low-emission hybrid-powertrain car, and even fuel-cell technology that Toyota said it may use in the future.

"Toyota decided to come out of the closet with a vengeance," said James Olson, Toyota vice president.

In the past, the company has been especially secretive about advanced technologies. But California's fast-approaching requirements for zero-emission vehicles have pushed Japanese automakers into the spotlight. In fact, the demand for lower emissions and better fuel economy are increasing worldwide, especially in countries where air pollution is severe and the price of gasoline is high.

Secrecy from Japanese automakers has worried the Big Three that they are falling behind in advanced technology development. Despite the apprehension in Detroit, it seems leading Japanese car companies are no further along in electric vehicle (EV) development than the Big Three and other EV manufacturers. In fact, the Japanese seem to be lagging in some areas.

"Toyota has made good progress on improving the gas engine, but when you look at advanced technologies, the U.S. companies are probably stronger," said David Cole, executive director of the University of Michigan's Office for the Study of Automotive Transportation.

Toyota, the largest and richest Japanese automaker, has taken a conservative and practical approach to AFV technology development, generally refining known technologies. Though the company sees a future in AFVs, it says it could be decades away.

At the same time that it is increasing research and development efforts for electric vehicles, gasoline-electric hybrids and fuel cells, Toyota is spending just as much to perfect the conventional gasoline engine. For example, the automaker is pushing the development of "lean burn" and other technologies that improve gasoline engine efficiency.
(LOS ANGELES TIMES: 5/4)

EDITORIALS, REVIEWS & ASIDES

Ballard Seeks Engineers for Fuel Cell Development

Ballard Power Systems recently announced that it is in search of specialists to work in various technical fields related to fuel cell development.

Positions of different levels of seniority are available in fuel processing, cost reduction, manufacturing, systems/test, power plant development and air pressurization.

Ballard said it will provide "competitive compensation/benefits packages, including relocation assistance where applicable."

Contact: Human Resources, Ballard Power Systems, 9000 Glenlyon Parkway, Burnaby, B.C. V5J 5J9, fax 604-412-4700, e-mail careers@ballard.com.
(HYDROGEN & FUEL CELL LETTER: MAY 1997)

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INDUSTRY REPORT

ECD Reports Low Revenues, Increased Investment

Energy Conversion Devices, Inc. (ECD) of Troy, MI last week released its operating results for the three- and nine-month period ended March 31.

The company reported a decrease in revenues for the three-month period, from $7.5 million in FY 96 to $5.7 million currently. Meanwhile, net loss increased from $758,000 in the three months in FY 96 compared to $7.1 million this period.

For the nine months, revenues were down $22,440 from $30,954 in FY 96. Net loss rose, $13,046 during the nine months in FY 97 compared to $3,829 in the same period the previous year.

According to ECD, the rise in the company's net loss was due to factors such as increased electric and hybrid electric vehicle battery development, expenses related to the General Motors (GM) Ovonic L.L.C. manufacturing joint venture and costs associated with the start up and expansion of negative electrode production equipment.

Stanford Ovshinsky, president and CEO of ECD also reported on development in energy storage-battery efforts. Among them were GM's upcoming introduction of Ovonic nickel metal hydride (NiMH) batteries in its EVs and a joint venture with Sanoh Industrial Company, Ltd. of Japan to produce NiMH batteries for electric scooter applications. **Contact: Energy Conversion Devices, phone 810-280-1900.**

(ECD RELEASE: 5/8)

Project California Completes Five-Year Mission

The California Council on Science and Technology's Project California, started in 1992 in response to defense budget related base closings in that state, officially completed its mission last week.

During a ceremony on the office of Governor Pete Wilson, the project's executive director John Stearns and co-chair Roy Anderson of Lockheed presented a report detailing the initiative's accomplishments.

The project's mission was to create 425,000 new jobs in California by 2010 while helping the state maintain its commitment to the reduction of pollution and urban congestion. The project identified six technology areas to be targeted for aggressive action, including the development of zero-emission and hybrid electric vehicle technology.

"Although Project California is coming to an end, it will live far beyond 1997 in the form of vision and sustained leadership provided by the alliances it has developed," said the project's other co-chair Malcolm Currie, of the Hughes Aircraft Company. "The Project's real legacy is the model it provides for coherently mobilizing California's vast resources in attacking important economic and societal issues."

The project's work will be continued through its legacy organizations, including the Advanced Telecommunications Alliance, the California Alliance for Advanced Transportation Systems, the Southern California Initiative Maglev Consortium, the Advanced Transportation Job Training Alliance and the California Communications Leadership Collaboratory. **Contact: Project California, phone 714-442-7800, fax 714-442-7831, e-mail projcal@ccst.org.**

(PROJECT CALIFORNIA RELEASE: 5/6)

SCIENCE & TECHNOLOGY REPORT

Saft Sees Future EV Battery Market for Itself

Saft, a company whose batteries and power electronics are used in everything from satellites to portable computers, said it sees a future for its batteries in electric vehicles (EVs).

"The electric vehicle is key to the company's growth strategy," states a brochure from Saft, the battery unit of France's Alcatel Alsthom.

The battery maker predicts that in about 10 years, EVs will account for about three percent of the personal automobile market. "Saft seeks to have 50 percent of it," the company said.

Saft EV development director Jean-Pierre Cornu, said 5.7 percent of annual turnover is pumped directly into EV battery research and development. That amounts to about $20 million per year.

"We have three very coherent programs," Cornu said, one for nickel-cadmium (Ni-Cad) batteries, one for nickel metal-hydride batteries (NiMH), and another for lithium-ion batteries, a technology the company believes will make EVs range-competitive with gasoline-powered vehicles.

"We have to improve the range of the vehicles, especially in the U.S." said Cornu. The company already makes lithium-ion batteries for portable electronics applications at its Valdese, NC plant.

Saft also produces Ni-Cads for EVs at its $20 million Bordeaux, France facility. The plant can turn out about 5,000 batteries per year, but it has a capacity of 15,000, the company reported.

The company's industrial battery plant in Valdosta, GA carries out some of the assembly work.

Because nearly all of the metal used in batteries is recycled, Cornu played down the environmental concerns associated with cadmium metal.

He said a greater concern is a fundamental shortage of cadmium metal, which is why the company has invested in NiMH battery technology as well. Cornu added that NiMH batteries can obtain a 25 to 30 percent performance gain over Ni-Cads. **Contact: Mike Saft, phone 410-771-3200, fax 410-771-1144.**

(FLEETS & FUELS: 5/5)

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INDUSTRY REPORT

SunFuel to Supply Ballard With Refueling Station

SunFuel Energy Systems, a division of the Electrolyser Corporation Ltd. of Toronto, Ontario, recently announced that is has signed a hydrogen contract with Ballard Power Systems, Inc.

Under the agreement, three Ballard fuel cell electric buses to be delivered to B.C. Transit will operate on hydrogen in the Vancouver area beginning this fall. Natural Resources Canada and B.C. Hydro are also taking part in the project.

"The Vancouver project is a demonstration of the use of clean hydrogen fuel in a highly efficient, economic and environmentally attractive manner," said Alexander Stuart, founder and chairman of the Electrolyser Corporation.

SunFuel develops integrated hydrogen energy systems, which produce hydrogen and store it on-board the buses while they are out of service at night, a period of low electricity demand. The process generates no emissions except pure water vapor.

Electrolyser has already supplied SunFuel hydrogen fueling stations in Toronto, Montreal, Los Angeles and Riverside, CA. **Contact: SunFuel, phone 416-621-9460, fax 416-621-9830, e-mail sunfuel@electrolyser.com.**
(SUNFUEL RELEASE: 5/21)

SCIENCE & TECHNOLOGY REPORT

Electric S-10 Pickup to Tackle Pikes Peak

The Chevrolet electric S-10 pickup truck will make its racing debut in July at the famous Pikes Peak International Hill Climb Event on Independence Day. Piloting the vehicle will be three-time Baja 1000 winner Larry Ragland.

"We plan to flex the muscle and reliability of this powerful Chevy S-10 by being the first to make it to the top of the 14,110 foot summit," said Ragland. "And I'm planning to be the driver to turn this first-time attempt into an historical feat for the S-10 electric truck."

The electric S-10 is the first electric truck offered by General Motors (GM) since early this century. The truck features a Delco 85-kilowatt AC induction motor and valve-regulated battery pack, located under the truck's bed, and is capable of speeds up to 70 miles-per-hour. Chevy also modified the truck somewhat for the Pikes Peak race.

"We're using a nickel-metal-hydride battery pack with modules to further test the technology of the truck," said Russ O'Blenes of GM Motorsports. "And we've added a roll cage, racing seats, an auxiliary power cut-off, and aftermarket wheels and tires. Basically it's a stock production truck -- with the standard frame, body, door panels, interior, and so forth. It really looks sharp. It's red, white and blue with a 'stars and stripes' theme for the 4th of July race date."

Among the many obstacles facing the S-10 will be the weather, which can vary considerably between the bottom of the peak and the summit. **Contact: Chevrolet/Geo Communications, phone 1-800-CHEVY-MI.**
(CHEVROLET RELEASE: 5/21)

INTERNATIONAL REPORT

Economical EVs Introduced in Britain

Great Britain's Daihatsu UK and Zytec Automotive have introduced their new electric vehicle (EV) lines, both of which are considered relatively economical. Daihatsu said its line of EVs includes "the first six-seater electrically-powered vehicle in the world."

The Daihatsu HiJet MPV and its utility van and pickup truck variants are being sold to individuals and organizations "who have an interest in lower pollution and consider inexpensive motoring of prime concern," according to the automaker's Thomas Starr.

The MPV uses 20-kilowatt electric motors with lead-acid batteries that reportedly provide a range of about 50 miles, plus an eight-mile "emergency reserve," the company said. The MPV six-seater utility van costs about $22,700 and the pickup costs about $19,500 at current exchange rates.

Zytec, a supplier of high-end EV motors, has introduced its 150-kilowatt Lotus Elise EV conversion. "No one has ever built a fully road-ready electric supercar before, so at this stage we can only speculate on how it will feel," said Bill Gibson of Zytek. "The vehicle will have a power-to-weight ratio equivalent to many supercars and could enter low-volume production if there is sufficient demand."

The Lotus Elise uses two internal, oil-cooled, brushless direct current motors with a combined weight of only 57.3 pounds and produce a total of 200 horsepower. It also uses a 300-volt array of nickel-cadmium batteries, which ensure that performance and "throttle" response are consistent, Zytek said.

"Zytek's electronic control system coordinates all power-related functions and provides regenerative braking and traction control," the company said. "The company believes that the high-efficiency motor and control system together help to overcome many of the limitations currently imposed by electric vehicle propulsion batteries."

The company said that if the Zytek Elise EV enters production, "the cost of the vehicle without batteries could be similar to that of the standard car. Owners may then lease batteries at a penny-per-mile cost equivalent to buying gasoline." **Contact: Thomas Starr, Daihatsu UK, phone +44-1246-582953; Steve Tremble, Lotus, phone +44-1953-608428, fax +44-1295-277030.**
(FLEETS & FUELS: 5/19)

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ELECTRIC VEHICLE TODAY

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INDUSTRY REPORT

GM's EV1 Proving Itself in Los Angeles Market

Introduced in Los Angeles last December, General Motors EV1 is proving popular with those operating the electric vehicles. "I haven't been to a gas station since January, and I love it," said David Hardin, who leased the GM EV1 in January. He estimates he has spent only about $30 a month on electricity for the vehicle.

Tim Gohmann of J.D. Power and Associates pointed out, "The true success of the EV will be based on its performance as a vehicle, not as an environmental solution." According to their survey -- the first independent study of potential EV buyers -- 25 percent of Southern Californians would consider purchasing an EV.

Driving range continues to be one drawback for EVs, but this past Friday a converted Geo Metro traveled 249 miles setting an EV world record. According to Robert Stempel, former chairman of GM, the same battery will be utilized in EV1s this year. The current range for the EV1 is 70 to 90 miles, but "we easily double that, and better" with a new battery.

"Everybody who rides in it says this is the future," said Hardin of his EV1. "It will take a little time, but it will be there, especially if electric cars from other manufacturers are as fun to drive."

The EV1s are not available for sale, but can be leased along with a charging apparatus for $399 per month. Hal Rinsey and Partners have been marketing the EV1 through radio and television ads.

(WASHINGTON TIMES: 5/25)

INTERNATIONAL REPORT

ZAP Signs EV Distribution Agreement

ZAP Power Systems, an electric bike manufacturer based in Sebastopol, CA recently announced that it has signed a distribution agreement with Switzerland's Fondametal Export Ag.

Fondmetal plans to purchase at least 250 ZAP electric bikes and motor systems, with the first $50,000 in orders already being processed for delivery to Swiss customers.

"Of all the electric bikes I have looked at, I found ZAP to be the best," said Jvan Aeberli, president of Fondmetal.

According to ZAP, the company has received orders for its electric bike motors from more than 30 countries. Earlier this year, it signed distribution agreements with Movity S.r.l. of Italy and Shanghai Forever Company of China.

The company hopes to finance its increased manufacturing and marketing through a public offering of stock. **Contact: Alex Campbell, ZAP Power Systems, phone 707-824-4150, World Wide Web http://www.zapbikes.com.**

(BUSINESS WIRE: 5/20)

WORLD CONFERENCE REPORT

Solectria Takes First Place in NESEA EV Race

Solectria Corporation of Wilmington, MA took top honors for the ninth consecutive year at the 1997 Northeast Sustainable Energy Association's (NESEA) American Tour de Sol electric vehicle (EV) championship, which concluded last Friday in Portland, ME.

Solectria's 1997 Force electric sedan traveled 584 miles over a five-day race to win first in the production vehicle category. The EV operated on nickel metal hydride (NiMH) batteries manufactured by Ovonic Battery Company, a subsidiary of Energy Conversion Devices, Inc.

A Ford Ecostar placed second by driving a total of 533.6 miles, while Toyota's RAV4-EV took third with 425.6 miles. Connecticut EV/NAVC (Northeast Alternative Vehicle Consortium/Rideshare Company) received first place for best lead acid battery production EV with its 1995 lead acid battery-powered Solectria Force.

Solectria has developed many advanced EVs and EV components such as electric air conditioning and heating, cabin pre-heat, automatic battery thermal management, and drive systems for electric transit buses, student-built solar cars and other vehicles.

Contact: Karl Thidemann, Solectria, phone 508-658-2231, World Wide Web http://www.solectria.com.

(SOLECTRIA RELEASE: 5/24)

EDITORIALS, REVIEWS & ASIDES

Technology, Not Laws Will Boost EV Sales

The following are excerpts from an editorial by Dorin Levin, which appeared in the May 27 issue of *Detroit Free Press*:

"Just a few years ago the state of California appeared to be clamoring for electric cars with near-messianic fervor. The state actually passed a law, much resisted by automakers, requiring that sales of zero-emission -- battery-powered -- cars total 10 percent of all cars sold in the state by 2003...

"After much pleading from Detroit, the California Legislature finally came to its senses late last year and drastically toned down the mandate. A prudent move, it turns out, since initial sales of the EV1, General Motors' battery-powered car, suggest that consumer interest in electric vehicles is, to put it mildly, rather weak...

"GM hopes to sell electric cars one day, but not before battery technology has reached a far more advanced stage than that of today. Spending hundreds of millions on a project that sells vehicles by the hundreds is a surefire road to ruin...

"Technology tends to progress in small steps: Laws, no matter how well-intentioned, will never stimulate consumption as effectively as the profit motive does."

(DETROIT FREE PRESS: 5/27)

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SCIENCE & TECHNOLOGY REPORT

EVs Introduced By CARB-Led Group

The California Air Resources Board (CARB), Transportation Design & Manufacturing (TDM) and the Defense Advanced Research Projects Agency (DARPA) have teamed up to introduce two new electric vehicles -- the Zero Emission World Vehicle (Ze/WEV) and the Zero Emission Utility Electric Vehicle (Ze/UEV).

The Ze/UEV is powered by a sodium nickel chloride battery system which was developed by AEG. The vehicle platform is adaptable for use in various applications such as hydrogen fuel cells and hybrids.

Grumman Olson and the Global Transportation Institute are among the manufacturers considering the technology for postal, utility, taxi, and physically challenged vehicle applications.

"This Advanced Composite Electric Vehicle program is the first successful project funded through both taxpayer and private sector dollars that offers a broad spectrum of consumer applications," said Doug Mann, TDM vice president of sales and marketing.

South Coast Air Quality Management District and Northrop Grumman also contributed funds to the project. **Contact: TDM, 13000 Farmington Rd., Livonia, MI 48150-4209, phone 313-458-9100, fax 313-458-9118.**

(BATTERY & EV TECHNOLOGY: MAY 1997)

INTERNATIONAL REPORT

Daimler Fuel Cell Car Jumps Ahead of Schedule

Daimler Benz announced last week that it is ahead of schedule in the development of its fuel cell car, which is virtually emission-free and does not require batteries for power.

"Within a short time we have made a quantum jump and in two-years the first all-wheel drive fuel cell car in the world will be ready to roll," said Daimler Benz chairman Juergen Schrempp at the company's annual shareholder meeting.

Daimler fuel cells cars will convert methanol into hydrogen and then mix it with oxygen to generate energy onboard.

The cars are environmentally friendly since they produce only water vapor and do not create the same noise that occurs in internal combustion engines. The automaker expects to display the new A-Class car with fuel cell power in October at the Tokyo Motor Show.

(REUTER: 5/28)

WORLD CONFERENCE REPORT

NESEA Reschedules S/EV Conference

The Northeast Sustainable Energy Association (NESEA) recently announced that its Sustainable Transportation and Solar/Electric Vehicle conference scheduled for September 21-24 in Boston has been postponed until next year.

According to NESEA associate director Nancy Hazard, the event has been rescheduled due to increased activity and competing demands of would-be attendees in the alternative fuel and electric vehicle industry.

The EVS-14 electric vehicle conference to be held in Orlando, FL in December was one competing factor.

"We figured that would meet the need of people to get together and share information at a large convention level," she said.

"In '98 we don't have a date yet but we definitely plan to hold an event."

The NESEA symposium is an annual event, with last year's event taking place at Madison Square Garden in New York City and drawing over 800 visitors worldwide.

Contact: NESEA, phone 413-774-6051, World Wide Web http://www.solstice.crest.org/nesca.

(EVNEWS: MAY 1997)

EDITORIALS, REVIEWS & ASIDES

CALSTART Updates Web Site

CALSTART, a nonprofit consortium of over 200 advanced transportation companies, announced this week that it has updated its World Wide Web site to help users locate electric vehicle (EV), natural gas vehicle (NGV) and advanced transportation information more easily.

CALSTART also has added several new services to give companies a competitive advantage in the industry. Among the new features are a redesigned EV recharge and NGV refuel site directory, a listing of hundreds of industry companies, a comprehensive review of clean vehicle offerings, clean-vehicle data for fleet operators, and a new reorganized news center that is updated twice daily.

The new site contains 10 major areas, including a site map. "We've developed maps to help consumers and fleets find where to recharge or refuel their electric and natural gas vehicles," said Michael Gage, president and CEO of CALSTART.

"Now showing people how to find a dealer that has what they're interested in is the next logical step. This is just another in a steadily growing list of services we're offering on our Web site to support a new industry," Gage added.

CALSTART participants include electronic, defense, and aerospace technology firms; vehicle manufacturers; transit districts; natural gas and electric utilities, public agencies; and labor and environmental groups.

Contact: Bill Van Amburg or Dave Sotero, CALSTART, phone 818-565-5600, World Wide Web http://www.calstart.org.

(CALSTART RELEASE: 5/19)

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