Electric Vehicle Community Market Launch Manual:

A Guide to Prepare Your Community for Electric Vehicles.

VOLUME I: GENERAL POLICY-LEVEL CONSIDERATIONS

Prepared by the Electric Transportation Coalition (ETC) and the Electric Vehicle Association of the Americas (EVAA) in cooperation with the U.S. Department of Energy (DOE) and the U.S. Department of Transportation (DOT).

December 1995

Preface

Dear Reader:

Welcome to the *Electric Vehicle Community Market Launch Manual: A Guide to Prepare Your Community for Electric Vehicles*. The Manual, designed to be a how-to guide to assist communities in becoming "EV-Ready," was prepared by the Electric Transportation Coalition (ETC) and the Electric Vehicle Association of the Americas (EVAA) in cooperation with the U.S. Department of Energy (DOE) and the U.S. Department of Transportation (DOT). The ETC is a national, nonprofit organization of industry, government, academic and other interests working to promote a public policy framework that supports the development of a widespread, sustainable market for electric vehicles. EVAA is an international nonprofit membership organization working to advance the commercialization of EVs in the United States, Canada and Latin America through comprehensive public information and market development programs.

This Manual results from a program initiated by the Electric Transportation Coalition known as the EV Market Launch Framework. The Framework is designed to result in the placement of up to 5,000 EVs in as many as 10 U.S. urban jurisdictions by the end of 1997. This initiative also calls for the deployment of infrastructure systems necessary to support EVs in operation, and the preparation of communities to assure the successful introduction of product into the market. The Framework builds upon EV America, a program which tests and evaluates EV technology to assure product quality and road-worthiness.

In order to help communities develop policies and deploy the infrastructure systems necessary to support the introduction of EVs, there is a need for a series of supporting documents to assist communities in this important activity. The three volumes that comprise the *Electric Vehicle Community Market Launch Manual: A Guide to Prepare Your Community for Electric Vehicles* were developed as a result of this need. The Manual has been designed to identify issues and possible options/solutions to the development of the infrastructure necessary to support the introduction and eventual widespread use of EVs.

In order to assure that the information contained in this Manual is disseminated to those key urban jurisdictions that may wish to participate in a large-scale EV demonstration program, the U.S. Department of Energy and the U.S. Department of Transportation have joined with the ETC and EVAA to undertake a program of electric vehicle infrastructure workshops in a number of key communities around the United States. The joint government/industry EV infrastructure workshops are being organized and structured based on the information contained in this Manual.

We invite you to review this document and find out more about the important activities that need to be undertaken in order for a community to become "EV Ready." Only through the development of a large-scale demonstration of electric vehicles will we develop the knowledge necessary to build a sustainable market for electric vehicles in the United States.

Sincerely,

ETC/EVAA/DOE/DOT
December, 1995

DISCLAIMER

This Manual was prepared with the support of the U.S. Department of Energy (DOE) Award No. DE-FC07-95ID13393 and the U.S. Department of Transportation (DOT). Neither the Unites States Government, nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute its endorsement, recommendation, or favoring, by the United States Government or any agency thereof. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Organization of Manual

This *Electric Vehicle Community Market Launch Manual: A Guide to Prepare Your Community for Electric Vehicles* is designed to educate and encourage various stakeholders in an urban jurisdiction to put in place the policies and the infrastructure necessary to support a large-scale demonstration of EVs, and to prepare urban jurisdictions for the successful entry of EVs into the marketplace.

The Manual has been divided into three volumes. One volume is directed toward community leaders and others who focus on policy-related issues. Another volume is directed toward those community participants who will be charged with the actual implementation of EV-related programs and policies. The third volume is a reference guide. The three volumes are linked together by a recurring Executive Summary that outlines policy-level considerations, infrastructure planning and deployment, and the important link between adopted EV-related policies and successful infrastructure deployment.

VOLUME I: GENERAL POLICY-LEVEL CONSIDERATIONS

Volume I addresses general policy-level considerations that an urban jurisdiction may want to consider in becoming an "EV-Ready" community. Each of the five sections of the volume contains a "Highlights of Section" which provides an overview of the issues addressed. These sections are designed to provide readers with information to answer the following questions:

- Why are electric vehicles beneficial to an urban community?
- What is the status, type and availability of electric vehicles, batteries and infrastructure support systems?
- What are the challenges confronting the development of EVs?
- When is a community considered "EV Ready" from a policy perspective?

In addition, Volume I describes a variety of materials that can be referenced in support of state, local, and/or regional policies that can benefit electric vehicles and related technologies. These materials can be found in Volume III of the Manual.

VOLUME II: THE "EV-READY" COMMUNITY: INFRASTRUCTURE PLANNING AND DEPLOYMENT

Volume II is designed to assist community participants, vested with responsibilities for implementing EV-related policies at the local level, with development of an infrastructure deployment plan. This plan will aid a community in preparing for the entry of EVs into the market. Each chapter in Volume II provides information on a particular aspect of the infrastructure deployment plan. Chapters address such issues as:

- The installation of EV charging stations;
- Emergency fire and rescue training;
- Battery recycling;
- Fuel supply issues; and,
- Public education materials.

VOLUME III: ADDITIONAL SOURCE INFORMATION

The third volume includes detailed source information and case studies referenced in the first two volumes of the Manual.

Supplements/Updates to the Manual

A listing of all recipients of the Manual will be maintained by both ETC and EVAA, and any updates and/or supplements that may be produced will be provided to those on the distribution list.

Request of Readers

This Manual is intended as a tool to assist in efforts to assure that policies favorable to the introduction of EVs and the development of EV infrastructure systems are put in place. If there is a need for information not contained in this Manual, please contact the Electric Transportation Coalition (202/508-5995), the Electric Vehicle Association of the Americas (415/249-2690), the U.S. Department of Energy's National Alternative Fuels Hotline (800/423-1DOE) or the U.S. Department of Transportation (202/366-4000).

ACRONYMS

ACTS	American Coalition for Traffic Safety
AFV	Alternative Fuel Vehicle
ALABC	Advanced Lead-Acid Battery Consortium
CAAA	Clean Air Act Amendments of 1990
CARB	California Air Resources Board
CMAQ	Congestion Mitigation and Air Quality Improvement Program
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
ETC	Electric Transportation Coalition
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 1992
EPRI	Electric Power Research Institute
EV	Electric Vehicle
EVAA	Electric Vehicle Association of the Americas
GM	General Motors Corporation
ICEV	Internal Combustion-Engine Vehicle
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
IWC	National Electric Vehicle Infrastructure Working Council
LEV	Low Emission Vehicle
MITI	Ministry of International Trade and Industry
MOU	Memorandum of Understanding
NEC	National Electric Code
OEM	Original Equipment Manufacturer
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
QVM	Qualified Vehicle Modifier
SAE	Society of Automotive Engineers
TCMs	Transportation Control Measures
USABC	United States Advanced Battery Consortium
ZEV	Zero Emission Vehicle

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Executive Summary

THE "EV-READY" COMMUNITY

The authors of this Manual share a common vision of the future: a long-term, sustainable market for electric vehicles (EVs) in the United States—one where electricity is an attractive and affordable form of fuel for transportation.

Envision an enhanced quality of life resulting from the incorporation of EVs into the fabric of your community: EVs quietly pulling up to red lights, with no tailpipe emissions and using virtually no energy while at a standstill. Vehicles refueling conveniently at the home, office or shopping center while the owners are occupied with other endeavors. And, citizens benefitting from the improved air quality that could result from EVs becoming an integral part of the community's transportation network.

With passage of the Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992, the federal government recognized the important role alternative fuels can play to help improve air quality in congested, urban areas, reduce this nation's dependence on imported oil, reduce the trade deficit and improve national energy security. However, ensuring the successful introduction of alternative fuels, like electricity, into the transportation sector will require more than just the support of the federal government.

CHARTING THE COURSE

Industry has charted a course—*the EV Market Launch Framework*—to assure that the next critical steps toward a sustainable EV market are taken. With active participation of the federal government, industry will begin to "roll-out" a limited, but significant number of EVs into controlled demonstrations in a few key areas of the country. The electric utility and automotive industries, in cooperation with government, have committed to place up to 5,000 road-worthy EVs into as many as ten communities by the end of 1997.[1]

Similar to the redevelopment of a downtown corridor, the EV Market Launch Framework is designed to proceed one block at a time. This *building block* concept calls for establishing a core base of product and infrastructure in a small number of communities and then expanding that base, both within and between the communities, as technology improves, prices fall, the infrastructure matures and markets broaden. Such an incremental approach can help to assure that infrastructure investments match product availability and, most importantly, that communities can adequately plan and prepare for increasing numbers of EVs.

THE CLEAN CITIES CONNECTION

One of the current challenges to EVs is finding a *select* group of communities to embrace these vehicles as they are provided by manufacturers in limited quantities, and with limited-range batteries. Currently, 41 communities throughout the nation have been designated Clean Cities by the U.S. Department of Energy (DOE). A Clean Cities community brings fleet owners, fuel suppliers, local utilities, auto manufacturers and government together to make commitments to the creation of a viable alternative fuels market. Since a network already exists in Clean Cities communities, selected Clean Cities will be among those targeted to commence the EV Market Launch program.

Each of the designated Clean Cities is required to draft and sign a Memorandum of Understanding (MOU) between the city, its stakeholders, and DOE. The MOU describes the commitments made by the stakeholders to raise public awareness of alternative fuels and to cooperate in the administrative requirements of the national Clean Cities program.

[1]The federal government's commitment is dependent on the availability of funding, and the cost and capabilities of the electric vehicles that are available for purchase.

Many of the same stakeholders involved in the Clean Cities program will be asked to develop and sign an MOU committing them to becoming an EV-Ready community as part of the EV Market Launch Framework. Each of the EV stakeholders in the community—the electric utility(ies), the automobile manufacturer, and the state and local government—will be asked to undertake specific actions to evidence their commitment to placing EVs and supporting infrastructure into the community.

Besides several Clean Cities, other communities may be targeted sites for an EV demonstration program. For example, if a community has evidenced a significant interest in EVs through the conduct of EV research, development and demonstration projects funded through the Departments of Transportation, Energy or Defense; participation in EV demonstration programs underway by original equipment manufacturers; participation in EV America; and/or the organization and conduct of other EV and infrastructure-related activities, that community also may be among those targeted to commence the EV Market Launch program.

As the Clean Cities program has learned, local business and government leaders are the key participants to assuring that a given community can participate successfully in the development of a sustainable market for EVs in the U.S. These local policy and opinion makers hold the key to assuring that the necessary actions are taken so that a community becomes "EV Ready." The advent of the EV will not be a simple substitution of one vehicle technology for another. Because EVs have special charging needs and currently have limited travel ranges, their introduction will create the need for an expansion of the infrastructure which currently supports the automobile.

ADDRESSING THE KEY ISSUES

To assure the successful integration of EVs into the community, there are four basic policy issues that community leaders are being asked to consider:

- A policy framework that will encourage the purchase and support the use of electric vehicles in the community;
- Building, electrical, health and safety codes that address EV charging equipment and the training of emergency, fire and rescue personnel; and,
- A public information/awareness campaign.

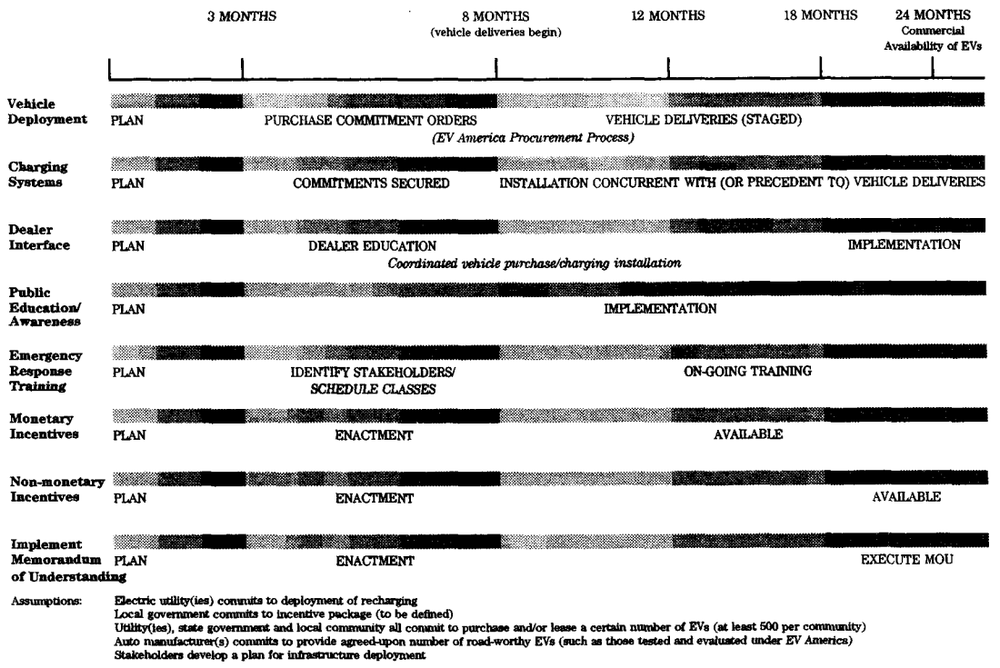
ACCEPTING THE CHALLENGE

In accepting the challenge to become "EV Ready," a community must recognize that, to be successful, appropriate policies supporting the commercialization of EVs must be set and adequate resources must be made available for infrastructure implementation. These two elements—appropriate policies and adequate resources—are interdependent. Therefore, it is critical that a coordinated effort involving all the key players be launched in order to assure the successful commercialization of EVs.

Based on the pace of implementation of infrastructure requirements already undertaken by some of the leading EV communities, it is generally believed that it will take between 18 months to two years of rigorous effort to adopt policies and begin implementing an EV infrastructure deployment plan. The graphic on the following page, entitled *"EV-Ready" Community Market Launch 2-Year Implementation Plan*, depicts the framework for activities that an urban jurisdiction needs to undertake and complete to be considered "EV Ready," and suggests a timeframe in which these activities should be achieved. The list of activities is illustrative, but should assist a community in focusing its efforts on those issues of priority for the next two years. One should not assume, however, that the EV planning and implementation can end at the conclusion of a 24-month period—as the market continues to expand, planning and infrastructure deployment must continue.

This Manual is designed specifically to assist those visionary community leaders who choose to accept the challenge to become "EV Ready."

"EV-READY" COMMUNITY MARKET LAUNCH 2-YEAR IMPLEMENTATION PLAN



The U.S. Department of Energy, the U.S. Department of Transportation, the Electric Transportation Coalition and the Electric Vehicle Association of the Americas have worked closely with the automotive and utility industries to craft this Manual, which identifies the key stakeholders necessary to undertake the effort to become "EV Ready"; defines those key issues that must be addressed; suggests approaches for achieving "EV Readiness"; provides specific information on EV/infrastructure planning and deployment to those persons charged with implementation; and, includes case studies, reports and other information that can be used to understand the elements and process involved in the introduction of EVs.

The electric utility industry is working with the federal government to assure that only road-worthy EVs are placed into demonstrations through a vehicle test and evaluation program known as EV America. The automotive and electric utility industries are working together to assure that adequate incentives (monetary and non-monetary) are in place to help jump-start the technology introduction and to assure the purchase and use of the vehicles. And, the federal government is working in conjunction with industry to assure that communities are prepared to attract and support EVs as they become available.

This Manual represents a central element of the EV Market Launch Framework—preparation of communities for the commercial availability of electric vehicles.

TIMELINE OF MAJOR EV MILESTONES

1973

Organization of Petroleum Exporting Countries (OPEC) embargoes oil imports into United States. Americans experience gasoline shortage.

1976

September

President Carter enacts the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 (P.L. 94-413) authorizing the U.S. Department of Energy to conduct an Electric and Hybrid Vehicle (EHV) Program.

1990

January

General Motors Corporation unveils the *Impact*, a sporty two-seat, purpose-built EV at the Los Angeles Auto Show.

April

GM announces production of the *Impact* by mid-1990's.

November

President Bush signs the Clean Air Act Amendments of 1990 (P.L. 101-549) into law.

****

California Air Resources Board adopts regulations that require two percent of the vehicles offered for sale by major manufacturers in the State of California in 1998 be Zero Emission Vehicles (ZEVs).

1991

January

The United States Advanced Battery Consortium (USABC), a partnership between the Big Three automobile manufacturers, with participation from the Electric Power Research Institute and U.S. Department of Energy, is formed.

March

The National Electric Vehicle Act of 1991 is introduced by Representative George Brown (D-CA) and Senator Jay Rockefeller (D-WV). Major portions of this legislation are incorporated into the Energy Policy Act of 1992 (P.L. 102-486).

1992

January

Massachusetts adopts the California Low Emission Vehicle Program, including the ZEV mandate.

April

New York adopts California Low Emission Vehicle Program, including the ZEV mandate.

May

Solectria's *Force GT* sets distance record of 84 miles, on a single charge, using lead-acid batteries, during the Tour de Sol.

October

President Bush signs the Energy Policy Act of 1992 (P.L. 102-486) into law.

****

Initial funding is provided to the U.S. Department of Defense for EV and related infrastructure research, development and demonstration projects.

****

The Japanese Ministry of International Trade and Industry (MITI) announces a program to place 200,000 EVs on the road in the Tokyo and Kanagawa areas by the year 2000.

1992 (cont'd)

October (cont'd)

Mercedes-Benz, BMW, Audi, Opel and Volkswagen announce a $30 million, 60-electric vehicle test and evaluation program on Rugen Island in Germany.

December

After reassessing the business climate for EVs, GM discontinues the *Impact* production program.

1993

April

Chrysler Corporation begins placement of its prototype *TEVans* into electric utility fleets.

****

President Clinton issues Executive Order 12844 committing the federal government to significant purchase of alternative fuel vehicles for fiscal years 1993 through 1995.

****

Ford Motor Company announces plans to place 81 *Ecostars* into electric utility and other fleets.

December

Residents of La Rochelle, France begin 18-month test-drive program of electric *Peugeot 106s* and electric *Citroen AXs*. Mayors in 25 cities in France sign protocols to provide supporting infrastructure for EVs.

1994

February

Ozone Transport Commission votes in favor of recommending that the U.S. Environmental Protection Agency impose a California-style "Low Emission Vehicle" Program in the northeastern states.

March 11

The land speed record for EVs is set by General Motors' *Impact* with a recorded speed of 183.075 mph.

May

Solectria's *Force RS* sets distance record of 214 miles, on a single charge, using Ovonic nickel-metal hydride batteries during Tour de Sol.

July

General Motors launches the GM PrEView Drive Program, a two-year, consumer-oriented nationwide field test of EV technology and inductive charging infrastructure.

September

National Electric Vehicle Infrastructure Working Council announces an agreed-upon definition for three charging levels for EVs.

****

GM Ovonic, the joint venture between General Motors and Ovonic Battery Company, announces that limited production of the Ovonic nickel-metal hydride battery will begin in 1996.

October

EV America begins 30-day performance evaluation of nine EVs supplied by five different manufacturers in Phoenix, Arizona.

November

Peugeot/Citroen announces that it will begin commercial production of EVs in France in 1995.

December

The Environmental Protection Agency approves the Low Emission Vehicle program petition submitted to the Ozone Transport Commission.

1995

January

The Society of Automotive Engineers (SAE) adopts the *Electric Vehicle Inductive Charge Coupling Recommended Practice* (J1773).

April

Ford announces that it intends to sell Ford Ranger pickup truck "gliders" to Qualified Vehicle Modifiers (QVM)—companies that will convert these vehicles to run on electricity.

****

Chrysler announces 1998 production plans for an electric minivan (the NS series) that will incorporate the Electrosource Horizon advanced lead-acid battery.

May

Solectria's *Sunrise* EV sets distance record of 238 miles, on a single charge, using Ovonic nickel-metal hydride batteries during the Tour de Sol.

****

General Motors, the Los Angeles Department of Water and Power, and Southern California Edison announce that the 79 Los Angeles-area test-driver participants in GM's PrEView Drive Program reported the *Impact* met their daily driving needs 83 percent of the time, and added that this percentage would increase with a greater vehicle range and as a more extensive public charging infrastructure is put in place.

June

Ford announces that in 1998 it will offer for sale an electric version of the Ford Ranger pickup truck.

July

68 investor-owned utilities sign "letter of intent" to purchase EVs to comply with the alternative fuel providers provision under the Energy Policy Act of 1992.

August

EV America begins 17-month test and evaluation of prototype and production EVs, some equipped with advanced batteries, at a Phoenix, Arizona proving ground.

HIGHLIGHTS OF SECTION

PURPOSE OF SECTION:

In order for a community to attract and embrace electric vehicles (EVs) as a new form of transportation, the stakeholders in that community (i.e. the electric utilities, local governments and citizens) are being asked to foster the development, deployment, and promotion of incentive programs that are necessary to assure early vehicle sales and to encourage investment in EV infrastructure support systems.

This section of the Manual defines an "EV-Ready" community from a policy perspective; identifies suggested steps to be undertaken by community stakeholders to support the widespread use of EVs; and provides a graph depicting a conceptual path that community leaders may want to consider as a process for achieving "EV readiness."

ISSUES ADDRESSED:

- What activities must be undertaken in order for a community to be deemed "EV Ready"?
- What is the process for becoming "EV-Ready"?
- Who are the stakeholders that should be involved in the "EV-Ready" planning process?
- What sort of timetable should the community follow in order to support the delivery of EVs into the community?

GENERAL CONCLUSIONS:

The activities that a community is being asked to undertake to become "EV Ready" include the adoption of incentives (monetary and nonmonetary) to encourage EV use and infrastructure deployment; development of a plan to deploy charging equipment; assessment and modification of building, electrical and safety codes for expedited deployment of charging equipment; and, execution of a public information/awareness campaign.

A formal process can be undertaken by the EV stakeholders in the community to develop a scope of work and set a schedule for completion of the tasks required to become an "EV-Ready" community.

Since EVs likely will be introduced gradually into a community, the community needs to anticipate the pace of vehicle introduction, and stage the rate at which required EV-related activities are addressed and accomplished in accordance with that vehicle "rollout" timetable.

What Does It Mean to be an "EV-Ready" Community?

In order for a community to attract and embrace EVs as a form of transportation for the 21st century, the stakeholders in that community (*i.e.* the electric utilities, local governments and citizens) are being asked to foster the development, deployment and promotion of incentive programs that are necessary to assure early vehicle sales and encourage investment in EV infrastructure support systems. Simply stated, a community can be defined as "EV Ready" once it has put in place the following elements:

- **A policy framework that will encourage the purchase of, and support the use of, electric vehicles in the community.**

  Possible Action(s):
  - Identify incentives (financial and other) necessary to encourage the use of EVs.
  - Adopt incentives (financial and other), policies and programs to support EV development in the community.

- **Building, electrical, health and safety codes that allow for expedited and cost-effective deployment of charging equipment and the training of emergency, fire and rescue personnel.**

  Possible Action(s):
  - Adopt model codes.
  - Accomplish needed local code revisions.
  - Implement policies that encourage fire and rescue personnel to be trained in EV emergency response protocols.

- **A plan and schedule for the deployment of charging equipment.**

  Possible Action(s):
  - Establish charging system and system safety needs.
  - Create incentives for installing charging facilities.

- **A public information/awareness campaign.**

  Possible Action(s):
  - Conduct EV ride-and-drives.
  - Design a media campaign.

While the definition of an "EV-Ready" community may be stated simply, getting prepared for the market entry of EVs is not so simple and will take time.

SUGGESTED PROCESS FOR BECOMING "EV READY":

The various steps that could be taken by a community to put in place the four elements of "EV Readiness" defined above can be accomplished through the following suggested process:

STEP ONE: Establishment of an EV Stakeholders Group

- Includes all parties necessary to assuring elements of EV Readiness are accomplished.

STEP TWO: Execution of a Memorandum of Understanding (by Stakeholders Group) or resolutions

- Memorandum of Understanding (MOU) commits parties to undertaking the actions necessary to become an "EV-Ready" community. Alternatively, each stakeholder can adopt one or more resolutions tailored to its mission.
- Communities that have executed an MOU as a participant in the U.S. Department of Energy Clean Cities program already have evidenced their commitment to transition to the use of alternative fuels and will have identified many of the key stakeholders that need to be brought together to prepare for the entry of EVs into the community. Consider executing an EV-specific MOU that would be appended to the Clean Cities MOU.

STEP THREE: Formation of four committees, each of which concentrates on one of the four elements of "EV Readiness" (see graph on next page)

- Stakeholder Group members are assigned appropriate committee(s).
- Committees devise a schedule for accomplishing tasks, and report to the Chair of the Stakeholders Group (should be a high-level representative of the local government(s)).
- Integrate, if necessary, the four elements of EV Readiness into existing Clean Cities Working Groups.

STEP FOUR: Regular meetings of the full Stakeholders Group to report on the progress of the committees.

WHEN DOES A COMMUNITY NEED TO BE "EV READY"?

Based on the pace of implementation of some of the leading "EV communities," it is now generally believed that it will take between 18 months to two years of rigorous effort to adopt policies and begin implementing an EV infrastructure deployment plan.

Just as it is anticipated that EVs will be introduced gradually into the community, it is anticipated that a community will be afforded the opportunity to stage, over some period of time, the preparations required for EV introduction. Therefore, it should not be assumed that every single element of the "EV-Readiness" plan must be completed before any vehicles can be introduced into the community. All of the stakeholders in the community will need to work together to ensure that the required steps are taken to create an environment that is conducive to the introduction of vehicles into the community.

STEP THREE: ONE POSSIBLE CONCEPTUAL PATH TO COMMUNITY "EV-READINESS":

STAKEHOLDERS GROUP
Chair: Principal Community Official

EXECUTE FORMAL AGREEMENT TO BECOME EV-READY

FORMATION OF THE FOUR COMMITTEES

POLICY COMMITTEE

Examples of Membership:

- Fuel Provider
- Vehicle Manufacturer
- Vehicle Dealer
- City Council Member
- Utility Commissioner
- Community Advisory Council
- Insurance Industry

Action Items

Identify incentives (financial and other) necessary to encourage the use of EVs

Adopt incentives (financial and other), policies & programs to support EV development in the community

INFRASTRUCTURE COMMITTEE

Examples of Membership:

- Environmental Planner
- Transportation Planner
- Land-use Agency
- Building Owners & Managers
- Electric Utility
- Vehicle Dealer
- Fleet Owner
- Recharging Equipment Supplier

Action Items

Establish charging system, battery recycling, and system safety needs

Create incentives for installing charging stations

Prepare Load Management Plan

PUBLIC INFORMATION COMMITTEE

Examples of Membership:

- Public Agency
- Electric Vehicle Advocate
- Educator
- Business Community
- Environmental Community

Action Items

Conduct EV Ride & Drives

Educate community about benefits of EVs

Design a media campaign

Assess the market for EVs

ELECTRICAL/BUILDING CODES COMMITTEE

Examples of Membership:

- Electric Utility
- Residential/Commercial Developer
- Recharging Equipment Supplier
- Building & Electrical Code Official
- Fire Marshal
- Fleet Owner
- Emergency Response Organization

Action Items

Develop model codes (Bldg, Health & Electrical)

Accomplish needed local code revisions

Educate inspectors

Prepare and conduct Safety Training Program

Note: Supporting documents providing further information on the implementation of these action items can be found in Volume III of the Manual.

HIGHLIGHTS OF SECTION

PURPOSE OF SECTION:

Federal and state policies have been put in place requiring the U.S. to increase the use of alternative fuels. This section of the Manual addresses why an urban area may want to consider incorporating EVs into the community. The section also provides a general overview of the federal and state regulations and programs that have been put in place to encourage the use of alternative fuel vehicles in the U.S.

ISSUES ADDRESSED:

- Environmental Benefits
- Energy Independence
- Efficient Use of Electricity Generation
- Convenience of Charging
- Consumer Interest
- Potential for Economic Development
- Existing Regulations and Programs

GENERAL CONCLUSIONS:

Given that EVs do not emit any tailpipe pollutants, many urban areas could benefit from incorporating electric modes of transportation into the community.

The transportation sector (air, ground, water, etc.) currently accounts for approximately two-thirds of all U.S. petroleum use and roughly one-fourth of total U.S. energy consumption. The gap continues to widen between our demand for petroleum and our domestic petroleum production. According to the U.S. DOE, this gap is projected to rise to at least seven million barrels of oil per day by the year 2010.

A variety of federal laws, regulations and programs have been put in place to encourage the U.S. transportation providers and fleet users to use alternative fuels, including electricity.

Field tests conducted by domestic and foreign vehicle manufacturers and electric utilities are indicating that consumers are excited about many of the prospects of driving EVs, but are not willing to pay a high differential price for a vehicle with limited range.

Benefits to the Community

General Benefits

ENVIRONMENTAL BENEFITS

Electric vehicles (EVs) emit no tailpipe pollutants; therefore, they produce no emissions at street level, which is particularly important in highly polluted and congested urban areas where poor ambient air quality can pose a health risk.

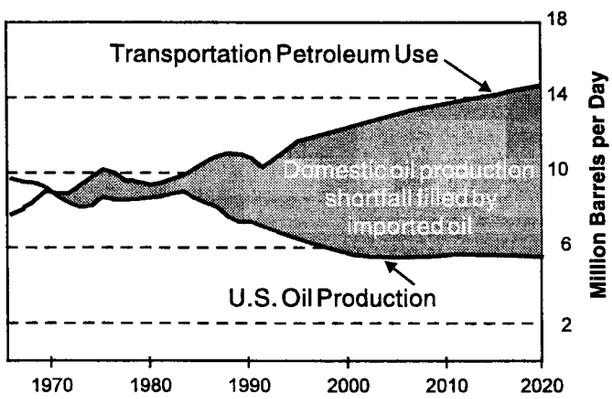
Although EVs do not emit tailpipe pollutants, some emissions are associated with the operation of electric power plants. Electricity generation—regardless of the fuel source—emits virtually no carbon monoxide or hydrocarbons. Powerplant emissions vary, based on the fuel used to produce the electricity that charges the vehicle's batteries. Electric utilities employing coal, oil or gas do contribute nitrogen oxide and/or sulfur dioxide emissions at the powerplant. Although sulfur dioxide emissions might be expected to increase—if coal-burning plants are used to generate additional electricity to charge EVs—the Federal Clean Air Act caps sulfur dioxide emissions across all power plants, *thus precluding any overall increases in these emissions.* Thus, increased electricity for EVs will not result in sulfur dioxide emissions above already statutorily prescribed levels. The generation of electricity by nuclear power, hydropower, or other renewable sources (*e.g.*, wind or solar), does not emit these pollutants.

ENERGY BENEFITS

Energy Independence

The transportation sector (air, ground, water) currently accounts for approximately two-thirds of all U.S. petroleum use and roughly one-fourth of total U.S. energy consumption. For every one percent conversion from the existing national fleet of vehicles to alternative fuels, we could reduce petroleum usage in the transportation sector by an equivalent one percent.

Furthermore, the gap continues to widen between our demand for petroleum and our domestic petroleum production. According to the DOE, this gap is projected to rise to at least *seven million barrels of oil per day* by the year 2010. The current gap requires large oil imports that add $40 to $50 billion annually to the nation's trade deficit.[1] By contrast, the electricity needed to charge EVs is abundant (if off-peak charging is utilized), domestically produced, and generated from diverse fuel sources.



The gap between transportation petroleum use and domestic crude oil production is projected to continue to widen.

Efficient Use of Electricity Generation

An additional benefit of EVs is their potential to efficiently utilize generation capacity at power plants. EV batteries are expected to be charged primarily during off-peak (nighttime and weekend) hours as a result of favorable rates that are available during those periods. Through off-peak charging, EVs can take advantage of underutilized utility generation capacity, thereby improving the utility's overall efficiency. These improvements could help to stabilize rates to all electricity consumers.

CONVENIENCE OF CHARGING

The majority of charging for EVs is expected to be at the location where the vehicles are routinely housed. For the residential customer, the ability to charge a vehicle during the night while sleeping may be more appealing than making trips to the local service station. In the future, it is expected that commercial stations will provide convenient, fast-charging service away from home.

The charging system design for EVs will do more than just charge the battery. While parked, the EV charging system, with built-in intelligent circuitry, will be able to make sure the batteries are fully charged, but not overcharged. Industry is planning charging systems with communication links to facilitate automatic billing, load management, vehicle security and other functions.

CONSUMER INTEREST

Evidence is mounting that potential consumers in the U.S. and abroad are excited about the prospects of driving EVs. Domestic and foreign automobile manufacturers, often in cooperation with electric utilities, are conducting field tests of EVs to gauge potential customers' reactions to currently available EVs.

GM PrEView Drive

In July, 1994, General Motors Corporation (GM) launched the GM PrEView Drive Program, a two-year, consumer-oriented nationwide field test of EV technology and inductive charging infrastructure. During the six-month period of July to December, 1994, 79 Southern Californians test-drove the GM *Impact* EV as their primary mode of transportation in the Greater Los Angeles area for either a two-or four-week period. This test and evaluation program was conducted with the cooperation of the Los Angeles Department of Water and

[1]*EPAct Initiatives for Alternative Fuel Vehicles, An Integrated Approach for Implementing the Energy Policy Act,* U.S. Department of Energy, March, 1995.

Power and Southern California Edison Company.

According to the PrEView Drive results from Southern California, the test-drive participants who were loaned an *Impact* said the vehicle met their daily driving needs 83 percent of the time and that this percentage would increase with a greater vehicle range and as more extensive public charging infrastructure is put in place. What the drivers liked most about the *Impact*, in preference order, is its acceleration, charging safety and convenience, and environmental benefits. Comments from the drivers about the car have indicated that it is fun to drive, and that they enjoy the vehicle's quietness and smooth acceleration. While customers were generally pleased with the vehicle, the following concerns about the vehicle and the technology were expressed: maximum trip range (70–90 miles), vehicle price, and battery cost/replacement.

The $32 million GM PrEView Drive Program will continue in cities across the U.S. through mid-1996. When the program is complete, nearly 700 test drivers in 11 U.S. cities will have driven the *Impact* over 400,000 miles.

La Rochelle EV/Infrastructure Demonstration Program

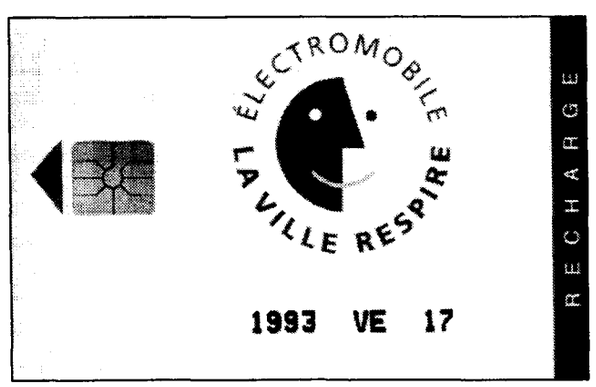
In December, 1993, residents of La Rochelle, France were asked to test 25 electric *Peugeot 106s* and 25 electric *Citroen AXs* for a period of 18 months. The objective of this demonstration program was to provide PSA Peugeot Citroen, Electricite de France (the state-owned electric utility company) and the City of La Rochelle the opportunity to study a number of parameters with a view to marketing EVs in France in 1995. The participants in the demonstration program gave an 8.4 rating out of 10 for overall satisfaction with the EVs. Furthermore, the participants did not change their usual driving habits with the EVs. Their average driving speed and trip duration were comparable to their gasoline-powered vehicle habits.

EV demonstration programs and surveys suggest that many consumers are interested in EVs, but are unwilling to pay a premium for a vehicle with limited range and performance. As battery technologies improve, infrastructure systems are put in place, and more consumers are educated about the benefits and convenience of electric modes of transportation, it appears that consumers will be willing to integrate EVs of various types into their modes of transportation.

POTENTIAL FOR ECONOMIC DEVELOPMENT

Businesses that integrate EVs into their fleets may have the potential for future mobile/stationary source trading if a program is designed and approved by regulators. In other words, instead of being required to put expensive emission control devices on the stationary source emitting the pollution, businesses could invest in EVs, thereby reducing emissions from their fleet vehicles.

EVs also represent a potential export market. As countries around the globe begin to assess their transportation requirements, they may begin to look to EVs to fulfill some of their needs. Particularly, developing countries which currently lack a mature transportation infrastructure (e.g., fueling, roads and servicing) may be candidates for the introduction of electricity as a transportation fuel.



"Smart-Card" for La Rochelle's EV charging stations

Assisting Communities in Complying with Federal & State Regulations and Programs

Electric vehicles (EVs) have been targeted by the federal government as a transportation technology that has the potential to reduce our nation's dependence on imported oil and to improve air quality in the U.S. In order to introduce EVs into a community, it is important to have an understanding of the mechanisms that have been put in place at the federal and state levels to encourage the transition to alternative fuels. The following information provides a synopsis of existing laws and regulations impacting EVs.

CLEAN AIR ACT AMENDMENTS OF 1990

One of the primary environmental drivers for the utilization of EVs is the Clean Air Act, as amended in 1990. While the Clean Air Act does not contain specific requirements for use of EVs, compliance strategies may include the acquisition and use of EVs by fleet operators and others. The Clean Air Act requires the introduction of "clean fuel vehicles" in many areas of the nation beginning in the latter part of this decade. The Clean Fuel Fleet Program requires each state containing nonattainment areas with a 1980 population of 250,000 or more to establish a clean fuel vehicle program for covered fleets. Beginning in model year 1998, an increasing percentage of new vehicles added to covered fleets must be clean fueled. EVs will qualify as clean fuel vehicles, and acquisition of EVs could be part of a fleet operator's compliance strategy.[1]

ENERGY POLICY ACT OF 1992 (EPAct)

In order to reduce this nation's dependence on imported oil and thereby increase our energy security, the federal government enacted the Energy Policy Act of 1992. EPAct imposes mandatory requirements for the acquisition of alternative fuel vehicles (AFVs) by federal fleets, state government fleets and fleets operated by "providers" of alternative fuels. EPAct also gives the U.S. Department of Energy authority to require private and municipal government fleets to acquire alternative fuel vehicles if such programs prove necessary to enable the nation to make progress toward the replacement of petroleum fuels in the transportation sector. EVs are specifically identified as meeting fleet requirements under EPAct. Furthermore, EPAct provides tax incentives for the purchase of EVs and the installation of refueling property.[2] A chart comparing the new alternative fuel vehicle requirements for affected vehicle fleets under the Clean Air Act Amendments of 1990 and EPAct is on the next page.

CLEAN CITIES PROGRAM

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 the voluntary action of 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.

Clean Cities builds on local initiatives, provides options to local problems, and creates

[1]A more detailed description of the implications of the Clean Air Act Amendments of 1990 for electric vehicles, including market-based mechanisms to achieve air quality standards, can be found in Volume III of the Manual.

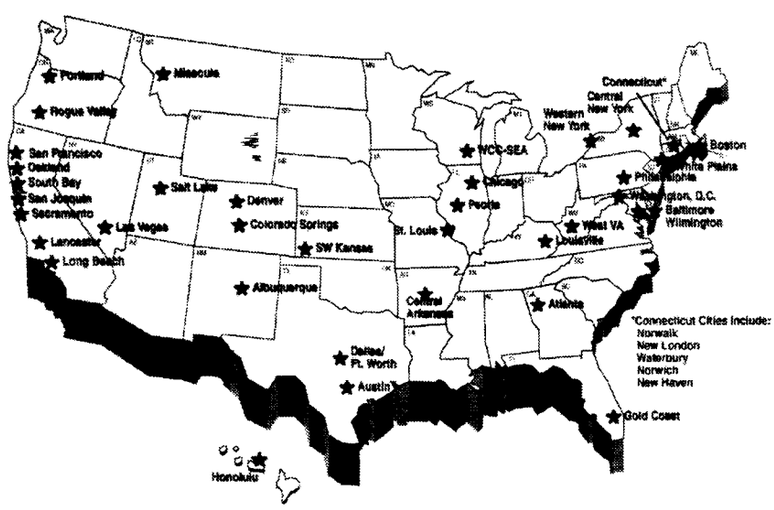
[2]For additional information on the EV and EV infrastructure-related programs and tax incentives authorized under EPAct, and a summary of the EPAct fleet requirements as compared to the Clean Air Act and California requirements, please refer to Volume III.

AFV ACQUISITION REQUIREMENT FOR AFFECTED FLEETS

Year	Clean Air Act		Energy Policy Act			
	Gross vehicle weight < 8,500 lbs. (% of CFVs)[a]	Gross vehicle weight < 26,000 lbs. (% of CFVs)	Federal[b] (% or Number of AFVs)	State (% of AFVs)	Fuel Provider (% of AFVs)	Municipal/ Private[c] (% of AFVs)
1993			7,500[d]			
1994			11,250[d]			
1995			15,000[d]			
1996			25%	10%	30%	
1997			33%	15%	50%	
1998	30%	50%	50%	25%	70%	
1999	50%	50%	75%	50%	90%	20%
2000	70%	50%	75%	75%	90%	20%
2001	70%	50%	75%	75%	90%	20%
2002	70%	50%	75%	75%	90%	30%
2003	70%	50%	75%	75%	90%	40%
2004	70%	50%	75%	75%	90%	50%
2005	70%	50%	75%	75%	90%	60%
2006	70%	50%	75%	75%	90%	70%

[a] Clean fuel vehicles
[b] Fiscal Year for federal fleet acquisition requirements; Model Year for all others.
[c] May be required if DOE finds these voluntary acquisitions unlikely to be met.
[d] As required by Executive Order No. 12844.

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 through the Clean Cities "mayor-to-mayor" network, by relating local problems to state and federal objectives, and by providing on-going feedback to the 1,200+ industry and government stakeholders, Clean Cities can continually pioneer innovations and aspire to effect national as well as local achievements.



42 cities currently participate in the U.S. DOE Clean Cities Program.

CALIFORNIA LOW EMISSION VEHICLE PROGRAM

As part of the State of California's response to the requirements of both the Federal and California Clean Air Acts, the California Air Resources Board (CARB) has adopted a series of regulations imposing stricter limitations on emissions from motor vehicles operated in the State than those in the rest of the country. The program also requires that, beginning in 1998, two percent (roughly 20,000) of the vehicles offered for sale in California by manufacturers with volume sales in the State of over 35,000 vehicles per year (*i.e.*, the seven largest manufacturers) must be zero emission vehicles (ZEVs). Currently, only EVs qualify as ZEVs. By 2003, the ZEV requirement will apply to 10 percent of all vehicles offered for sale in the State.

OZONE TRANSPORT COMMISSION LOW EMISSION VEHICLE PROGRAM (OTC LEV)

To combat the movement of ground-level ozone across state lines, Congress established the Ozone Transport Region (OTR) during consideration of the Clean Air Act Amendments of 1990. The OTR was formed based on the recognition that the transport of ozone and ozone precursors throughout the Northeastern states may render the Northeast states' attainment strategies interdependent. The commission representing the OTR, the Ozone Transport Commission (OTC), petitioned the U.S. Environmental Protection Agency (EPA) to impose the California Low Emission Vehicle program throughout these states. The OTC petition gives states the option of adopting a ZEV mandate modeled on the California regulation. Massachusetts and New York also have adopted the California ZEV requirement as an additional air quality improvement measure. EPA approved the OTC petition in December, 1994. (However, in lieu of the current OTC LEV program, EPA has encouraged states to consider a *National LEV Program* and indicated that it would provide air quality benefits equal to, or greater than, those proposed in OTC LEV. This alternative would require that by 2001, 100 percent of new vehicles sold nationwide, except in California, would be required to meet the California LEV emissions standards. Negotiations on these issues continue between the states, the domestic automobile industry, EPA and other interested parties.)

CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT (CMAQ) PROGRAM

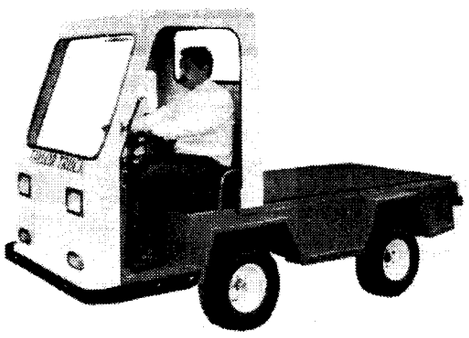
The Congestion Mitigation and Air Quality Improvement (CMAQ) Program is an innovative $6 billion program established by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). These funds are allocated to states which may use them for transportation control measures (TCMs) and programs designed to help states implement their transportation/air quality plans and attain the national standards for carbon monoxide, ozone and, in some cases, small particulate matter. State programs may be eligible to receive CMAQ funds for conversion of public fleet vehicles to alternative fuels, including electricity.

Local EV-Related Activities in Your Community

The purpose of this section of the Manual is to provide the stakeholders in the community with information about the activities underway/planned by the local utility(ies), state and local governments, business community and others to promote the development, demonstration and commercialization of EVs. As an EV advocate, please use this section of the Manual to describe the local activities industry and government have undertaken to showcase EVs and support infrastructure technologies.

Examples of local EV-related activities could include:

- electric transit, trolley and school bus demonstrations;[1]
- airport electrification which calls for the replacement of conventional fossil-fueled vehicles used at airports, such as transport buses, food delivery trucks and baggage handling equipment, with electric counterparts;
- demonstrations of station cars, battery-powered vehicles commuters drive to and from public transit stations;
- urban electric rail transit projects such as subways, light rail and commuter rail; and,
- projects to develop, demonstrate and commercialize EV/ infrastructure technologies.



A Taylor-Dunn utility vehicle, the *Taylortruck*

Electric school bus, built by Blue Bird and Westinghouse, operating in California's Antelope Valley School District

[1]For additional information on manufacturers of electric buses and sites where electric buses are in operation, please refer to Volume III.

HIGHLIGHTS OF SECTION

PURPOSE OF SECTION:

As EVs begin to enter the commercialization phase, the spectrum of challenges, depending on the local jurisdiction, can be quite varied. This section of the Manual outlines some of the challenges that must be dealt with and proposes solutions to ensure the successful introduction of EVs.

ISSUES ADDRESSED:

- EV Range and Battery Technology
- EV Range and Charging Facilities
- EV Price and Availability
- Emergency Assistance
- Building and Electrical Codes
- Electricity Supply
- Service and Maintenance
- Public Education

GENERAL CONCLUSIONS:

EV range can be increased with advanced batteries. EV stakeholders can commit to purchase EVs with advanced batteries and provide incentives to reduce the cost.

EV range can be increased with the availability of publicly-accessible charging facilities. Policymakers can adopt policies and provide incentives to deploy charging facilities.

The purchase and operating costs of EVs must be reduced, and road-worthy products must be made available. Stakeholders can reduce the costs of EVs for a limited period of time by providing incentives to purchasers.

Purchase commitments by local governments and private fleet operators will encourage EV manufacturers to make products available.

Policies to stimulate the development and deployment of EV infrastructure support systems that address emergency assistance, building and electrical codes, electricity supply, and service and maintenance will encourage consumers to purchase EVs.

The development and dissemination of a comprehensive public information program is imperative to the successful introduction of EVs.

Actions to Encourage the Widespread Use of Electric Vehicles

ELECTRIC VEHICLE TECHNOLOGY

Most major automobile manufacturers are exploring several alternatives to improve the available range of EVs. These alternatives include improvements in overall vehicle efficiency, hybrid-electric vehicle technology (vehicles that have two or more sources of energy), battery technology and the availability of EV charging facilities.

EV Range and Battery Technology

Of the above-mentioned items, probably the two most important elements to ensuring near-term success of EVs are improvements in battery technology and the availability of EV charging stations.

Advancements in battery technology that will increase energy storage capacity are expected through the research and development efforts of the Advanced Lead-Acid Battery Consortium (ALABC) and the United States Advanced Battery Consortium (USABC). The ultimate range of any vehicle, however, is dependent upon a variety of factors including the overall design of the vehicle, the terrain driven, driver habits, and weather conditions.

Issues	• Ensure that advanced battery development continues, through the United States Advanced Battery Consortium and the Advanced Lead-Acid Battery Consortium, to increase the range of EVs. • Increase advanced battery manufacturing to reduce price.

Actions	• Use local level support to encourage the federal government to continue funding advanced battery research and development. • Provide local incentive funds to help commercialize advanced batteries. • Commit locality to purchase EVs with advanced batteries.

EV Range and Charging Facilities

The widespread availability of "residential" EV charging stations and "public" EV charging facilities are expected to ease consumer con-

cerns about EV range limitations. The range issue can be partly addressed by the timely installation of charging stations in both residential structures for retail purchasers and in commercial structures for fleet purchasers. Access to public charging facilities will increase the effective range of an EV by allowing the user to "refuel" the vehicle, if necessary, and continue the trip without returning home to charge. Some public charging locations are planned for Massachusetts that are expected to have "quick" charge capability which could charge an EV in 5–10 minutes (from 80 percent to 20 percent depth of discharge).

Issues	• Timely installation of residential EV charging stations. • Availability of a suitable number of public EV charging facilities.

Actions	• Adopt policies to encourage the deployment of residential and public EV charging facilities (*i.e.*, require that new construction/building codes include EV charger wiring). • Provide incentives to businesses and homeowners to deploy EV charging facilities. • Install public charging facilities in municipal parking lots.

EV Price and Availability

The higher cost of EVs produced in limited quantities will impact the product's market potential. The higher cost is being driven by the state-of-the-art technology incorporated into the vehicle and by limited EV production. To improve the market potential for EVs, the cost to the consumer (both on a purchase and life-cycle basis) must be reduced. Studies have been conducted by the U.S. Department of Energy (May, 1995) and the U.S. General Accounting Office (December, 1994) addressing the purchase and life-cycle costs of EVs versus internal combustion-engine vehicles (ICEVs). Though the studies use different assumptions, both studies concluded that the difference between the purchase cost of an EV and ICEV will decrease as EV technology advances and EVs reach mature production levels, which may take some years. (The Executive Summaries of the May, 1995 DOE report and the December, 1994 U.S. GAO report are included in Volume III of the Manual.)

Automobile manufacturers are continuously working to reduce vehicle costs through design modifications. However, until electric vehicle technology matures, battery technology improves, and demand increases, additional measures are required to lower the cost of EVs. One method suggested to reduce these costs includes government and industry-funded incentives which not only lower the purchase price of a vehicle, but also lower its operating cost. As EV technology matures and demand increases, the cost will decrease; this will make EVs more acceptable to consumers and minimize the need for incentives.

Issues	• Reduce the purchase and operating costs of an EV. • Encourage automotive manufacturers to make road-worthy vehicles available.

Actions	• Adopt policies to incorporate EVs into the transportation mix. • Provide incentives to purchasers of EVs. • Secure commitments from local government and private fleet operators to purchase EVs.

ELECTRIC VEHICLE INFRASTRUCTURE

The study, development and deployment of EV infrastructure support systems is crucial to the successful introduction of EVs into a community. These infrastructure support systems include adequate battery recycling facilities, emergency response preparedness, adoption

of building and electrical code modifications, electricity supply, service and maintenance and public education.

Emergency Assistance

When EVs take to the road, it is imperative that firefighters, law enforcement officers and paramedics have the knowledge necessary to respond appropriately to accidents involving EVs. To prepare local emergency response personnel, in 1994 the American Coalition for Traffic Safety, in conjunction with General Motors Corporation, Ford Motor Company, Chrysler Corporation, Detroit Edison, U.S. Department of Energy and the EV consortium CALSTART, developed a training course and other materials to answer questions regarding EVs when the vehicles are involved in traffic accidents. To ensure that safety personnel are adequately prepared to deal with EV emergencies, local communities should incorporate such training into existing training programs.

Issue	• Prepare your local firefighters, law enforcement officers and paramedics to respond to accidents involving EVs.

Action	• Implement policies and programs that encourage fire and rescue personnel to be trained in EV emergency response procedures.

Building and Electrical Codes

Since EVs have certain characteristics that are different from ICEVs, this could present a challenge to code enforcement officials attempting to apply existing building and electrical codes to this new technology. Enforcement of existing codes could lead to inconsistent applications, thereby resulting in the installation of potentially hazardous EV charging facilities, overly-long lead times to install EV charging stations, and possibly the unsuccessful introduction of EVs.

At the request of the National Electric Vehicle Infrastructure Working Council (IWC), the Society of Automotive Engineers recommended to the National Fire Protection Association, Inc., that the National Electric Code (NEC) be modified to ensure the safe installation and use of EV charging equipment. The 1996 edition of the NEC will include a new provision, Article 625, to address those concerns. In addition, IWC is in the process of submitting proposals for the modification of building codes to five code organizations across the country. The adoption of these suggested building code changes is dependent on each organization's internal revision schedule. The California Building Standards Commission is in the process of adopting proposed language that would amend state codes; it is expected that such changes would become effective on July 1, 1996. Meanwhile, inspectors will be provided the proposed language in the form of guidelines.

The challenge to local communities is to ensure that national and state building and electrical codes are modified and implemented at the local level. This will help ensure the successful introduction of EVs through the avoidance of delays in residential and commercial charging facility installations. If EV-related building and electrical codes are not uniformly applied, consumer safety and the timely installation of EV charging stations may both be compromised.

Issue	• Building and electrical codes need to be modified to support the operation of EVs.

Action	• Adopt building and electrical code changes at the local level based on model code language being developed.

Electricity Supply

The availability of electricity to refuel an EV is pivotal to consumer acceptance of this form of transportation. Since all electric utilities in

the U.S. have the obligation to serve all their customers, utilities are assessing the impact of EV charging. Based on current findings, utilities are implementing policies and procedures to make certain that adequate electric power is available.

Given that most EVs, like ICEVs, will be driven during the daytime and parked during the evening hours, an opportunity exists to charge EVs during off-peak hours (nighttime and weekends) when the system-wide demand for electricity is substantially lower. According to Southern California Edison Company and the Los Angeles Department of Water and Power, these two utilities have the capability to recharge over one million EVs during off-peak hours without the addition of any new generation capacity. Fast charging at commercial and "public" charging facilities represents a significant load management challenge for electric utilities if used during on-peak (daytime) hours when the demand for electricity is generally the greatest. Utilities are working closely with the developers of fast charge technologies to reduce the impact of such systems on the electric-utility grid.

To make sure that EV charging is managed correctly, many utilities are designing new rates that encourage off-peak EV charging, and some utilities are designing load-management devices to ensure off-peak charging.

Issue	• Ensure that the local electric utility understands the impacts of EV charging on its system.

Action	• Encourage the local electric utility to adopt policies and procedures to promote charging of EVs at night and on weekends (off-peak).

Service and Maintenance

As EVs are made available for sale to the general public, the vehicle manufacturers will be expected to provide the purchaser the same level of service and maintenance that is currently available for gasoline-powered cars. Once a substantial number of EVs enter the marketplace and outlive the manufacturer's warranties, trade-technical colleges, community colleges, and independent automotive repair businesses must be prepared to provide trained service and maintenance personnel for EVs.

Issue	• EV service and maintenance will need to be available to the public.

Action	• Encourage trade-technical colleges and community colleges to offer curricula in EV service and maintenance procedures.

Public Education

Public education programs are a key link to the successful introduction of EVs. To date, automakers and EV-related organizations on a national level, and electric utilities on a local level, have developed public education programs to address the following EV issues:

- Environmental Benefits
- Energy Security
- Infrastructure
- Vehicle Development

It is important that EV stakeholders develop a comprehensive public education program tailored to their local community that addresses the above-mentioned items and provides the public a realistic framework from which to make purchase decisions.

Issue	• Balanced information regarding EVs needs to be made available to the public.

Action	• Encourage the local stakeholders group to form a public education task force.

HIGHLIGHTS OF SECTION

PURPOSE OF SECTION:

Electric vehicle (EV) technology continues to improve; however, today's state-of-the-art EV still does not offer the range of a gasoline-powered vehicle and is expected to carry a significant price premium in early, low-volume production. Furthermore, the infrastructure systems that can allow for the convenient and safe operation of EVs must be defined and then employed in advance of, or concurrent with, vehicle availability. This section of the manual provides background information on EV technology (both domestic and foreign) and infrastructure support systems.

ISSUES ADDRESSED:

- Status of Electric Vehicle Development
- Status of Electric Vehicle Charging Development
- Summary of Battery Technology

GENERAL CONCLUSIONS:

Both domestic and foreign automakers have built limited numbers of electric vehicles.

To ensure that EV recharging is managed correctly, many utilities are designing new rates that encourage off-peak EV charging, and some utilities are employing load management devices to ensure off-peak charging.

The price of advanced batteries must come down and the performance of advanced batteries must improve in order to produce and market an EV that will be widely accepted by today's consumer. This has been a continuing challenge and many individuals and companies are working to solve these problems.

Recycling of lead-acid batteries is occurring today, and sufficient recycling capacity exists to assimilate the near-term increase of batteries produced for use in EVs.

The purchase price and life-cycle costs of an EV must be reduced so that EVs can be commercially viable.

Electric Vehicle Technology

Status of Electric Vehicle Development

(As of August, 1995)

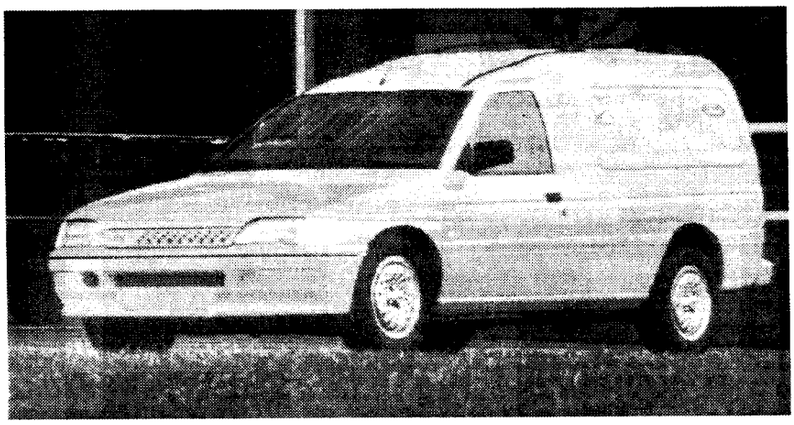
U.S. ORIGINAL EQUIPMENT MANUFACTURERS

U.S. automakers currently are focusing on the development of limited production runs of EVs. These vehicles are being tested and evaluated in the field to provide data on key performance features that are expected to be available to the consumer in the late 1990's.

Chrysler Corporation

Chrysler Corporation began placing 48 of its *TEVans*, based on the Dodge Caravan, into electric utility fleets during April of 1993. Each of the vehicles is undergoing test and evaluation by the utilities with the results being provided to Chrysler for further analysis. The *TEVan* has a payload capacity of five passengers plus 50 pounds cargo, or 800 pounds of payload. Each vehicle is powered by a 70-horsepower peak direct current traction motor with a range of 80 miles (SAE J227) between charges and a top speed of 65 miles-per-hour. One-half of the *TEVans* are powered by nickel-

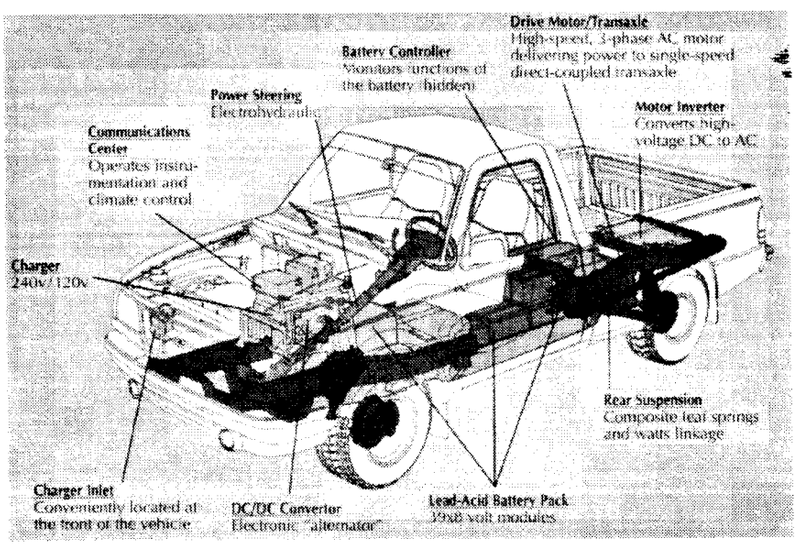
Chrysler *TEVan*



Ford *Ecostar*

iron batteries and the other half by nickel-cadmium batteries. The vehicles are recharged via a 240 volt/40 ampere or 208 volt/three phase electric circuit utilizing a traditional conductive plug and cord set. (see p. F-8)

More recently, Chrysler announced that it is developing the next generation of an electric-powered van, the NS-series, which will incorporate the Electrosource Horizon advanced lead-acid battery. The NS-series electric van is expected to be powered by a 100-horsepower alternating current motor which will provide acceleration from 0 to 60 miles-per-hour in approximately 16 seconds. The vehicle is expected to be made available by model year 1998.



Cutaway of 1998 Ford *Ranger EV*

Ford Motor Company

Ford Motor Company began placing 81 of its *Ecostars*, based on the European Escort van, into electric utility and other fleet operations in 1993. Each of the vehicles will undergo test and evaluation by fleet operators and the results will be provided to Ford for further analysis. As of May 1995, 103 of the *Ecostars* have been placed into service and driven a total of 500,000 miles. Equipped with a sodium-sulfur battery pack and a 75-horsepower alternating current induction motor, the *Ecostar* has a range of 100 miles (average of actual customer experience) between charges, a "governed" top speed of 70 miles-per-hour, and a payload of 1,020 pounds. The vehicle is recharged via a 240 volt/30 ampere or 120 volt/15 ampere electric circuit utilizing a conductive plug and cord set.

During April of 1995, Ford announced that it intends to sell Ford Ranger pickup truck "gliders"—vehicles without engines, transmissions or fuel systems—to companies that will convert these vehicles to run on electricity. Ford has indicated that the first gliders will be made available by the end of 1995 to Qualified Vehicle Modifiers (QVM) that meet specific guidelines set by Ford. TDM Worldwide Conversions has indicated that it will produce for sale, beginning in 1996, an electric version of the Ranger utilizing the Ford-provided glider; the initial price is expected to be $20,000–$24,000.

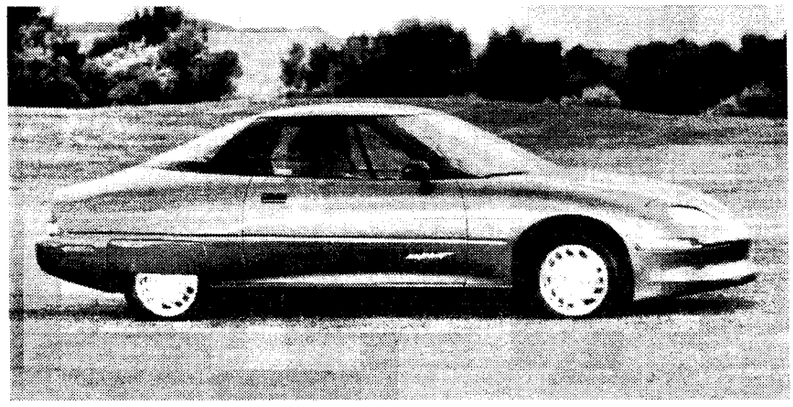
Additionally, Ford announced in June of 1995 that it will offer for sale in 1998 an electric version of the Ford Ranger pickup truck. Equipped with a sealed lead-acid battery pack and a 75-horsepower alternating current induction motor, the Ranger will have a range of up to 58 miles between charges, a governed top

speed of 75 miles-per-hour, acceleration from 0 to 50 miles-per-hour in less than 14 seconds, and a payload of 700 pounds. The vehicle is recharged via an on-board 240 volt/30 ampere or 120 volt/15 ampere charger. The initial price is expected to be about $30,000.

General Motors Corporation

In 1990, General Motors Corporation (GM) unveiled the *Impact*, a sporty two-seat purpose-built EV, and announced plans to produce and sell them by the mid-1990's. The *Impact* uses an advanced maintenance-free sealed lead-acid battery pack, and a 137-horsepower alternating current induction motor, which results in a range of 70 to 90 miles (Federal Urban Driving Cycle, 80 percent battery depth of discharge, 70°F), a governed top speed of 80 miles-per-hour and acceleration from 0 to 60 miles-per-hour in 8.5 seconds. Being designed and built as a purpose-built vehicle, the *Impact* incorporates several technological innovations such as an aluminum body structure, low rolling resistance tires, a heat pump for interior cooling and heating, and an exterior shape that substantially reduces aerodynamic drag.

In 1992, GM reassessed the business climate for EVs and discontinued the *Impact* production program. In 1994, GM announced the $32 million GM PrEView Drive Program, whereby 30 Impacts would be test driven, for two or four weeks, by 700 drivers in 11 U.S. cities over a two-year period. The PrEView Drive Program has as its goal the collection of performance data, assessment of market potential, and the testing of a new inductively-coupled charging system.



General Motors' *Impact* electric vehicle

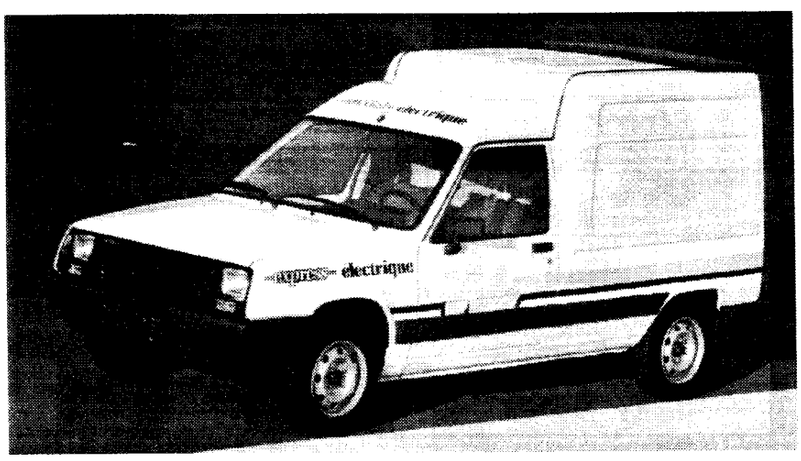
SUMMARY OF U.S. ORIGINAL EQUIPMENT MANUFACTURER EV TECHNOLOGY AS OF 1995

Attribute	**General Motors Corporation** ***Impact***	**Ford Motor Company** ***Ecostar***	**Chrysler Corporation** ***TEVan***
Acceleration	0–60 mph in 8.5 seconds	0–50 mph in 12 seconds	0–50 mph in 27 seconds
Top Speed	80 mph (electronically limited)	70 mph (electronically limited)	70 mph
Range	70–90 miles[1]	Up to 127 miles[1]	Up to 80 miles
Motor	137 HP AC Induction	75 HP AC Induction	70 HP DC Traction
Battery Pack	16.8 KWH Lead Acid	30 KWH Sodium Sulfur	Nickel Iron or Nickel Cadmium
Charge Time @ 220 Volts	2–3 hours	6 hours	6–8 hours
Charger Location/ Type	Off-Board/Inductively Coupled	On-Board/Conductively Coupled	On-Board/Conductively Coupled

[1]Based on the Federal Urban Driving Cycle.

Electric *Peugeot 106*

Peugeot *Ion*



Renault *Express Electrique*

OVERSEAS ORIGINAL EQUIPMENT MANUFACTURERS

Overseas automakers are actively pursuing EV development programs. Many of the manufacturers in recent years have shown concept vehicles and have deployed limited quantities of EVs for test and evaluation.

French Automobile Manufacturers

Peugeot/Citroën

After successful public trials in La Rochelle, France of its prototype EVs, Peugeot/Citroën (PSA) announced in late 1994 that it would begin commercial production of the *Peugeot 106* and *Citroën AX* EVs in 1995. These vehicles are scheduled to be available for sale before the end of 1995 in France. Equipped with a nickel-cadmium battery pack, the *Citroën AX* has a range of 55–100 miles between charges, a top speed of 55 miles-per-hour, and accelerates from 0–30 miles-per-hour in nine seconds. These vehicles will retail for about $3,000–$4,000 more than the corresponding gasoline-powered model (does not include the battery) but will benefit from a $3,000 rebate provided by the French government and the state-owned electric utility. The nickel-cadmium batteries will be leased for approximately $100 per month. In addition, PSA recently announced the *Peugeot Ion*, a purpose-built EV that is a precursor of an EV that PSA intends to produce before the turn of the century.

Renault

Renault has produced 52 large *Express* electric vans equipped with lead-acid batteries, and 30 smaller *Master* electric vans equipped with nickel-cadmium batteries. These vehicles are part of a one-year test and evaluation program by major fleet users located in France and other European countries. In addition, Renault is developing the *Clio* which should be available to the general public in 1996. The *Clio* is a four-passenger vehicle equipped with a nickel-cadmium battery pack and a direct current motor which offers the driver a range of 60 miles per

charge and a maximum speed of 60 miles-per-hour.

German Automobile Manufacturers

BMW

Over the last few years, BMW has shown two prototype, purpose-built EVs, the E1 and E2. The E1, a two-door, four-passenger commuter vehicle, and the E2, a four-door, four-passenger vehicle, are powered by sodium-sulphur batteries with a top speed of 75 miles-per-hour, and a range of 75 miles and 161 miles, respectively.

Mercedes-Benz

The electric vehicle program of Mercedes-Benz A.G. includes passenger cars, commercial vehicles like transporters, and small electric buses and buses with overhead lines. Mercedes-Benz A.G. has demonstrated an electric version of its new C-class, a five-passenger vehicle, that is powered by sodium nickel-chloride batteries. The actual development of an electric passenger car for the U.S. market is based on the smaller A-Class, a completely new compact vehicle. This EV is powered with a 30 KWH sodium nickel-chloride battery, minimum range of 100 miles, top speed of 75 mph, and acceleration of 0-60 mph in approximately 15 seconds.

In March of 1994, Mercedes-Benz A.G. announced that it would also manufacture a small, ultra compact EV, the Smart (Swatchmobile), the product of a joint venture with Swatch, a Swiss watch manufacturer. The production facility for the Smart Car will be built in Hambach, France with the first vehicles being delivered in certain markets in the late 1990's.

During October of 1992, Mercedes-Benz, Opel and Volkswagen began a $30 million, 60-vehicle test and evaluation program on Rugen Island in the Baltic Sea. This program, which is scheduled to be completed mid-1996, was funded in part with $15 million of German government funding.

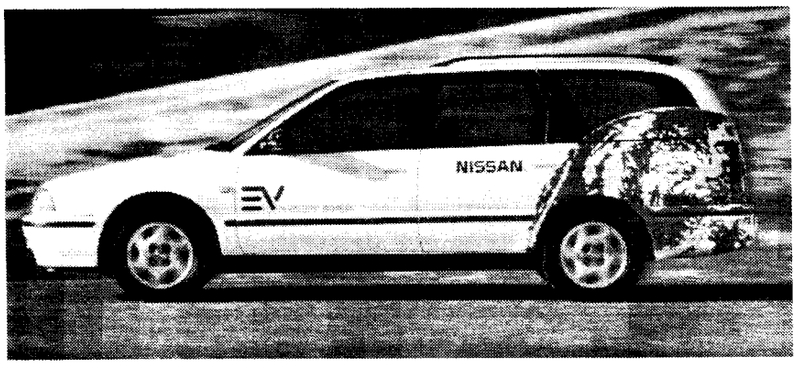
Renault *Master Electrique*

Japanese Automobile Manufacturers

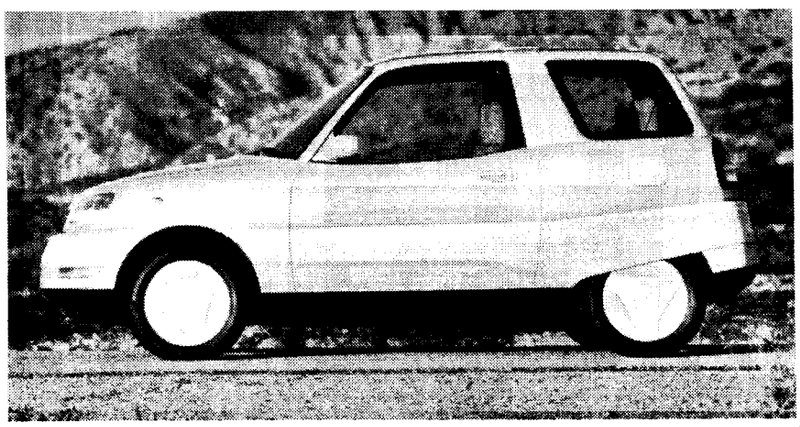
Honda

In late 1994, Honda delivered three Civic-based EVs to Southern California Edison Company and five Civic-based EVs to Pacific Gas and Electric Company for a two-year test and evaluation program. This is a two-door, four-passenger vehicle powered by a sealed lead-acid battery pack with a 40-70 mile range, and a top speed of 80 miles-per-hour. The vehicle is equipped with an on-board 120/220 volt charger with a recharge time of six to eight hours on 220 volts.

1994 Honda Civic-based electric vehicle



Nissan *Avenir*



Toyota *EV-50* concept vehicle

Mazda

Mazda has shown a two-seat electric vehicle known as the *MX-5* based on the Mazda Miata. This vehicle incorporates an alternating current motor and a nickel-cadmium battery pack which delivers 0 to 60 miles-per-hour acceleration in 14.7 seconds, a top speed of 81 miles-per-hour, and a range of 112.4 miles at 25 miles-per-hour constant speed.

Nissan

In 1994, Nissan produced the *Cedric* EV, converted from an internal-combustion-engine vehicle, for use mainly by government agencies. This vehicle is equipped with valve regulated lead-acid batteries, has a top speed of 63 miles-per-hour, a range of 25 miles under urban driving conditions, and a recharge time of five hours.

In late 1994, Nissan produced and sold the *Avenir* EV commercial van for use by utility companies in Japan. The *Avenir*, equipped with valve regulated lead-acid batteries, has a top speed of 72 miles-per-hour and a range of 50 miles under urban driving conditions.

Toyota

At the 1993 Tokyo Motor Show, Toyota unveiled the *EV-50*. This vehicle has been equipped with either a 40 kilowatt (max power) alternating current induction motor, or a 40 kilowatt (max power) direct current permanent magnet motor; the permanent magnet motor increases vehicle range. Equipped with lead-acid batteries, the *EV-50* has a range of approximately 111 miles at 25 miles-per-hour.

OTHER U.S. MANUFACTURERS OF ELECTRIC VEHICLES

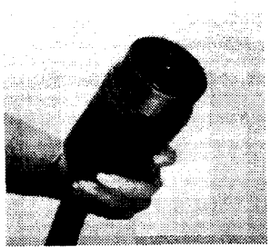
On the following page is a summary of some of the EVs now available for purchase from other U.S.-based manufacturers. These performance specifications are based on the results of a 60-day proving ground evaluation that commenced in August, 1995 of three "production" vehicles tested under EV America. The full performance specifications as published by EV America can be found in Volume III of this Manual.

With assistance from the U.S. Department of Energy's Site Operator Users Task Force program, EV America also is conducting field test evaluations of these vehicles. The objective of the field evaluations is to replicate proving ground results over an extended period of time and to demonstrate vehicle reliability. Additional proving ground evaluations of "prototype" EVs are being conducted by EV America through December, 1996. The EV America process precludes dissemination of information on the evaluation results of "prototype" category vehicles without prior approval from the manufacturer.

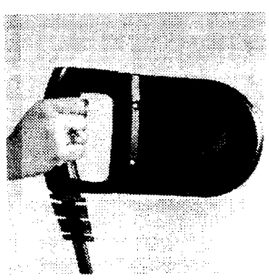
SUMMARY OF EV AMERICA RESULTS

Attribute	Solectria Force	Solectria E10 Pickup	Baker EV 100 Pickup
Vehicle Type	Converted Geo Metro	Converted Chevrolet S10	Converted GMC Full Size Pickup
Acceleration @ 50% State of Charge (SOC) (0–50 MPH)[1]	18.5 Seconds	17.4 Seconds	14.9 Seconds
Top Speed (50% SOC)[2]	69.9 MPH	67.9 MPH	71.1 MPH
Driving Cycle Range[3]	84.5 Miles	55.1 Miles	56.6 Miles
Battery	Nickel-Metal Hydride	Sealed Lead Acid	Nickel-Metal Hydride
Charge Time[4]	8 Hours 57 Minutes	11 Hours 11 Minutes	7 Hours 50 Minutes
Charger Location/Type	Trunk/Conductive	Under hood/ Conductive	Off-Board/Inductive

[1]Performance Goal: 13.5 seconds or below
[2]Performance Goal: 70 MPH in one mile or higher
[3]Performance Goal: 60 miles when subjected to the combined UDS-HWFET Drive Cycle established in SAE J1634
[4]Performance Goal: 8 hours or below



220 volt, alternating current, conductive plug and cord set



Paddle-shaped inductive couple

Status of Electric Vehicle Charging Development

Today's charging technology includes conductive (metal-to-metal contact) and inductive (magnetically coupled) charging systems.

Conductive Systems

Conductive charging systems shown to date use a plug and cord system which can vary by the type of connector used and the level of voltage and current. The charger can be located either on-board (built into the vehicle) or off-board (separate from the vehicle) depending on the design of the conductive system. In cases where the charger is located on-board the vehicle, some type of off-board control and/or interconnection device may be required.

Inductive Systems

Inductive charging systems, such as the Delco Electronics *MAGNE CHARGE*™ (Underwriter Laboratory (UL) approved), use a cord and paddle-shaped inductive couple that transfers energy from the power source to the vehicle by means of magnetic induction. The charger for the Delco inductive charging system is located off-board the vehicle.

Both the conductive and inductive systems will require electronics off-board the vehicle to provide communication and diagnostic capabilities required by recommended practices being developed.

Recently, the Society of Automotive Engineers (SAE) adopted a recommended practice for the inductive charging interface design (SAE J1773); and in 1995, SAE is expected to adopt a recommended practice for the conductive charging interface design.

Standard EV Charging Levels

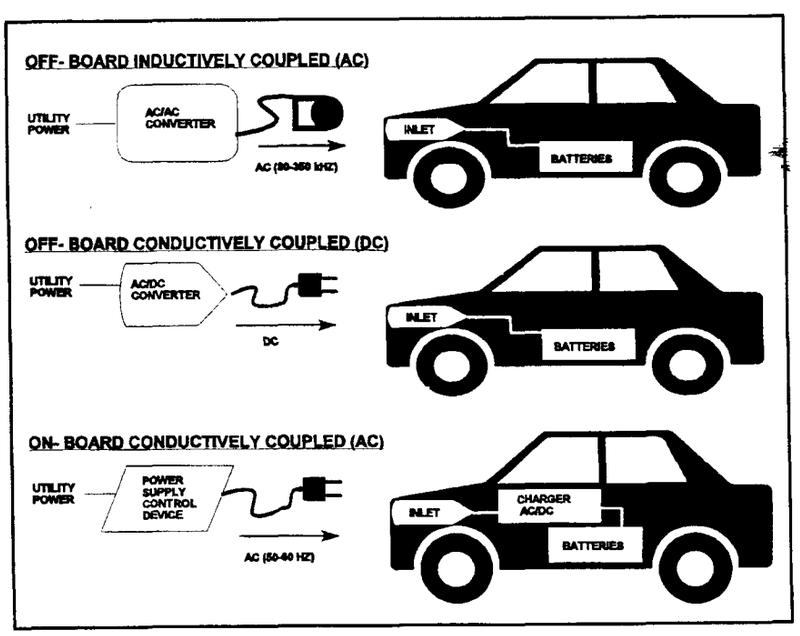
The National Electric Vehicle Infrastructure Working Council (IWC), a collaborative effort of automotive, electric utility and other interested industries, announced in late 1994 the standardization of charging levels for EVs. These include:

Level 1:
Charging that can be done from a standard, grounded 120 volt, 3-prong outlet available in all homes.

Level 2:
Charging at a 240 volt, 40 ampere charging station 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 5–10 minutes (from 80 percent to 20 percent depth of discharge), making it analogous to filling the tank of an internal combustion-engine vehicle at a gasoline station.

In conjunction with the above-mentioned charging levels, the IWC intends for future conductive charging system interfaces to be standardized.



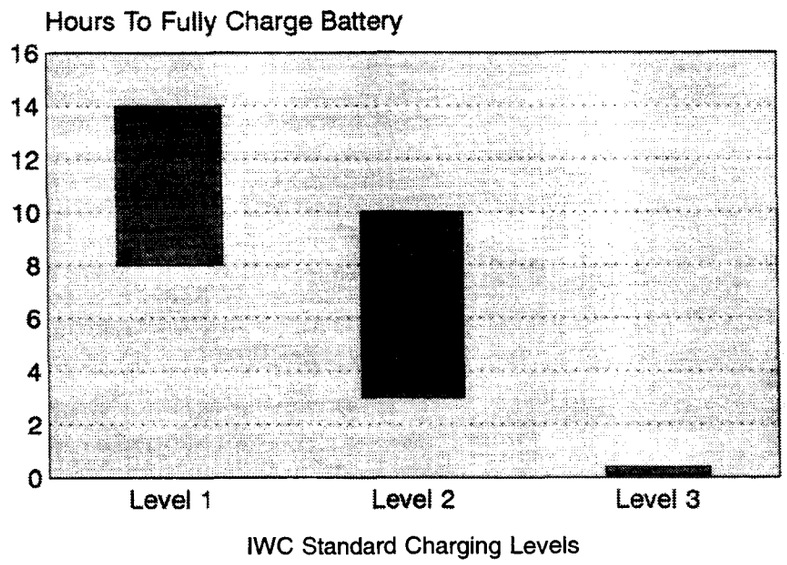
Charger alternatives

Charging Time

To fully charge an EV, today's charging technology requires that the vehicle be charged for at least two- to three-hours at 220 volts. Currently, quicker charging technologies have not been completely proven, although a significant amount of research is being dedicated to this activity. In addition, quick charging at power levels above 25 kilowatts may put extraordinary demands on the electric utility's distribution grid during daytime or peak hours.

By working to establish connector and charging standards, the automakers and electric utilities are helping to lay the foundation for the successful introduction of EVs. This will enable the electric utilities to provide the appropriate electrical service, the manufacturers to develop compatible charging systems, and the automakers to design and build compatible vehicles at the lowest possible cost.

EXPECTED ELECTRIC VEHICLE CHARGE TIMES



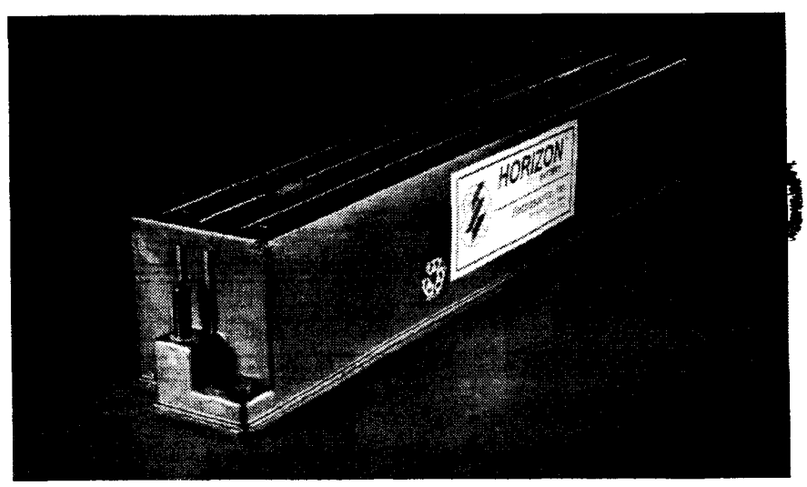
Note: Charge times vary due to battery type, temperature and other factors.

Summary of Battery Technology

BATTERY TECHNOLOGY

To provide rapid acceleration and long-distance trips, EV batteries must have high specific power[1] and high specific energy[2], respectively. Further, they must be low-cost, easy to maintain, safe under normal operating conditions, and tolerant of abuse to which vehicles are typically exposed in daily operation.

The lead-acid battery continues to be the major battery type commercially available for EVs. Research to enhance lead-acid batteries focuses on increasing specific energy, specific power and cycle life, and on decreasing maintenance requirements, volume, weight and cost.



Electrosource *Horizon* advanced lead-acid battery

[1]Specific Power is a measurement of the battery's power-to-weight ratio (or watts of power held in the battery per kilogram of mass) which in terms of the vehicle's performance translates into acceleration.

[2]Specific Energy is a measurement of the battery's energy-to-weight ratio (or watt hours of energy held in the battery per kilogram of mass) which in terms of the vehicle's performance translates into range and energy to power accessories (*e.g.*, heater, air conditioner, windows).

The Horizon advanced lead-acid battery, developed by Electrosource, is now available.

Some alkaline systems—including nickel-cadmium—have been successfully adapted for use in EVs. Nickel metal-hydride batteries, developed by Ovonic and currently being tested in vehicles, will begin limited production by GM/Ovonic in 1996.

The need to develop a battery with higher specific power, higher specific energy, and a longer cycle life resulted in the formation of the Advanced Lead-Acid Battery Consortium (ALABC) and the United States Advanced Battery Consortium (USABC).

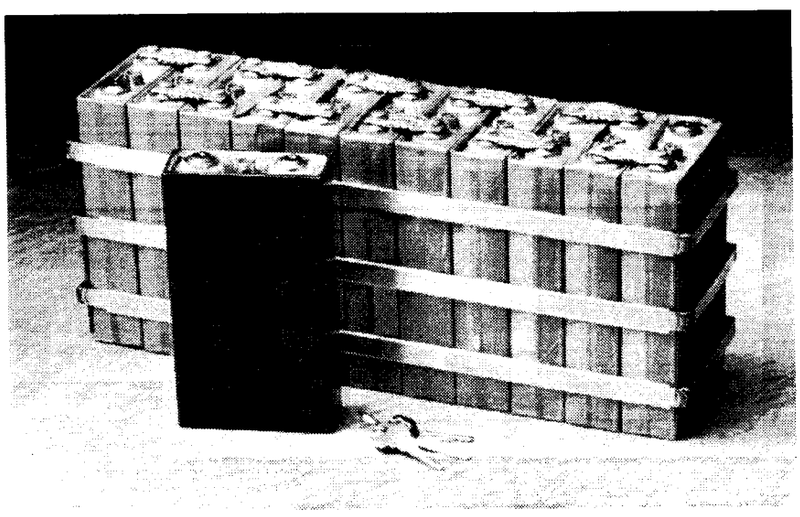
Advanced Lead-Acid Battery Consortium

Formed within the charter of the International Lead Zinc Research Organization, Inc., in March of 1992, ALABC's membership is comprised of 51 companies, including battery manufacturers, suppliers, and automobile manufacturers from 11 countries. ALABC has implemented a four-year research plan at a total funding level of $19.3 million, half of which comes from industry contributions and half from government grants and contractor-matching funds. To date, the Federal Transit Administration of the U.S. Department of Transportation has provided $1.2 million in funding to ALABC. ALABC has identified five critical goals to improving lead-acid batteries for use in EVs:

- Improve Specific Power—150 watts per kilogram at 80 percent depth-of-discharge.
- Improve Specific Energy—50 watt-hours per kilogram at a three-hour discharge rate.
- Improve Battery Life—three years or over 500 cycles based on the simplified Federal Urban Driving Cycle with less than 20 percent capacity loss.
- Improve Cost Per Battery Pack—$150 per kilowatt-hour.
- Improve Rapid Charging—100 percent charge in four hours, 80 percent in 15 minutes, and 50 percent in five minutes.

United States Advanced Battery Consortium (USABC)

USABC is a collaborative partnership which includes General Motors Corporation, Ford Motor Company and Chrysler Corporation; the U.S. Department of Energy (DOE), the Electric Power Research Institute (EPRI) and the following five U.S. electric utilities: Pacific Gas and Electric Company, Southern California Edison Company, Public Service Electric and Gas Company, Southern Company, and the Empire State Electric Energy Research Corporation (representing electric utilities in the State of New York). DOE provides half of the funds, and the USABC partners, along with EPRI, individual electric utilities and battery developers, provide the remainder. With $262 million committed through 1995, USABC has been developing mid-term battery technologies (*e.g.*, nickel metal-hydride) for the late 1990's, and long-term battery technologies (*e.g.*, lithium polymer) for the year 2003. Enhancing specific energy, specific power, and cycle-life, while maintaining a reasonable cost, are the major battery research goals for USABC.

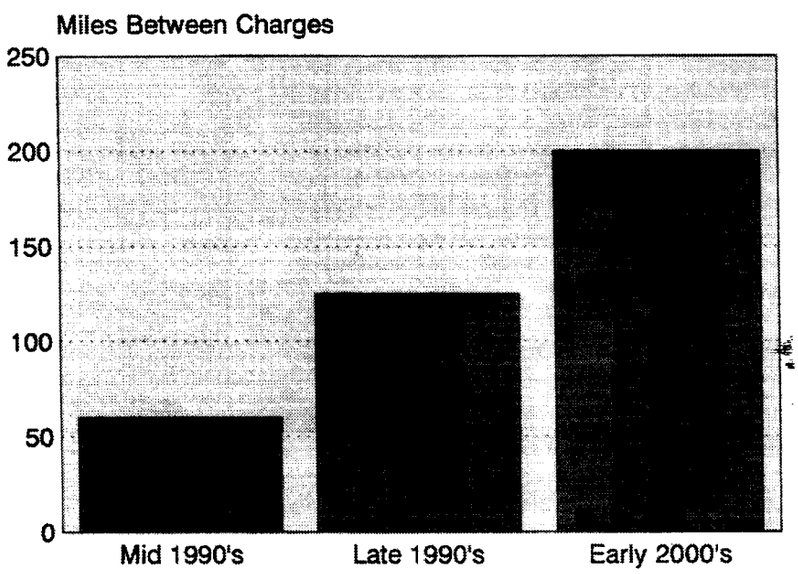


GM/Ovonic nickel metal-hydride battery

SUMMARY OF UNITED STATES ADVANCED BATTERY CONSORTIUM GOALS

USABC Goals	Specific Power	Specific Energy	Lifetime	Cost
Mid-Term Goal	150–200 Watts per kilogram	80–100 Watt Hours per kilogram	5 years	$150 or less per kilowatt hour
In a Typical EV, This Would Mean . . .	0–50 MPH acceleration in 12 seconds	A driving range of 100–125 miles in normal use	Battery cost could be amortized over 5 years	$4,500–$6,000 battery
Long-Term Goal	400 Watts per kilogram	200 Watt Hours per kilogram	10 years	$100 or less per kilowatt hour
In a Typical EV, This Would Mean . . .	0–60 MPH acceleration in 9 seconds	A driving range of 200 miles in normal use	Battery cost could be amortized over 10 years	$4,000 battery

ELECTRIC VEHICLE RANGE AND BATTERY TECHNOLOGY GOALS



BATTERY RECYCLING

One critical piece of the infrastructure picture is ensuring that EV batteries are disposed of in an environmentally responsible manner. Recycling of lead-acid batteries is occurring today, and sufficient recycling capacity exists to accommodate the near-term increase of batteries resulting from commercialization of EVs. According to the Battery Council International, for the last five years more than 95 percent of all battery lead was recycled.

According to the DOE-sponsored Ad Hoc Electric Vehicle Battery Readiness Working Group, reclamation/recycling processes for mid-term batteries, as defined by USABC, are partially developed. A feasibility study on the recyclability of nickel metal-hydride batteries has been shown to be cost effective.

Long-term battery technologies, as defined by the USABC—which include lithium iron-disulfide and lithium-polymer batteries—are still in the research and development stage; therefore, the recycling process for these types of batteries are not well defined. One of the stated goals of USABC is the development of batteries that are both recyclable and nontoxic.

Organizational/ Planning Tools

The first section of Volume III of the Manual provides the stakeholder in the community with a variety of tools he/she may need in order to advocate the demonstration of EVs in the community. The following is a brief description of the materials found in Volume III of the Manual.

ORGANIZATIONAL PREMISE FOR STATE AND LOCAL STAKEHOLDERS

To establish a coherent public policy framework to support EVs, a variety of policymakers—elected or appointed—must get involved. Bringing together a variety of planners and decision makers (*e.g.*, environmental planners, transportation planners, city councils, utility commissions, building commissioners, etc.) is highly effective in developing broad support for EVs. EV advocacy efforts may be undertaken by existing groups, such as a local Clean Cities committee, or by an ad hoc organization specifically formed for the purpose of supporting EV-related programs. To assist in the formation of such a group at the state level, an organizational premise is included to serve as the foundation for the EV "stakeholders" group.

ELECTRIC VEHICLE INFRASTRUCTURE CHECKLIST

The infrastructure checklist notes the many activities that must be undertaken, and the new systems and procedures that must be put in place, to support the successful introduction of EVs onto America's roadways. EV advocates may use this tool as a comprehensive listing of infrastructure needs. The checklist should be helpful in pinpointing the areas where action and the setting of priorities are required.

EV MODEL LEGISLATION FOR STATE & LOCAL ENACTMENT

The Electric Transportation Coalition has developed model state legislation for consideration by regulators and policymakers at the state and local levels. This suggested legislative

package would establish a state program of regulatory and financial incentives to support the initial customer purchases of EVs and EV-related infrastructure.

COMMON QUESTIONS ABOUT ELECTRIC VEHICLES & INFRASTRUCTURE

This document provides answers to commonly asked questions about the development and commercialization of EVs such as: When will EVs be commercially available? How much will EVs cost? How will EVs be recharged?

LAWS, REGULATIONS AND POLICIES AFFECTING ELECTRIC VEHICLES

Presently, there are both state and national initiatives to push for the emergence of EVs in the U.S. In order to understand these programs and how they impact the development of EVs, the Electric Transportation Coalition has developed a variety of materials detailing pertinent federal laws, including:

- *Energy Policy Act of 1992 (EPAct) Box Charts:* Summarizes EV and EV infrastructure-related programs and tax incentives authorized under EPAct. Also provides a summary of the EPAct fleet requirements as compared to the Clean Air Act and California requirements.
- *Federal EV-Related Appropriations Chart*: Outlines level of federal funding provided for EV-related programs in the current fiscal year and provides brief summaries of on-going programs.
- *State Level Incentives Maps*: Details state-level incentives to encourage the development and use of EVs. Each map provides information on available incentives—such as tax credits or registration fee waivers — for the purchase of EVs and for EV conversions. The maps also include general information on other types of monetary incentives such as loans, grants and rebates.
- *State Laws and Regulations Impacting Electric Vehicles*: Outlines all existing legislation at the state level that impacts electric transportation.

PUBLIC EDUCATION INFORMATION

In order to successfully introduce electric modes of transportation into a community, potential EV customers, students and the general public need to be educated about EVs and their supporting infrastructure. A variety of documents have been developed by industry and the federal government to do just that. For example, electric utilities have developed maps of public charging locations, technical colleges have developed comprehensive curricula for EV technical training, automobile manufacturers have conducted nationwide field tests to gauge customers' reactions to EVs, and the federal government has released reports designed to educate the general public about alternative fuel vehicles and the reasons our nation is converting to the use of alternative fuels. Examples of some of the public education information developed by industry and government can be found in Volume III of the Manual.

GLOSSARY OF TERMS

This document defines commonly-used technical terms related to electric transportation.

REFERENCE, RESOURCE AND INFORMATION CONTACTS

This section is designed to suggest means by which EV advocates can gather additional information about EVs and the activities already underway to support the introduction of EVs and the development of infrastructure. The section also contains information on technical, human and organizational resources that might be useful in planning and/or executing an effective state-level EV advocacy campaign.

The resource guide includes a listing and description of EV-related entities, a partial bibliography of EV studies and reports, points of contact for regional EV consortia, information on U.S. Department of Energy Clean Cities participants and other information.