CENTER FOR THE COMMERCIALIZATION OF ELECTRIC TECHNOLOGIES

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Volume 3
Texas Triangle Plug-in Electric Vehicle Readiness Plan

Appendices

Driving on Texas Highways

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Executive Summary

This is Volume 3, the appendices to Texas Triangle PEV Readiness Plan. The Plan addresses barriers to readiness and PEV acceptance in the triangle formed by the Texas metro areas of Dallas/Ft. Worth, Houston, and Austin-San Antonio with a focus on the small and mid size cities in between. The Plan benefits the stakeholders and general public by laying out the issues and providing a set of recommendations to address these issues.

About the Authors

The Texas Triangle Plug-In Electric Vehicle Readiness Plan of the Center for the Commercialization of Electric Technologies was a collaboration between five planning teams: Plug-in Texas (state legislation and agency initiatives); Frontier Associates (electric utility issues and PEV grid interface); Southwestern Economics and CCET (local best practices to promote readiness); ECOtality North America (PEV charging infrastructure along the triangle corridors); and Dave Tuttle Consulting (consumer information program). In addition, a Technical Advisory Committee including Clean Cities coalition staff, electric utility representatives, and cognizant state agencies provided review of the work products. Finally, Southwest Research Institute provided key technical review and valuable insights into the implications of the economic change from a petroleum-based to an electricity-based transportation system.

Acknowledgements and Disclaimers

Opinions expressed in this report, as well as any errors or omissions, are the authors' alone. The examples, facts, results, and recommendations summarized in this report represent our interpretations. Nothing herein is intended to provide a legal opinion. The recommendations are voluntary except to the extent that governing bodies may decide to enact them in the form of legislation or ordinance. The plan may not be copied, reproduced, modified, distributed, sold, broadcast, stored or otherwise used without the express permission of CCET or the original copyright holder or the authors.

Electric vehicles first made their entry into the transportation systems early in the last century only to disappear under the market pressure of the internal combustion engine and Henry Ford. But in my life time the electric vehicle "ride" has been for not-so-energetic golfers and two-wheeled scooter enthusiasts. But that's about to change. Modern electric vehicles offer all the comfort, safety and convenience of their gasoline counterparts, save one thing--range limitations. Our Texas efforts will provide leadership to the nation in developing the needed infrastructure to support electric vehicle travel among our major cities, and we'll clean up smog along the way.

Milton Holloway, President & COO of CCET

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Appendix 1A Sales of BEVs and EREVs in the Four Metro Areas of the Texas Triangle (through Mar 2012)

Sales of PEVs in the Four Metro Areas of the Texas Triangle

	Austin Region PEVs	DFW Region BEVs EREVs	Houston-Galveston Region BEVs EREVs	San Antonio Region BEVs EREVs	Total of Four BEVs EREVs	All Other Regions in Texas Combined
2010	6	1	0	2	9	4
2011	222	417	321	93	1,053	209
2012 (Jan-Mar)	47	70	71	19	207	45

Following is the same data broken out by make. Since early 2012 several new models have been introduced.

	Austin Region			DFW Region			Houston-Galveston Region			San Antonio Region			Total of Four Regions			All Other Regions in Texas Combined		
	Volt	Leaf	iMiEV	Volt	Leaf	iMiEV	Volt	Leaf	iMiEV	Volt	Leaf	iMiEV	Volt	Leaf	iMiEV	Volt	Leaf	iMiEV
2010	4	2	0	1	0	0	0	0	0	2	0	0	7	2	0	2	2	0
2011	109	113	0	214	203	0	170	151	0	38	55	0	531	522	0	159	50	0
2012 (Jan-Mar)	25	22	0	44	25	1	35	36	0	12	7	0	116	90	1	25	20	0

Source: North Central Texas Council of Governments, based on and analysis of PEV model (BEV, Nissan Leaf; EREV, Chevrolet Volt) registrations by VIN found in the Texas Department of Motor Vehicles Registration Database.

Appendix 1B Texas Triangle PEV Planning Team

Each of the tasks listed below resulted in a corresponding chapter in Volume 2. Thus, the Task 2 work appears at Chapter 2, and so forth.

Task 1 Management

The overall responsibility for this work resided with *Dr. Milton Holloway*, President and COO of the Center for the Commercialization of Electric Technologies (CCET). CCET is non-profit consortium of Texas public and private electric companies, technology companies, universities, research organizations, and members of Texas public interest groups devoted to the improvement and modernization of the Texas electric system through technological progress and development of innovative market solutions. (www.electrictechnologycenter.com).

Lori Lynn Wincek, of CCET was the project accountant and dealt with all the financial and audit aspects of the project. Additionally, Ms. Wincek provides administrative and logistical support.

Bob Davis, also with CCET, was the Principal Investigator, Mr. Davis provided day-to-day management and direction to the other task leaders below, was responsible for most of the work reflected in Chapter 3, and was overall editor. Mr. Davis was an environmental consultant for 30 years on domestic and foreign energy-related projects.

Task 2 State Legislation and Regulations

Russ Keene of Plug-In Texas directed this work. Mr. Keene is President of Plug-In Texas (http://www.plugintexas.org/) a coalition of public and private interests promoting PEVs in Texas.

Task 3 Local Best Practices

Bob Davis of CCET developed this section, with assistance from *Bill Knesek* of Southwestern Economics, LLC, of Rosenberg, Texas; and *George Bellino* of General Motors. Bob Davis worked as a city planner and as a reporter for municipal affairs in a large Texas City. Southwestern Economics provides economic development consulting services to small towns in Texas. George Bellino is staff project engineer, Infrastructure Planning, General Motors. Russ Keene and Annette Golemi of Plug-In Texas helped organize a City Leadership forum and communicate with Texas Triangle city leaders. The City Leadership forum was co-sponsored by the City of College Station, College Station Utilities and the City of Bryan with additional support from ECOtality NA, AeroVironment and General Motors.

Task 4 Electric utilities

Frontier Associates (www.FrontierAssoc.com) is an Austin, TX based consulting firm providing design, management, and evaluation of utility energy efficiency and renewable energy programs. *Margaret Marchant* is Frontier's office manager and served as project management liaison with CCET for the Frontier team and edited iterations of the Task 4 report. *Mark Kapner, PE*, Director of Engineering at Frontier, conducted interviews with individuals at the electric utilities, the PUCT and ERCOT. As a former Senior Strategy Engineer at Austin Energy (AE), he brings special expertise with electric vehicles. *Julia Harvey*, Energy Analyst, developed the survey instrument used for data collection, compiled the research, and authored the draft Task 4 report. *Jay Zarnikau, Ph.D.*, President of Frontier provided executive oversight for Frontier's preparation of the Task 4 chapter, with special contributions to the recommendations to the PUCT and ERCOT.

Task 5 Intercity Charging

ECOtality North America (http://www.ecotality.com/locations/north-america/) is a leader in clean electric transportation and storage technologies with a history in electric transportation dating back to1989. The intercity charging analytical work and writing was done by *Nakul Sathaye, PhD*, Infrastructure Planning Specialist at ECOtality.

Task 6 Consumer Education

The consumer information website concept and communication plan ideas were developed by *DP Tuttle Consulting*. Mr. Tuttle is a Research Fellow at the University of Texas at Austin (Renewable Energy Systems, eMobility, Technology). Mr. Tuttle provided general expertise on a wide variety of PEV technical and policy topics.

Task 7 Beyond Readiness

Southwest Research Institute (SwRI) (http://www.swri.org/) is one of the oldest and largest independent, nonprofit, applied research and development organizations in the United States. Longer Term Planning for Electrification of Transportation was prepared by *Joe Redfield*, Principal Engineer and heads up the Advanced Vehicle Technology section at SwRI. Mr. Redfield also provided general recommendations and guidance on several PEV related technical and policy topics.

Regional Coordination

Two of the four metro areas comprising the "corners" of the Texas Triangle were contracted directly to support this work. These include *Allison Carr* of the Houston Galveston Area Council of Governments (H-GAC), Clean Cities Coalition. Several individuals with the North Central Texas Council of Governments (NCTCOG) provided assistance including *Jenny Danieau*, *Jody Loza*, *Lori Clark*, and *Shawn Dintino*. H-GAC and NCTCOG each held a public meeting in order for CCET to receive comments from stakeholders and the general public on the

draft report and to provide valuable region-specific information on PEV readiness, promotion, and events in their areas of Houston and Dallas-Ft.Worth respectively.

Although not under contract, CCET coordinated with Austin area and San Antonio area PEV experts including the following. *Kurt Stogdill* of Austin Energy (http://www.austinenergy.com/) and several on his staff including *Matthew Crosby* who was formerly involved in PEV work in California. Mr. Stogdill is the project director of the ***Texas River Cities*** - Plug-In Electric Vehicle Initiative (a parallel and similar DOE-funded project to the Texas Triangle Plan). Serving as technical advisors for both the Texas Triangle and Texas River Cities were *Julia Jones*, of CPS Energy, *Bill Barker*, of the City of San Antonio, Environmental Planning Dept, and *Chris Ashcraft* of the Alamo Area Council of Governments, a Clean City Coalition. Ms. Jones, Mr. Barker and Mr. Ashcraft have provided valuable information on PEV readiness based on their experiences in San Antonio and elsewhere.

Appendix 1C Technical Advisory Group for the Texas Triangle PEV Readiness Plan

Technical Advisory Group for the Texas Triangle PEV Readiness Plan			
Organization / Company	**Name**	**Organization / Company**	**Name**
Alamo Area COG	Chris Ashcraft	**IBM**	Gerry Metzler
UT Austin	Ross Baldick	**General Electric**	Robert Minor
NRG Energy	Saurabh Bansal	**EPRI**	Tom Reddoch
City of San Antonio	Bill Barker	**Oncor Electric**	Lance Spross
PUCT	Julie Black	**AEP Texas**	Gary Throckmorton
TXDOT	Duncan Stewart	**TXU Energy**	Brian Tulloh
Houston Area Research Council	David Hitchcock	**Environmental Defense Fund**	Kate Robertson Zerrenner
City of Houston	Lisa Lin	**CenterPoint Energy**	David Owen
Reliant Energy	Mike McCabe	**NRG Energy**	Phil Ovitt
Ford Motor Company	Mike Tinskey	**Lone Star Clean Fuels Alliance**	Stacy Neef
Ford Motor Company	Donna Bell	**EPRI**	Bernard Neenan
Ford Motor Company	Barbara Rodgers	**CleanTX Foundation**	Laura Benold
CPS Energy	Julia Jones	**Texas A&M University**	Ron Steedly
UT Arlington	Wei-Jen Lee	**City of College Station**	Jason Stuebe
ERCOT	Michael Legatt	**City of Bryan**	Bobby Walker
ERCOT	Paul Wattles	**City of Killeen**	Matthew Wojnowski
Nissan-USA	Mark Perry	**City of Killeen**	Kim Randall
UTSA	Dwain Rogers, J.D.	**City of Crockett**	Ron Duncan
UTSA	Juan Gomez	**City of Huntsville**	Chandra Steinback
SAIC	David Mulder	**City of Corsicana**	Connie Standridge
SAIC	Christina Davies Waldron	**City of College Station**	Timothy Crabb

Appendix 2A PEV and Alternative Fuel Legislation in the Last Three Sessions (80th through 82nd) of the Texas Legislature

: Plug-In Electric Vehicle and Alt. Fuel Legislation – 82nd Texas Legislature			
Bill Number/ Author	**Caption/ Description**	**Bill History**	**Reasons for Fail/Pass**
SB 1742 Fraser [Companion Bill: HB 3308 Rodriguez]	Relating to the operation of plug-in electric motor vehicles. (HOV lane usage for PEVs)	Filed 3/11; Referred to Transportation & Homeland Security 3/23; Scheduled for public hearing on 4/20; Testimony taken in committee 4/20; Voted out of committee on 4/20; Placed on intent calendar 5/02; reported Engrossed 5/05; received from Senate 5/05; Referred to Transportation 5/9; Left pending in committee 5/19; Passed out of committee on 5/20.	Failed to be heard on final day to consider Senate bills in the House.
HB 3308 Rodriguez [Companion Bill: SB 1742 Fraser]	Relating to the operation of plug-in electric motor vehicles. (HOV lane usage for PEVs)	Referred to Transportation 3/18; Scheduled for public hearing on 4/13; Left pending in committee on 4/13; reported favorably as substituted 4/27; Placed on General State calendar 5/05; Postponed 5/05, 5/06, 5/07; Passed 2nd reading/to engrossment as amended 5/09; 3rd reading postponed 5/11.	On 2nd reading HB 3308 received amendments to make compressed natural gas (CNG) vehicles eligible as well as an amendment to alleviate concerns of a major Tollway Authority in regards to the receipt of federal funds. The legislation was then postponed indefinitely on 3rd reading after other House members' objections were not able to be resolved.

HB 3310 Rodriguez	Relating to incentives for the purchase or lease of an electric-powered light-duty motor vehicle. (Proposed to make 2000 new light-duty passenger PEVs eligible for a $2,500 grant from TERP.)	Referred to Energy Resources on 3/18; Scheduled for public hearing on 3/30; left pending in committee 3/30; Voted out of committee on 4/20; Reported favorably as substituted 4/20; Placed on General State calendar 5/06; Failed to pass to engrossment 5/11.	The legislation had been labeled as a "subsidy" by vocal House members and failed on a highly partisan vote, 92-50. TERP funding was decreased substantially in the new fiscal biennium; its appropriations were very competitive.
HB 1037 Otto [Companion Bill: SB 385 Williams]	Relating to the creation of an alternative fuel program to be funded by the Texas emissions reduction plan fund. (Repurposes a portion of TERP funds for alternative fuel refueling stations.)	Referred to Environmental Regulation on 3/03; Scheduled for public hearing on 4/13; Left pending in committee on 4/13.	Failed to make it out of committee; its companion bill was progressed in its place and passed out of both chambers to become law.
SB 385 Williams [Companion Bill: HB 1037 Otto]	Relating to the creation of an alternative fuel program to be funded by the Texas emissions reduction plan fund. (Repurposes a portion of TERP funds for alternative fuel refueling stations.)	Referred to Natural Resources on 2/02; Scheduled for public hearing on 3/22; passed out of committee and made eligible for local and uncontested calendar; Testimony taken in committee 3/22; 3/23/2011 S Recommended for local & uncontested calendar; placed on intent calendar 3/24; Received from the Senate 4/5; referred to House Environmental Regulation on 4/11; Considered in committee 5/05; Reported favorably w/o amendments 5/05; Committee report sent to Calendars 5/09; placed on general state calendar 5/20; Passed 112 – 27; Signed by Governor 6/17/11.	The reimbursements for the program were limited to two percent of the available TERP funds.

HB 1669 Harper-Brown	Relating to the establishment of an electric motor vehicle mileage fee pilot program by the Texas Department of Motor Vehicles.	Referred to Transportation on 3/03; Scheduled for public hearing on 3/23 rescheduled for 3/28; left pending in committee 3/28; Reported favorably as substituted 4/27; Committee report sent to Calendars 5/10.	PEV supporters believed the imposition of a new tax on PEVs with limited data and limited experience to draw upon was unfair on early adopters and would depress sales and interest. Bill was amended but failed to be heard in second reading.
HB 1863 Anchia	Relating to utilities' expenditures for recharging stations for electric vehicles. (Proposed to keep utilities from making this investment.)	Referred to State Affairs on 3/07; Scheduled for public hearing on 4/13; Left pending in committee 4/13.	This bill was left pending in House committee on April 13 where it expired.
HB 3272 Burnam/ Chisum	Relating to the low-income vehicle repair assistance, retrofit, and accelerated vehicle retirement program. (Expanded LIRAP to include alternative-fueled vehicles.)	Referred to Environmental Regulation on 3/18; Scheduled for public hearing on 4/06; left pending on 4/6; out of committee 4/11; Committee report sent to Calendars 4/13; Placed on General State Calendar 4/26; Received from the House 4/28; Referred to Natural Resources on 5/03; Scheduled for public hearing on 5/10; Left pending in Senate Committee; Senate passage reported 5/19; **Signed by Governor on 6/17/11**	The "LIRAP" program is expanded to permit up to $3,500 in assistance for a replacement vehicle that is a hybrid, electric, or natural gas vehicle for low-income Texas families. This simply expanded the definition and did not require a fiscal note, therefore was supported.
SB 15 Fraser	Relating to state energy policy and the planning of energy development and utilization. (Proposed to create the Texas Energy Policy Council to develop and present a statewide energy policy plan, including how to incorporate alternative-	Referred to Natural Resources 3/14; Scheduled for public hearing on 4/7; left pending in committee 4/7; Out of Committee and placed on intent calendar 4/18; Received from the Senate 4/20; Scheduled for public hearing on 5/04; Withdrawn from schedule 5/04; Scheduled for public hearing on 5/12; Left	It expired in the House due to non-support for reasons including that it would distort free-market competition and that it was an indirect attack on fossil fuels.

	fuels, to the next legislature.)	pending in committee on 5/12;	
HB 3399 Legler / Strama / Reynolds / Chisum	Relating to the requirements for grant programs funded through the Texas emissions reduction plan. (Proposed to change the law to make it easier to apply for the clean fleet program.)	Passed the full House on 5/11; Referred to Senate Natural Resources 5/12; Scheduled for public hearing on 5/17; Reported favorably w/o amendments on 5/18; Recommended for local and uncontested calendar 5/18; Committee report printed and distributed 5/18; **Signed by the Governor on 6/17/11.**	

PEV and Alt Fuel Legislation – 82nd Texas Legislature			
Bill Number/ Author	**Caption**	**Bill History**	**Reasons for Fail/Pass**
SB 20 Williams [Companion Bill: HB 2938 Strama]	Relating to a grant program for certain natural gas motor vehicles. (Creates the "Natural Gas Vehicle Program" using TERP monies to replace on-road-heavy-duty vehicles with natural gas vehicles.)	Referred to Transportation & Homeland Security 3/14; Scheduled for public hearing on 3/31; Testimony taken in committee 3/31; Placed on intent calendar 4/6; Reported engrossed 4/7; Received from the Senate 4/11; Referred to House Energy Resources 4/14; Left pending in House Energy Regulation on 4/20; Reported favorably w/o amendments 4/27; Committee report sent to calendars 5/04; Placed on Major State Calendar 5/21;	
SB 1146 Estes	Relating to programs funded under the Texas emissions reduction plan fund. (Proposed to create an air quality research program within TERP.)	Referred to Natural Resources on 3/16;	

HB 454 Lucio, III	Relating to exempting fuel ethanol derived from cellulosic biomass and blended with gasoline from the motor fuels tax.	Referred to Ways & Means 2/17	
SB 990 Carona [Companion Bill: HB 1762 Harper-Brown]	Relating to regulation of high occupancy vehicle lanes operated, managed, or maintained by a regional transportation authority; providing penalties. (Provides regional authority with power to regulate HOV lanes.)	Referred to Transportation & Homeland Security 3/08; Scheduled for public hearing on 3/23; received from Senate 4/5; Referred to House Transportation on 4/11; Reported favorably w/o amendments 4/13; H Comm. Report sent to local and consent calendar 4/20; Placed on Local, Consent, and Res. Calendar 5/19; **Passed full House w/o amendments on 5/19**	
HB 1762 Harper-Brown [Companion Bill: SB 990 Carona]	Relating to regulation of high occupancy vehicle lanes operated, managed, or maintained by a regional transportation authority; providing penalties. (Provides regional authority with power to regulate HOV lanes.)	Referred to Transportation; Scheduled for public hearing on 3/30; left pending in committee 3/30; Companion considered in lieu of in committee 4/13;	
SB 552 Carona	Relating to the creation of the Energy Efficiency Coordination Council and to statewide energy efficiency; providing penalties. (Proposed to create an Energy Efficiency Coordination Council to facilitate coordination among state agencies that administer energy efficiency programs.)	Referred to Natural Resources on 3/17; Scheduled for public hearing on 4/19; Left pending in committee 4/19;	
SB 1318 Hinojosa	Relating to design, construction, and renovation standards for state buildings and facilities.	Referred to Natural Resources on 3/16;	

PEV and Alt. Fuel Legislation – 81st Texas Legislature			
Bill Number/ Author	**Caption/Description**	**Bill History**	**Reasons for Fail/Pass**
HB 629 Anchia	Relating to the purchase of plug-in hybrid electric vehicles by state agencies. (Prohibits a state agency from purchasing a vehicle other than a PEV, unless the cost is determined to be prohibitive.)	Filed 1/14; Referred to Energy Resources 2/18; Scheduled for public hearing 3/25; Testimony taken in committee 3/25; Reported favorably w/o amendment 4/1; considered in calendars 5/5	
SB 1821 Fraser	Relating to a study and a pilot project with regard to, and implementation of policies to promote, the adoption of plug-in hybrid electric vehicles. (Requires the PUC to make an evaluation of the policies regarding PEVs, including the potential for wide scale adoption of PEVs.)	Filed 3/11; Referred to Business and Commerce 3/20; Scheduled for public hearing 4/7; testimony taken in public hearing 4/7; reported favorably w/o amendments 4/9; placed on Intent Calendar 4/14; Reported Engrossed 4/15; Received from Senate 4/16; Referred to Energy Resources 5/1	
SB 1425 Williams [Companion Bill: HB 3150 Anchia, HB 2978 Otto]	Relating to the creation of an alternative fuel program to be funded by the Texas emissions reduction plan fund. (Proposed to create the Texas clean fleet program to encourage the conversion or replacement of fleets of diesel-powered vehicles to alternative-fueled vehicles.)	Filed 3/6; Referred to Natural Resources 3/17; Scheduled for public hearing 4/7; testimony taken in committee 4/7; reported favorably as substituted 5/5; placed on intent calendar 5/7; reported Engrossed 5/8; received from Senate 5/11; Referred to Environmental Regulation 5/13; Scheduled for public hearing 5/18; considered in formal meeting 5/18; reported favorably as substituted 5/18; Placed on General State Calendar 5/23	
HB 3150 Anchia [Companion Bill: SB 1425 Williams, HB	Relating to the creation of alternative fuel programs to be funded by the Texas Emissions Reduction Plan Fund. (Proposed to create the Texas clean fleet	Filed 3/10; Referred to Environmental Regulation 3/18	

2978 Otto]	program to encourage the conversion or replacement of fleets of diesel-powered vehicles to alternative-fueled vehicles.)		
HB 2978 Otto [Companion Bill: SB 1425 Williams, HB 3150 Anchia]	Relating to the creation of alternative fuel programs to be funded by the Texas Emissions Reduction Plan Fund. (Proposed to create the Texas clean fleet program to encourage the conversion or replacement of fleets of diesel-powered vehicles to alternative-fueled vehicles.)	Filed 3/10; Referred to Environmental Regulation 3/17; Scheduled for public hearing 4/29; Testimony taken in committee 4/29; Reported favorably as substituted 5/1; placed on general state calendar 5/13	
HB 2516 Chisum	Relating to the use of alternative fuels by a county mass transit authority. (Requires the authorities to only purchase alternative-fueled vehicles.)	Filed 3/5; Referred to Energy Resources; Scheduled for public hearing 3/25; testimony taken in committee 3/25; left pending in committee 3/25	
HB 650 Rodriguez	Relating to the low-income vehicle repair assistance, retrofit, and accelerated vehicle retirement program. (Extends the LIRAP program to include $3,500 to an alternative-fueled vehicle.)	Filed 1/15; Referred to Environmental Regulation 2/18	
SB 16 Averitt	Relating to the enhancement of air quality, including the capture and storage of carbon dioxide and development of a greenhouse gas registry, the development of emissions reduction technologies, and the improvement of energy efficiency in buildings, vehicles, and appliances.	Filed 1/29; Referred to Natural Resources 2/10; Scheduled for public hearing 3/19; testimony taken in committee 3/19; Reported favorably as substituted 4/6; placed on intent calendar 4/7; reported engrossed 4/14; received in House 4/15; referred to environmental regulation 4/22; scheduled for public hearing 4/29; testimony taken in committee 4/29; scheduled for public hearing 5/4;	

	(see Article 3 - Low-Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program)	testimony taken in committee 5/4; reported favorably as substituted 5/18; placed on major state calendar 5/23	
SB 1192 Ellis	Relating to biodiesel and cellulosic ethanol content requirements for certain fuels.	Filed 2/26; Referred to Natural Resources 3/13	
HB 4459 Strama	Relating to economic development and employment opportunities in the renewable energy or energy efficiency industries. (see Section 11 - Plug-in Hybrid Vehicle Rebate Program)	Filed 3/13; Referred to State Affairs 3/25	
HB 1467 Chisum	Relating to the purchase or lease by state agencies of vehicles using alternative fuels. (Establishes a minimum usage requirement for these state vehicles.)	Filed 2/19; Referred to Energy Resources 3/2; Scheduled for public hearing 3/25; testimony taken in committee 3/25; Reported favorably w/o amendments 4/1; Placed on General State Calendar 5/1; Reported engrossed 5/1; Received in Senate 5/4; Referred to Natural Resources 5/6; Scheduled for public hearing 5/14; testimony taken in committee 5/14; Left pending in committee 5/14	
HB 1171 Martinez	Relating to the addition of certain counties to the Texas Emissions Reduction Plan.	Filed 2/10; Referred to Environmental Regulation 2/26; Scheduled for public hearing 3/18;Testimony taken in committee 3/18; Left pending in committee 3/18	
SB 2016 Watson	Relating to the purchase and operation of plug-in hybrid electric motor vehicles, including the establishment of a pilot program by the state energy conservation office. (Pilot program would provide vehicles with	Filed 3/12; Referred to Natural Resources 3/24	

	insignia to receive free parking, access to HOV lanes and free tolls, and would install charging stations in state parking areas.)		
SB 131 Ellis [Companion Bill: HB 4071 Smith, W]	Relating to the operation of hybrid motor vehicles. (Provides HOV access to hybrid vehicles.)	Filed 11/10; Referred to Transportation & Homeland Security 2/10	
HB 4071 Smith, W [Companion Bill: SB 131 Ellis]	Relating to the operation of hybrid motor vehicles. (Provides HOV access to hybrid vehicles.)	Filed 3/12; Referred to Transportation 3/23	
HB 3656 Bohac	Relating to the Texas emissions reduction plan, including the motor vehicle purchase or lease incentive program under the plan. (Provides funds for the purchases of a clean vehicle.)	Filed 3/12; Referred to Environmental Regulation 3/19	
HB 2867 Strama	Relating to the development by the Texas Commission on Environmental Quality of a rebate program for plug-in hybrid motor vehicles. (Provides a $4,000 rebate to PEV purchasers.)	Filed 3/9; Referred to Energy Resources 3/17	
HB 432 Lucio III	Relating to the acquisition by state agencies of low-emissions vehicles and vehicles using alternative fuels. (Requires an increase in the percentage of state vehicles that are alternative-fueled.)	Filed 12/18; Referred to State Affairs 2/18; Scheduled for public hearing 3/17; Considered in committee 3/17, 4/7; Reported favorably w/o amendments 4/7; Placed on General State Calendar 4/21; Reported engrossed 4/23; Received in the Senate 4/23; Referred to Natural Resources 5/1; Scheduled for public hearing 5/14; Considered in	

		committee 5/14, 5/22, 5/23; Reported favorably as substituted 5/25; Placed on Intent calendar 5/26; Senate passage reported 5/28; House appoints conferees 5/29; Senate appoints conferees 5/30; Reported Enrolled 6/1; **Signed by Governor 6/19**	
SB 1759 Watson	Relating to the extended registration of a commercial fleet of motor vehicles. (see Section 5 - Clean Fleet Program) (Requires commercial fleet registration funds to go to the Texas Clean Fleet program.)	Filed 3/11; Referred to Transportation and Homeland Security 3/20; Scheduled for public hearing 3/30; Considered in public hearing 4/6; Reported favorably as substituted 4/14; Placed on intent calendar 4/20; Reported Engrossed 4/20; Received in the House 4/21; Referred to Transportation 4/22; Considered in public hearing 5/19; Considered in formal meeting 5/20; Reported favorably as substituted 5/20; House passage reported 5/28; Senate appoints conferees 5/29; House appointees conferees 5/30; Reported Enrolled 6/1; **Signed by Governor 6/19**	
SB 1495 Williams	Relating to the taxation of motor fuels; providing penalties. (see Sections 6 and 7)	Filed 3/6; Referred to Finance 3/17; Scheduled for public hearing 3/26; Considered in public hearing 3/26, 3/30; Reported favorably w/o amendments 3/31; Placed on Local & Uncontested Calendar 4/9; Reported Engrossed 4/9; Received in the House 4/9; Referred to Ways & Means 4/20; Considered in public hearing 4/29; Reported favorably w/o amendments 4/29; laid out in lieu of companion HB 3900 5/4; House passage reported 5/8; Senate appoints conferees 5/15; House appointees conferees 5/20; Reported Enrolled 6/1; **Signed by Governor 6/19**	

SB 380 Van de Putte [Companion Bill: HB 1777 Deshotel]	Relating to a loan program to encourage the use of cleaner hydrogen fuel; providing for the issuance of bonds. (Requires SECO to implement a loan program to those that manufacture, store, distribute, or sell hydrogen as a fuel source.)	Filed 12/18; Referred to Natural Resources 2/17; Scheduled for public hearing 3/12; Meeting cancelled 3/12; Scheduled for public hearing 3/17; Testimony taken in public hearing 3/17; Left pending in committee 3/17	
HB 1777 Deshotel [Companion Bill: SB 380 Van de Putte]	Relating to a loan program to encourage the use of cleaner hydrogen fuel; providing for the issuance of bonds. (Requires SECO to implement a loan program to those that manufacture, store, distribute, or sell hydrogen as a fuel source.)	Filed 2/24; Referred to Energy Resources 3/3; Scheduled for public hearing 3/25; Considered in public hearing 3/25; Left pending in committee 3/25	

PEV and Alt. Fuel Legislation – 80th Texas Legislature			
Bill Number/ Author	**Caption**	**Bill History**	**Reasons for Fail/Pass**
HB 827 Anchia	Relating to the purchase of plug-in hybrid electric vehicles by state agencies.	Filed 1/24; Referred to Government Reform 2/7; Scheduled for public hearing 4/30; Testimony taken in committee 4/30; Left pending 4/30	
SB 1060 West	Relating to the operation of hybrid motor vehicles. (Provide HOV access to hybrids.)	Filed 3/1; Referred to Transportation and Homeland Security 3/14	

SB 436 Ellis	Relating to the operation of hybrid motor vehicles. (Provide HOV access to hybrids.)	Filed 2/5; Referred to Transportation and Homeland Security 2/21; Scheduled for public hearing 3/7; Testimony taken in committee 3/7; left pending 3/7; Reported favorably as substituted 4/12; Placed on intent calendar 4/17; reported engrossed 4/18; Received in the House 4/19; Referred to Transportation 4/24; Scheduled for public hearing 5/8; meeting cancelled 5/8; considered in formal meeting 5/8; Left pending 5/8; Considered in formal meeting 5/10; Failed to receive affirmative vote in committee 5/10	
HB 2836 Strama	Relating to discount programs provided by toll project entities (30% discount on tolls for hybrid motor vehicles)	Filed 3/7; Referred to Transportation 3/14	
SB 12 Averitt	Relating to programs for the enhancement of air quality, including energy efficiency standards in state purchasing and energy consumption; providing penalties. (see article 1 - Low-Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program)	Filed 2/15; Referred to Senate Natural Resources 2/21; Scheduled for public hearing 3/1; Testimony taken in committee 3/1; Considered in committee 3/6; Left pending 3/6; Scheduled for public hearing 3/13; Testimony taken in committee 3/13; Reported favorably as substituted 3/19; Placed on Intent Calendar 3/20; Received in the House 3/22; Referred to Environmental Regulation 3/26; Scheduled for public hearing 4/10; Testimony taken in committee 4/10; left pending 4/10; Considered in formal meeting 5/2; Reported favorably as substituted 5/2; Placed on Major State Calendar 5/14; Passed House as amended 5/17; House passage reported in the Senate 5/18; Senate appoints conferees 5/21; House appoints conferees 5/24; Reported enrolled 5/28; **Signed by Governor 6/8**	

HB 1291 Hochberg [Companion Bill: SB 529 Watson]	Relating to the clean school bus program. (Provides funding to the clean school bus program from TERP and LIRAP.)	Filed 2/9; Referred to Environmental Regulation 2/14; Scheduled for public hearing 4/10; Testimony taken in committee 4/10; Left pending in committee 4/10	
SB 529 Watson [Companion Bill: HB 1291 Hochberg]	Relating to the clean school bus program. (Provides funding to the clean school bus program from TERP and LIRAP.)	Filed 2/8; Referred to Natural Resources 2/26; Scheduled for public hearing 3/27; Testimony taken in committee 3/27; Reported favorably as substituted 4/3; Placed on Intent Calendar 4/10; Reported Engrossed 4/11; Received in the House 4/11; Referred to Environmental Regulation 4/12; Considered in formal meeting 5/11; Reported favorably w/o amendments 5/11; Placed on General State Calendar 5/22	
HB 1335 Bohac	Relating to the Texas emissions reduction plan, including the motor vehicle purchase or lease incentive program under the plan. (Provides funds for the purchases of a clean vehicle.)	Filed 2/12; Referred to Environmental Regulation 2/14; Scheduled for public hearing 4/10; Testimony taken in committee 4/10; Left pending 4/10	
SB 1929 Carona	Relating to transportation infrastructure in this state; providing penalties; authorizing the issuance of bonds; making an appropriation. (see Article 30 - Use of High Occupancy Vehicle Lanes by Hybrid Vehicles) (Provides HOV access for hybrids.)	Filed 3/9; Referred to Transportation and Homeland Security 3/22; Scheduled for public hearing 4/18; Testimony taken in committee 4/18, 4/25, 4/26; Reported favorably as substituted 5/1; Placed on intent calendar 5/3; Not again placed on intent calendar 5/14	
HB 344 Strama	Relating to the implementation by the Texas Commission on Environmental Quality of a low-emission vehicle	Filed 11/30/06; Referred to Environmental Regulation 1/31; Scheduled for public hearing 4/10; Testimony taken in committee 4/10;	

[Companion Bill: HB 548 Farrar, SB 124 Ellis]	program. (Implements a low-emission vehicle program that is consistent with Phase II of the California Low-Emission Vehicle program.)	Left pending in committee 4/10	
HB 548 Farrar [Companion Bill: HB 344 Strama, SB 124 Ellis]	Relating to the implementation by the Texas Commission on Environmental Quality of a low-emission vehicle program. (Implements a low-emission vehicle program that is consistent with Phase II of the California Low-Emission Vehicle program.)	Filed 1/11; Referred to Environmental Regulation 2/6	
HB 1072 Giddings	Relating to the low income vehicle repair assistance, retrofit, and accelerated vehicle retirement program. (Establishes monetary limits to LIRAP.)	Filed 2/2; Referred to Environmental Regulation 2/12; Scheduled for public hearing 4/10; No action taken in committee 4/10	
HB 375 Anchia	Relating to the development of a state strategy for increasing the availability of low-emission automotive fuels for Texas drivers. (Requires SECO to prepare a report regarding alternative fuels and a strategy for implementation.)	Filed 12/11/06; Referred to Environmental Regulation 2/1; Scheduled for public hearing 3/27; Testimony taken in committee 3/27; Considered in formal meeting 4/4; Reported favorably w/o amendments 4/4; Committee report sent Calendars 4/12	
HB 2293 Noriega	Relating to a requirement that state agencies purchase low-emissions vehicles as a minimum percentage of their vehicles purchased. (Requires that 10 percent of new vehicles purchased by state agencies be low-emission.)	Filed 3/1; Referred to Environmental Regulation 3/8; Scheduled for public hearing 4/10; Testimony taken in committee 4/10; Considered in formal meeting 4/18; Reported favorably as substituted 4/18; Placed on Local and Consent Calendar 5/2; Reported Engrossed 5/2; Received in Senate 5/3; Referred to Government Organization 5/15; Considered in public hearing 5/16; Reported favorably w/o amendments	

		5/17; Placed on Intent Calendar 5/18; Senate passage reported 5/21; Reported Enrolled 5/22; **Signed by the Governor 6/15**	
SB 124 Ellis [Companion Bill: HB 344 Strama, HB 548 Farrar]	Relating to the implementation by the Texas Commission on Environmental Quality of a low-emission vehicle program. (Implements a low-emission vehicle program that is consistent with Phase II of the California Low-Emission Vehicle program.)	Filed 11/28/06; Referred to Natural Resources 1/29; Scheduled for public hearing 4/10; Testimony taken in committee 4/10; Left pending in committee 4/10	
HB 3319 Keffer	Relating to the sales and use tax. (see Section 152.090 - sales tax related to Hydrogen-powered motor vehicles)	Filed 3/8; Referred to Ways & Means 3/20; Scheduled for public hearing 4/11; Testimony taken in committee 4/11; Considered in public hearing 5/1; Reported favorably as substituted 5/1; Placed on Major State Calendar 5/7; Reported Engrossed 5/10; Received in the Senate 5/10; Referred to Finance 5/14; Scheduled for public hearing 5/17; Considered in committee 5/17, 5/18; Reported favorably w/o amendments 5/19; Placed on intent calendar 5/23; Senate passage reported House conferees appointed 5/25; Senate conferees appointed 5/26; Reported enrolled 5/28; **Signed by Governor 6/15**	
SB 1612 Van de Putte	Relating to programs, incentives, and tax exemptions to encourage the use, manufacture, storage, distribution, or sale of carbon-free hydrogen energy; providing for the issuance of bonds. (relating to taxes and use of HOV lanes by hydrogen-powered motor	Filed 3/8; Referred to Finance 3/21; Scheduled for public hearing 4/26; Testimony taken in committee 4/26; Left pending in committee 4/26	

	vehicles)		
HB 2970 Chisum	Relating to programs, incentives, and tax exemptions to encourage the use, manufacture, storage, distribution, or sale of carbon-free hydrogen energy; providing for the issuance of bonds. (relating to taxes and use of HOV lanes by hydrogen-powered motor vehicles)	Filed 3/15; Referred to Ways & Means 3/15; Scheduled for public hearing 4/11; Withdrawn from schedule 4/11; Scheduled for public hearing 4/18; Testimony taken in public hearing 4/18; Left pending in committee 4/18	
SB 1608 Van de Putte	Relating to certain tax exemptions to promote sales and use of hydrogen-powered motor vehicles in this state.	Filed 3/8; Referred to Finance 3/21	
HB 2971 Chisum	Relating to certain tax exemptions to promote sales and use of hydrogen-powered motor vehicles in this state.	Filed 3/7; Referred to Finance 3/15; Scheduled for public hearing 4/11; withdrawn from schedule 4/11; scheduled 4/18; considered in public hearing 4/18; scheduled for formal meeting 5/3; considered in formal meeting 5/3; Reported favorably w/o amendments 5/3; Committee report sent to Calendars 5/7	
SB 1609 Van de Putte	Relating to the operation of hydrogen-powered motor vehicles.	Filed 3/8; Referred for Transportation & Homeland Security 3/21	
HB 2973 Chisum	Relating to the operation of hydrogen-powered motor vehicles.	Filed 3/7; Referred to Transportation 3/15; Scheduled for public hearing 4/3; Testimony taken in committee 4/3; Left pending in committee 4/3	

Appendix 2B State Agency Actions with regard to PEVs and Alternative Fuels

Railroad Commission - Alternative Fuels Research and Education Division (AFRED)

General Rules

The rules define the purpose of the Alternative Fuels Research and Education Division to administer the rules the commission adopts in regards to the obligation to pay a delivery fee is imposed by defining ad "means of conveyance", "delivery", or "sold and placed into commerce". The rules lay out those responsible for paying the fees and those responsible for reporting, collecting, and remitting fees. The rules continue to outline the computation for any time period needed in the rules. The rules state the last day shall be included in any time period unless it is a Saturday, Sunday, or state holiday. In such an event, the period should run until 5pm the next business day. The rules also lay out the types of forms used by the Alternative Fuels Research and Education Division. The forms are as follows:

(1) AFRED Form 1. Odorizer's or Importer's Report of Fees Collected.
(2) AFRED Form 1A. Schedule A: Schedule of Refund Amounts.
(3) AFRED Form 2. Load Exemption: Certificate of LPG Destined for Export.
(4) AFRED Form 3. Fee on Delivery of Odorized LPG: Refund Request to Commission.
(5) AFRED Form 4. Blanket Exemption.
(6) AFRED Form 5. Refund Request to Odorizer or Importer.
(7) AFRED Form 6. Odorizer or Importer Registration.
(8) AFRED Form 6A. Odorizer or Importer Designation of Agent.

The commission's rules under AFRED create the Propane Alternative Fuels Advisory Committee. The committee was created effective September 1, 1994 and abolished under the rules on October 31, 2014. The committee's purpose is to provide the commission the benefit of the committee's knowledge. The committee is composed of 17 voting members, 8 industry representatives, 8 consumer representatives, and the president of the Texas Propane Gas Association. The terms of the members are over-lapping two year terms with the president of the Texas Propane Gas Association service coinciding with his or her term as president.

The AFRED rules layout the registration requirements for odorizers and importers. Anyone meeting the rules under the section has 30 days upon meeting the rules to register and on or before each succeeding May 1. The rules allow for the odorizers to delegate administration of delivery fees if the odorizer never holds the title to the suppliers liquefied propane gas (LPG) and if the proper form is filed making the supplier legally responsible for the odorizers duties. The

same is applicable to importers. Importers may delegate the administration of fees to the suppliers with filing of the appropriate forms.
The rules set the following fees for the delivery of odorized LPG:

(1) $7.50 for each delivery of less than 1,500 gallons;
(2) $9.00 for each delivery of 1,500 gallons or more but less than 1,800 gallons;
(3) $10 for each delivery of 1,800 gallons or more but less than 2,000 gallons;
(4) $12.50 for each delivery of 2,000 gallons or more but less than 2,500 gallons;
(5) $13.50 for each delivery of 2,500 gallons or more but less than 2,700 gallons;
(6) $25 for each delivery of 2,700 gallons or more but less than 5,000 gallons;
(7) $37.50 for each delivery of 5,000 gallons or more but less than 8,000 gallons;
(8) $50 for each delivery of 8,000 gallons or more but less than 12,000 gallons;
(9) for each delivery of 12,000 gallons or more, $25 for each increment of 5,000 gallons, and $25 for any remainder of less than 5,000 gallons.

The fees are to be reported and remitted on or before the 25th day of each month or the first business day after the 25th should the 25th fall on a weekend or state holiday. No fee is collected on any LPG deliveries destined for export outside of Texas if the LPG is in continuous movement to a destination outside the state. The rules do allow for refunds from the odorizer or importer if the person paying the fee is exempt. An odorizer or importer may apply for a refund from the commission if the odorizer or importer submitted fees in error.

The commission imposes penalties for failing to report. The rules provide for anyone failing to remit a fee by the due date but no later than 30 days following are to pay a penalty of 5% of the amount of fees originally due. A 10% penalty is assessed on any payment over 30days late. The commission may impose a 75% penalty if it's determined the failure to pay is a result of fraud or intent to evade. The Natural Resources Code provide for fines of $25 to $200 for failing to pay.

The commission requires all importers and odorizers to keep proper records of papers, books, accounts, documents, and other business records regarding operations. Those records must be maintained for four years. The commission may send any employee or member to an importer or odorizers office at any reasonable time and for any reasonable purpose. No employee of those entities may refuse the commission member or employee entry.

The rules allow for the commission to preform audits of importers and odorizers. Upon completion of the audit or investigation a copy of the report must be delivered to the director and to the odorizer or importer. The odorizer or importer then has 30 days to submit a written response if requested. The director may gather additional information if needed and if the director finds a failure to pay fees; the director may prepare a report detailing the facts on which the determination is based on a recommendation for additional fees or penalties. The director is required to send the report to the odorizer or importer and notify the odorizer or importer of the

right to a hearing. The odorizer or importer then has 30 days to either accept the director's determination or request a hearing. Should the director's determination be accepted, the additional fees and penalties are due within 30 days of the postmark of the acceptance letter. However the director may extend that period to no more than 6 months. Should the odorizer or importer request a hearing the Office of General Counsel shall select an examiner to conduct a hearing. The Commission may find the odorizer or importer violated commission rules, determine fees and penalties or amount to be refunded, or may determine no violation took place. If fees and penalties are not paid, the commission may refer the matter to the attorney general for further action.

The rules provide that all fees on LPG are assessed on the total volume of in the delivery vehicle. This is regardless of whether the total volume will be delivered in Texas. The rules allow for refunds of fees if paid in error.

Propane Rebate Program

The program was established for consumers who purchase eligible LPG equipment or appliances. The program began August 1994 and under the rules may be terminated by the commission at any time. The commission is prohibited from using more than 50% of AFRED funds on the rebate program. Should funds become unavailable in the program, the rules allow for applications for carried over to the next year. The rules require the following to be eligible for the rebate program:

(1) an eligible installation has been performed;
(2) the eligible installation for which application is made either replaced existing electric or gasoline-fueled equipment or less efficient gas equipment, or occurred in new construction; and
(3) a safety inspection of the eligible installation has been performed.

The program does not allow for installations performed on motor vehicles, travel trailers, mobile or manufactures homes to be eligible for a rebate. Rebates are limited to one per installation. The application is a one or two page form. Applications are on first-come, first-served basis and will only be paid if funds are available. Applications must be submitted no later than 30 days after the installation. All applicants must agree to the following terms:

(1) to practice environmentally sound operating principles;
(2) not to modify the equipment for a period of five years from the date of installation in any way that would materially impair the equipment's performance with respect to energy conservation, energy efficiency or air quality;
(3) not to remove the equipment from this state;

(4) not to remove eligible equipment permanently from service for a period of five years from the date of installation; and
(5) either to allow commission inspection of the installation or to respond completely and accurately to a commission verification survey or questionnaire, or both.

The commission will not recommend which products are eligible and commission establishes the eligibly requirements. Determining which equipment is eligible is the responsibly of the purchaser. Representatives of the commission may upon reasonable notice and time enter premises where an installation took place to verify compliance with the rebate program. The commission may verify compliance by phone, mail, or electronic media. Any installation found to be out of compliance has 30 days to be brought into compliance. If the installation is not brought into compliance in 30 days the rebate will be disallowed and any payments must be refunded to the commission. The consumer may allow the rebate to be paid to propane dealer or equipment provider. The rules do provide for penalties for failing to comply with commission rules or an attempt to evade or commit fraud against the commission.

Media Rebate Program

The purpose of the program is to provide rebate for Texas propane dealers for marketing aimed at increasing public awareness advertising propane as an environmentally friendly alternative fuel. The program took effect in November 1994 and may be terminated by the commission at any time. Eligible media includes existing commission advertising that is altered in form, content, or both if written approval from the director is obtained.

The commission may find non-commission advertising eligible at its own discretion provided it complements existing commission advertising and is not anti-competitive, promote one company over another, or mentions specific brand name(s). Applications are on first-come, first-served basis and will only be paid if funds are available. Applications must be submitted no later than 60 days after the media purchase date. The rebate amount is subject to availability of funds and will be determined based on media outlet's rate card or rate schedule. The rebate will be based on the lowest available rate even if the purchaser used paid a higher amount. The rules do provide for penalties for failing to comply with commission rules or an attempt to evade or commit fraud against the commission.

Highway Signage Rebate Program

The purpose of the program is to provide rebate for Texas propane and natural gas motor fuel outlets for marketing aimed at increasing public awareness advertising propane and natural gas as an environmentally friendly alternative fuel. The program took effect January 1996 and may be terminated at any time by the commission. Any sign that can be moved or relocated without major structural or support changes are not eligible.

Applications must be submitted no later than 60 days after the ad installation and are taken on a first-come, first-served basis and will only be paid if funds are available. Representatives of the commission may upon reasonable notice and time enter premises where an installation took place to verify compliance with the rebate program. Any installation found to be out of compliance has 30 days to be brought into compliance. If the installation is not brought into compliance in 30 days the rebate will be disallowed and any payments must be refunded to the commission. The rules do provide for penalties for failing to comply with commission rules or an attempt to evade or commit fraud against the commission.

Texas Commission on Environmental Quality - Low Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP)

Overview LIRAP

The purpose of the LIRAP is to provide counties and persons with low income assistance with meeting vehicle emission requirements. The rules provide the minimum requirements for participation and implementation in the LIRAP. The program does not apply to the following:

(1) fleet vehicle;
(2) commercial vehicle;
(3) vehicle owned or leased by a governmental entity;
(4) vehicle registered as a classic motor vehicle;
(5) vehicle registered as an exhibition vehicle, including antique or military vehicles; or
(6) vehicle not regularly used for transportation during the normal course of daily activities.

Counties participating in the program must ensure vehicle owners do not receive direct monetary or compensatory assistance under LIRAP.

The program is funded from vehicle inspection and maintenance fees or other designated funds. Administrative costs for the program may include call-centers, application oversight, invoice analysis, education, outreach, and advertising. To the extent possible, counties are to receive funding in proportion with the amount of fees collected by the county. The rules stipulate that no more than 10% of funds may be used for administrative costs.

The program is managed by a grant contract between the TECQ and county. The contract sets out the conditions, requirements, and projected funding for the counties participation. The county may contract out LIRAP services to an entity approved by the TCEQ and either the county or entity must provide evidence that appropriate measures have been taken to determine applicant eligibility and protect against fraud.

LIRAP programs must provide monetary or compensatory assistance to eligible repairs or retrofit work. The assistance must be directly related to bringing vehicles having failed emissions tests into compliance. Repairs must be conducted at a recognized facility. The vehicle owners seeking assistance must, at a minimum demonstrate:

(1) the vehicle has failed a vehicle emissions test within 30 days of application submittal;

(2) the vehicle can be driven under its own power to the emissions inspection station or vehicle retirement facility;

(3) the vehicle is currently registered in and has been registered in the program county for the 12 months immediately preceding the application for assistance;

(4) the vehicle has passed the safety portion of the Texas Department of Public Safety (DPS) motor vehicle safety and emissions inspection as recorded in the Vehicle Inspection Report (VIR), or provide assurance that actions will be taken to bring the vehicle into compliance with safety requirements;

(5) the vehicle owner's net family income is at or below 300% of the federal poverty level; and

(6) any other requirements of the participating county or the executive director are met.

Similar to the repair and retrofit, the LIRAP must provide monetary or compensatory assistance to eligible vehicle owners for vehicle replacement. The vehicle owners seeking assistance must, at a minimum demonstrate:

(A) the vehicle meets the requirements under subsection (b)(1) - (3) and (5) of this section;

(B) the vehicle has passed a DPS motor vehicle safety or safety and emissions inspection within 15 months prior to application submittal; and

(C) any other requirements of the participating county or the executive director are met.

Replacement vehicles must meet the following requirements:

(A) be in a class or category of vehicles that has been certified to meet federal Tier 2, Bin 5 or cleaner Bin certification;

(B) have a gross vehicle weight rating of less than 10,000 pounds;

(C) be a vehicle, the total cost of which does not exceed $25,000; and

(D) have passed a DPS motor vehicle safety inspection or safety and emissions inspection within the 15-month period before the application is submitted.

Compensation for repairs and retrofit must be between $30 and $600. For vehicle replacement, the compensation is one award for one vehicle and must maximum awards are as follows:

(i) $3,000 for a replacement car of the current model year or previous three model years, except as provided by clause (iii) of this subparagraph;

(ii) $3,000 for a replacement truck of the current model year or the previous two model years, except as provided by clause (iii) of this subparagraph;

(iii) $3,500 for a replacement hybrid vehicle of the current model year or the previous model year.

Provided compensation levels and minimum eligibility requirements sections of the rule are met, counties may set a specific level of compensation or compensation schedule using the following criteria:

(A) model year of the vehicle;

(B) miles registered on the vehicle's odometer;

(C) fair market value of the vehicle;

(D) estimated cost of emission-related repairs necessary to bring the vehicle into compliance with emission standards;

(E) amount of money the vehicle owner has already spent to bring the vehicle into compliance, excluding the cost of the vehicle emissions inspection; and

(F) vehicle owner's income.

The rules provide that reimbursement for repairs and retrofits must be paid to repair facilities within 30 days of submitting invoice for repair or retrofit work. Dealerships selling replacement vehicles must receive payment with 10 days of submitting proof of sale or transfer.

The document confirming a person’s eligibility must include the full name of applicant, the vehicle identification number of the retired vehicle, expiration date of the document, the program administrator's contact information, and the amount of money available to the participating vehicle owner.

Retired vehicles must be dismantled, or salvaged in Texas. The vehicle must:

(1) destroyed;

(2) recycled;

(3) dismantled and its parts sold as used parts or used in the LIRAP;

(4) placed in a storage facility and subsequently destroyed, recycled, or dismantled within 12 months of the vehicle retirement date and its parts sold or used in the LIRAP; or

(5) repaired, brought into compliance, and used as a replacement vehicle under this division. Not more than 10% of all vehicles eligible for retirement may be used as replacement vehicles.

A dismantler must destroy all emissions control equipment and engine and certify those parts have been destroyed. The certification must be provided to the car dealership and the dealership must provide the certification to the county. All scrap metal must be provided to a recycler free of charge except for transportation costs.

Under the rules the private sector may provide monetary assistance to LIRAP. The private sector businesses may purchase eligible vehicles for accelerated retirement and have up to 100% of the emission reductions certified as emissions credits. This also extends to vehicles not covered by LIRAP including government or fleet vehicles.

Counties must submit quarterly reports to the TCEQ detailing the following:

(1) name of the county department or entity implementing the program and their mailing address;

(2) name of the official representative of the county department or entity;

(3) amount of funds received during the reporting period;

(4) amount distributed for repair assistance, retrofitting, accelerated retirement, and administrative costs;

(5) information regarding the recognized emissions repair facilities and vehicle retirement facilities participating in the LIRAP, including the number of approved assistance transactions, the amount of each transaction, and the total amounts paid to each facility;

(6) pending amount of funds that must be paid out;

(7) information for each vehicle participating in program, including:

(A) vehicle identification number (VIN);

(B) vehicle license plate number;

(C) name and business address of the Texas Department of Public Safety recognized emissions repair facility or vehicle retirement facility; and

(D) date of vehicle repair, retrofit, or retirement; and

(8) information for each replacement vehicle including:

(A) vehicle identification number (VIN);

(B) make of vehicle;

(C) model year;

(D) odometer reading;

(E) name and business address of seller; and

(9) any other information requested by the executive director.

The records must be maintained for three years and reports must be available on request from the TCEQ. The county and designated entity must allow the TCEQ to conduct audits and inspections.

The counties may appoint one or more local advisory panels to identify vehicles with intrinsic value that make them existing or future collectibles. A vehicle under this category may be sold to an individual if:

(1) repaired and brought into compliance;
(2) removed from the state;
(3) removed from an affected county; or
(4) stored for future restoration and cannot be registered in an affected county.

The advisory panels may consist of individuals from:

(1) automobile dealerships;
(2) automotive repair industry;
(3) safety inspection facilities;
(4) the general public;
(5) antique and vintage car clubs;
(6) local nonprofit organizations; and
(7) locally affected governments.

Proposed Rules for LIRAP

The proposed rule revisions would:

- Add definitions for electric and natural gas vehicles and modify the current definitions of hybrid motor vehicle and replacement vehicle. The proposal defines electric vehicle as a motor vehicle that draws propulsion energy only from a rechargeable energy storage system. A natural gas vehicle is defined as a motor vehicle that uses only compressed natural gas or liquefied natural gas as fuel. The proposal revises the current defined term hybrid motor vehicle to hybrid vehicle.

- Revise the length of time that a vehicle must be registered in a LIRAP participating county. The revised requirement would require that a vehicle be currently registered in and has been registered in a program county for at least 12 of the 15 months preceding the application for assistance.

- Add the requirement that eligible replacement vehicles have an odometer reading of no more than 70,000 miles.

- Revise the current cost limitation for a replacement vehicle with the proposed amendment that would increase the cost limitation from $25,000 to $35,000 and $45,000 for hybrid, electric, or natural gas vehicles or a vehicle certified as Tier 2 Bin 3 or cleaner.

- Modify the current replacement vehicle compensation amount of $3,500 for a replacement hybrid vehicle of the current model year or the previous model year. The proposed amendment would provide replacement assistance of $3,500 for a replacement hybrid, electric, natural gas, and federal Tier 2 Bin 3 or cleaner vehicle of the current model year or the previous three model years.

Texas Clean School Bus Program

The clean school bus program allows for grants to be given to all school districts operating one or more diesel powered school busses or a transportation system provided by a countywide school district. The rules allow for regional planning commissions, council of governments, or similar entities to apply for grants.

The program allows for the following eligible projects:

(1) diesel oxidation catalysts for school buses built before 1994;
(2) diesel particulate filters for school buses built from 1994 to 1998;
(3) the purchase and use of emission-reducing add-on equipment for school buses, including devices that reduce crankcase emissions;
(4) the use of qualifying fuel; and
(5) other technologies that the commission finds will bring about significant emissions reductions.

The rules allow for the commission to limit funding to certain areas, applicants, and/or types of projects. The commission may place a priority on certain areas which have not met national ambient air quality standards. The commission must, prior to each funding period, establish priorities and criteria for reductions. A proposed project must achieve a reduction in diesel emissions compared to the baseline emissions according to the commission's rules.

A school bus proposed for retrofitting must be on a daily, regular route. Any school bus that is replaced must be removed from Texas. The rules require annual reports to the TCEQ from grant recipients. The program expires on August 31, 2013.

Texas Clean Fleet Program

The program provides grants to entities that will replace 20 or more on-road diesel vehicles with alternative fuel or hybrid vehicles. The entity submitting an application with 20 or more qualifying vehicles is still eligible to participate in the program even if the commission denies one or more of the vehicles.

Vehicles qualifying as a replacement vehicle include:

(1) is certified to current federal emissions standards;
(2) replaces a diesel-powered on-road vehicle of the same weight classification and use; and
(3) is a hybrid vehicle or fueled by an alternative fuel.

To receive a grant a vehicle must be owned continuously, registered, and operated in Texas by the grant recipient for 5 years or until the vehicle has reached 400,000 miles.

A vehicle not qualifying as a replacement include neighborhood electric vehicles, has been used as a qualifying vehicle to qualify for a grant under this division for a previous reporting period or by another entity, or has qualified for a similar grant or tax credit in another jurisdiction.

Projects eligible for a grant must achieve a reduction of at least 25% in nitrogen oxides. Vehicles being replaced must be owned, leased, or financed in Texas and operated in Texas by the applicant for at least two years preceding the application. The vehicle must also satisfy any additional requirements set by the commission including mileage, usage, and vehicle condition requirements. The commission may set additional criteria to prioritize projects. No less than 75% of the vehicles work must occur in Texas. Vehicles replaced must be rendered inoperable by crushing the vehicle, putting a hole in the engine block and destroying the vehicle's frame or any other method approved by the commission.

The following are the eligible grant amounts:

The eligible grant amount for each heavy-duty on-road vehicle being replaced is determined as follows:

(1) 80% of the cost for replacement of a vehicle with an engine manufactured prior to 1988 and certified to meet the federal emissions standards, if any, applicable to the year of manufacture;

(2) 70% of the cost for replacement of a vehicle with an engine manufactured after 1987 and before 1998 and certified to meet the federal emission standards applicable to the year of manufacture;

(3) 60% of the cost for replacement of a vehicle with an engine manufactured after 1997 and before 2004 and certified to meet the federal emission standards applicable to year of manufacture; and

(4) 50% of the cost for replacement of a vehicle with an engine manufactured after 2003 and certified to meet the federal emission standards applicable to the year of manufacture.

(b) The eligible grant amount for each light-duty on-road vehicle being replaced is determined as follows:

(1) 80% of the cost for replacement of a light-duty diesel vehicle of a model year prior to 1994 and certified to meet the federal emissions standards, if any, applicable to the model year of the vehicle;

(2) 70% of the cost for replacement of a light-duty diesel vehicle of a model year after 1993 and before 2004 and certified to meet the federal emission standards applicable to the model year of the vehicle; and

(3) 60% of the cost for replacement of a light-duty diesel vehicle of a model year after 2003 and certified to meet the federal emission standards applicable to the model year of the vehicle.

The rules require annual reports to the TCEQ from grant recipients. The program expires on August 31, 2017.

Texas Natural Gas Vehicle Grant Program

The program's purpose is to allow the commission to prioritize qualifying vehicles eligible for grants under the program. The commission may consider the following in setting funding priorities:

(1) the potential for different types of projects to achieve reductions in nitrogen oxides (NO_X) and/or other pollutants of concern over the required period of use of the grant-funded vehicles, including consideration of the vehicle types, weight categories, and types of use with the greatest potential to achieve emissions reductions;

(2) the cost-effectiveness of potential projects, as determined by the cost per ton of expected reductions in NO_X and/or other pollutants of concern;

(3) the potential for different types of projects to help increase the use of natural gas for transportation in Texas;

(4) the areas of use of the grant-funded vehicles, including consideration of the availability of fuel and fueling infrastructure, the need for vehicle fleets to support fueling infrastructure, and the need for emissions reductions in those areas in order to meet federal air quality standards;

(5) support for conversion of large regional vehicle fleets moving goods and materials along interstate highways connecting the cities of Houston, San Antonio, Dallas, and Fort Worth from gasoline or diesel fuel to natural gas;

(6) support for projects to reduce exposure of vulnerable populations to pollutants of concern, including conversion of school bus fleets and other fleets transporting children or the elderly from gasoline or diesel fuel to natural gas;

(7) support for conversion of public transportation fleets, such as school buses, transit buses, airport shuttle buses, and similar vehicle fleets from gasoline or diesel fuel to natural gas;

(8) support for conversion of public utility and service fleets, such as refuse vehicles, maintenance and utility vehicles, and similar fleets from gasoline or diesel fuel to natural gas;

(9) support for the use of natural gas and natural gas vehicles, engines, and associated technologies produced, manufactured, or otherwise based in Texas; and

(10) support for implementation of new and innovative natural gas vehicle and engine technologies.

The rules stipulate that no less than 60% of the total amount of grants awarded in a fiscal biennium must be awarded to vehicles with a gross vehicle weight rating of 33,001 pounds. The provision only applies is the commission received enough applications to satisfy toe requirement.

The program expires August 31, 2017.

Low Emission Diesel (LED)

The rules prohibit the sale, supply, offer to supply, dispense, transfer, place, store, or hold any diesel that does not meet low emissions standards in the following counties: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller, Hardin, Jefferson, Orange, Anderson, Angelina, Aransas, Atascosa, Austin, Bastrop, Bee, Bell, Bexar, Bosque, Bowie, Brazos, Burleson, Caldwell, Calhoun, Camp, Cass, Cherokee, Colorado, Comal, Cooke, Coryell, De Witt, Delta, Falls, Fannin, Fayette, Franklin, Freestone, Goliad, Gonzales, Grayson, Gregg,

Grimes, Guadalupe, Harrison, Hays, Henderson, Hill, Hood, Hopkins, Houston, Hunt, Jackson, Jasper, Karnes, Lamar, Lavaca, Lee, Leon, Limestone, Live Oak, Madison, Marion, Matagorda, McLennan, Milam, Morris, Nacogdoches, Navarro, Newton, Nueces, Panola, Polk, Rains, Red River, Refugio, Robertson, Rusk, Sabine, San Jacinto, San Patricio, San Augustine, Shelby, Smith, Somervell, Titus, Travis, Trinity, Tyler, Upshur, Van Zandt, Victoria, Walker, Washington, Wharton, Williamson, Wilson, Wise, and Wood.

The rules provide that maximum aromatic hydrocarbon content in low emission diesel (LED) is 10% by volume per gallon or the LED is in accordance the Designated Alternative Limits (DAL) where aromatic hydrocarbon does not exceed the DAL and where the DAL exceeds 10% by volume and is offset is accordance with the rules.

The rules allow for a producer or importer to set a DAL for diesel if: 1) the aromatic hydrocarbon does not exceed the DAL in any way , 2) the producer or importer must notify the TCEQ of the volume in barrels and the DAL of the final blend. The notification must be received by the executive director before the start of the physical transfer of the LED from the production facility and no less than 12 hours before the completion of the transfer, 3) Within 90 days before or after the beginning of the transfer to which the producer or importer has set a DAL the producer or importer must complete transfer of LED with a DAL sufficiently below the standard set by the rules as to offset the diesel exceeding the standard.

The LED may not be sold or supplied if the total volume is more than or less than the volume reported to the TCEQ.

Producers and importers subject to the rules must register 30 days prior to the 1st date the LED is made available to the counties listed above. Producers and importers must maintain samples of the final blends for a period of two years. The samples must include type of sample and blend, container sampled, final blend volume and test results. All parties in the distribution chain are required to maintain records for a minimum of two years.

Exemptions to the low emission diesel rules include diesel for research, development, or test status. The diesel not subject to the rules must be kept separate from the non-exempt diesel and identified as being for research or development and may not be sold or transferred. Fuel used in competition racing is also exempt.

The rules allow for an alternative emission reduction plan. The plans must demonstrate that the emissions reductions are attributable to the volume of diesel sold or supplied in the counties listed above. The rules require the producer to demonstrate the average fule properties of all on-road diesel produced in a calendar year achieve a reduction of at least 5.5% in oxides of NO_x for 2007. Non-road diesel must achieve a reduction of at least 6.2%.

Alternative Fueling Facilities Program

The program's purpose is to allow the commission to prioritize facilities eligible for grants under the program. The commission may consider the following in setting funding priorities:

(1) the need for reductions in nitrogen oxides (NO_X) or other pollutants of concern in the area where the facility will be located in order to meet or maintain federal air quality standards;

(2) the type of alternative fuel and the vehicles or equipment that will use the fuel;

(3) the potential for the project to increase the use of the alternative fuel in nonattainment areas and Texas in general;

(4) the potential for the project to increase the use of alternative fuels and alternative fuel technologies produced, manufactured, or otherwise based in Texas;

(5) the need for the facility, based on the current and expected number of vehicles and equipment that would be served by the facility or the fuel made available as a result of the facility, and the availability of other sources of the alternative fuel in the area;

(6) the expected use of the facility for fueling vehicles funded under local, state, or federal incentive programs, including the programs implemented under the Texas Emissions Reduction Plan;

(7) the location of the proposed facility in relation to major highways and transportation routes and the ease of access to the facility for use by the public;

(8) the location of the proposed facility in relation to an area where increased vehicle traffic would not be expected to contribute to traffic congestion, reduce or negatively impact access to the area, or negatively impact the region's air quality or sensitive receptors;

(9) the percentage of costs of the facility to be paid by the applicant and other sources of funding;

(10) the commitment by the applicant to operating the facility over a period of time;

(11) consideration of technical and economic factors associated with a project; and

(12) the experience of the applicant in developing and operating the type of project proposed.

The commission may add criteria for grants including operational, maintenance, and reporting requirements.

The program expires on August 31, 2018.

Texas Comptroller of Public Accounts

Liquefied Gas Tax

The State of Texas' tax on liquefied gas became effective on October 13, 2004 for motor fuel transactions on or before January 1, 2004. The rules require all persons making deliveries of taxable liquefied gas to secure a dealers' license. Additionally, a licensed interstate trucker or trucker registered under a multi-state agreement (i.e. International Fuel Tax Agreement) maintaining bulk storage of liquefied gas must secure a separate dealer's license.

The liquefied gas tax decal must be used by any person who operates a vehicle registered in Texas powered by natural gas, methane, ethane, propane, butane, mixture of those gases, or interchangeably. The person must also prepay the tax on an annual basis. Motor vehicle dealers, interstate truckers and vehicles registered in another state must pay the tax at the time the fuel is delivered or purchased. The vehicle owner must submit an annual application for each vehicle.

The initial application must be purchased based on the estimated mile to be driven in the next year. On a renewal the applicant must submit a record of the mileage driven and the ending odometer reading. The tax does not apply to miles driven outside the state. For special use vehicles, required to be licensed for highway use but whose main purpose is for off-highway use, may renew at a rate less than the mileage indicated on the odometer if a log is kept indicating the miles traveled on the highway.

Exceptions to the liquefied gas tax are school districts and counties or commercial transportation providing services to school districts.

The taxable delivery liquefied gas includes:

- Liquefied gas delivered to a fuel supply tank of a motor vehicle meeting the definition of "interstate trucker" under the Tax Code and displays a current multistate tax agreement decal or operated by licensed liquefied gas trucker.

- Liquefied gas delivered to a fuel supply tank of a motor vehicle licensed in a state other than Texas.

- Liquefied gas delivered to a fuel supply tank of a motor vehicle licensed in Texas and displays a current motor vehicle dealer's liquefied tax decal.

The taxable deliveries are reported on the Texas Liquefied Gas Dealer Report. The taxable gallons are also reported on the interstate trucker or multistate tax agreement reports. In 2011, a $50 penalty is applied on all late reports due on October 1, 2011 or after.

The tax rate is $0.15 per gallon. For prepaid users the rate is based on mileage and registered gross weight of the vehicle. Liquefied gas dealers making timely payment are allowed tax deduction of 1% applied to the taxable gallons sold. The deduction is applied at the time the tax is paid. Interstate truckers making a timely payment are allowed a deduction of .5% on the total gallons used. The tax for dealers and truckers is due January 25 for the previous year. Prepaid users must make their annual payment 15 days prior the enrollment anniversary according the following table based on vehicle weight and estimated mileage:

	Less than 5,000 miles	**5,000 to 9,999 miles**	**10,000 to 14,999 miles**	**15,000 miles and over**
Class A: Less than 4,000 lbs	$30	$60	$90	$120
Class B: 4,001 to 10,000 lbs	$42	$84	$126	$168
Class C: 10,001 to 15,000 lbs	$48	$96	$144	$192
Class D: 15,001 to 27,500 lbs	$84	$168	$252	$336
Class E: 27,501 to 43,500 lbs	$126	$252	$378	$504
Class F: 43,501 lbs and over	$186	$372	$558	$744

Created by HB 2458, 78th Legislature, Regular Session
Amended by HB 3314, 80th Legislature, Regular Session and SB 1495, 81st Legislature, Regular Session
Statute: Tax Code, Title 2, Subtitle E, Chapter 162, Subchapter D
Rules: Title 34, Part 1, Chapter 3, Subchapter S Rules §3.434 and §3.436

Diesel Fuel Tax Exemption for Water, Fuel Ethanol, Biodiesel, Renewable Diesel, and Biodiesel and Renewable Diesel Mixtures

The rules for the diesel tax exemption apply to transactions on or after January 1, 2004. All transactions prior to that date are governed by Title 34, Part 1, Chapter 3, Subchapter L of the Texas Administrative Code. The exemption defines fuels as:

- Water-based diesel is a combination of water, conventional diesel, emulsifier, and/or seasonal additives.
- Fuel grade ethanol is denatured ethanol meeting ASTM D-4806 requirements
- Biodiesel –
    - Meets requirements of EPA Section 211 of the Federal Clean Air Act (42 U.S.C. Section 7545)
    - Is mono-alkyl ester of long chain fatty acid from vegetable oils or animal fats
    - Meets ASTM D-6751
    - Intended for engines designed to use conventional diesel fuel
    - Derived from agricultural products, vegetable oils, recycled greases, biomass, or animal fats
- Biodiesel blend – meets requirements for biodiesel blended with conventional diesel
- Renewable diesel –
    - Meets EPA Section 211 of the Federal Clean Air Act (42 U.S.C. Section 7545)
    - Is a hydrocarbon
    - Meets requirements of ASTM D-975
    - Intended for engines designed to use conventional diesel fuel
    - Derived from agricultural products, vegetable oils, recycled greases, biomass, or animal fats
- Renewable diesel blend – meets requirements for renewable diesel blended with conventional diesel

The rule provides that the diesel fuel tax does not apply to biodiesel, renewable diesel or to the volume of water, fuel grade ethanol, biodiesel or renewable diesel blended with taxable conventional diesel. The tax does apply to the portion of conventional diesel blended with the non-taxable diesel. The exemption applied must be documented as to apply to proper exemption to the fuel's end user.

The rule sets out requirements for the invoices used throughout the manufacturing and distribution process. The invoices must contain the volume of biodiesel or renewable diesel until the product is sold the end user.

Additionally, the volume of non-taxable diesel must be identified on the sales invoices with the taxable diesel. The sales invoice must include the type of fuel identified by a common

commercial name (i.e. B100 for a 100% biodiesel or renewable diesel or B20 for an 80/20 blend), list the volume or percentage of the blend and the taxable portion, and the basis for calculating the tax as either $0.20 per gallon or a ratable table.

The rules require public notice on storage tanks and retail pumps. The label must ID the fuel by a common commercial name. The rules allow for an alternative notice for blends containing up to 5%, 10%, 15% or 20% bio or renewable diesel. The alternative notice may read as "Contains up to X% Biodiesel or Renewable Diesel" where X is the percentage of the bio or renewable diesel in the blend.
The Comptroller requires the refiner, producer, importer, blender, or reseller to provide to all buyers except the end user a certificate including the following information:

- Name of seller and purchaser
- Date of transfer
- Number of gallons transferred or the percentage of biodiesel/renewable diesel component in the blend

The certificate may be a delivery ticket, certificate, letter, or statement.

For vehicles registered under the International Fuel Tax Agreement (IFTA), any fuel delivered to a fuel tank is considered to be used in the jurisdiction in which it is purchased. The rule may be overcome if the purchaser can show the amount of fuel or blend purchased in other IFTA jurisdictions is greater than the amount of fuel used in the other IFTA jurisdictions by all vehicles the IFTA licensee operates.

Created by HB 2458, 80th Legislature, Regular Session
Amended by HB 3314, HB 1332, and HB 2982, 81st Legislature, Regular Session
SB 1, 82nd Legislature, 1st Called Session
Statute: Tax Code, Title 2, Subtitle E, Chapter 162, Subchapter C.
Rule: Texas Administrative Code, Title 34, Part 1, Chapter 3, Subchapter S, §3.443

Appendix 3A PEV Readiness Activity Summary for Dallas/Ft. Worth and Houston Metro Areas

PEV Readiness Activities in two of the four metro areas in the Texas Triangle are provided in Tables 3A-1 through 3A-2 below. Table 3A-1 covers the Dallas Fort Worth area and was prepared by the staff of the North Central Texas Council of Governments. Table 3A-2, which follows, covers the Houston area and was prepared by staff at the Houston Galveston Area Council. The activities for Austin and San Antonio are covered separately in the Texas River Cities Readiness Plan being prepared under a parallel contract with DOE.

Note that because of rapidly changing PEV developments, these data are valid for early to mid-2012 only. They should be considered a snap shot in time.

Table 3A-1 PEV Readiness Programs and Activities Underway in the Dallas/Ft Worth Metro Area[I]

I. PEV Barrier or Readiness Issue Being Addressed	Program or Initiative (Organization leading the effort)	Program purposes and elements	Tangible results through first quarter 2012
PEV Readiness and Promotion Coordinating Group	The Dallas-Fort Worth area working group (entitled Electric Vehicles North Texas or EVNT) is spearheaded by the North Central Texas Council of Governments (NCTCOG) and the DFW Clean Cities Coalition. Its membership includes OEMs, Oncor Electric Delivery, TXU Energy, EVSE manufacturers, universities, municipalities, dealerships and interested parties.	Coordination meetings and development of sub-committees allowed for the region to address specific issues initially in four areas: • Home recharging • Public recharging • Fleets • Marketing/Education	Monthly or quarterly meetings are held to discuss topics and progress. The group brings people together with a common interest and serves an important role in networking and keeping the area focused on preparing for the widespread adoption of electric vehicles. Demographics and various statistics were studied to determine a plan for public recharging infrastructure. Trainings were held for contractors, inspectors, and first responders. Signage for public charging infrastructure was studied.

Training/Outreach			
Need for training of local building inspectors	NCTCOG/DFW Clean Cities, Oncor, Local Governments	Local permitting officials and inspectors can facilitate installation of EVSE by providing an appropriate framework to ensure safety. An initial training for building inspectors and contractors was held on May 5, 2011 in conjunction with a first responder training.	Initial training was held on May 5, 2011. Efforts are underway to assess the need for additional training of local building inspectors. Additional funding is needed to host continual training for this group. A potential partner for this effort would be the North Texas Chapter of the US Green Building Council.
Need for training of local electrical contractors	NCTCOG/DFW Clean Cities, Oncor, Local Governments	Electrical contractors provide an essential service to PEV owners who want to install at-home charging. An initial training for building inspectors and contractors was held on May 5, 2011 in conjunction with a first responder training.	Initial training was held on May 5, 2011. Efforts are underway to assess the need for additional training of local building inspectors. Additional funding is needed to host continual training for this group. Current EVNT stakeholders do maintain a current list of licensed contractors who are familiar with working with EVSE.
Need for outreach and training of public and private fleet operators	EVNT, DFW Clean Cities, NCTCOG, Oncor, EVSE manufacturers	Outreach and education is an essential part of the equation when it comes to EVs and EVSE. It will help raise public awareness and improve public perception about the technology and ultimately increase usage in both the short- and long-term.	DFW Clean Cities regularly promotes EVNT and EVs at various outreach events and hands out a variety of information regarding EVs (a majority of this information comes from DOE's AFDC) DFW Clean Cities and EVNT educates the fleet community about

			EVs at meetings, through newsletters and promotes various funding programs NCTCOG is leading by example and has installed blink chargers at its offices in Arlington, TX EVSE providers are regularly meeting with local municipalities and fleets and are installing numerous chargers across the region as well as informing the public about the facilities at outreach events Oncor has created a brochure about EVs, EVSE and the grid and regularly attends outreach events to educate the public about the interaction between EVs and the electric utility grid
Emergency responder training	NCTCOG, DFW Clean Cities, EVNT, Oncor, OEMs, EVSE, Training Providers	Training will provide the general public with a sense of security when driving in and around EVs. It will also provide the safety community with a better understanding of how to operate safely and with confidence when dealing with this new technology. Initial first responder training was held on May 5, 2011 in conjunction with inspector/contractor training.	Initial training was held on May 5, 2011. Efforts are underway to determine if and how much additional training is needed. NCTCOG regularly holds incident management training for first responders which is targeted at reducing congestion. Staff is investigating this as an opportunity to combine EV elements. If not, then in a region made up of over 230 individual

			municipalities, a train-the-trainer scenario may be the best fit for the DFW area.
General training and outreach to local officials and small municipally owned utilities	The EV Project	Ensure municipal leaders are aware that electric vehicles are coming to North Texas, and permit requests are coming.	Spoke to a majority of Dallas-Fort Worth area municipalities.
Code Revisions			
Progress in amending and adopting city electrical and building codes for PEV charging	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.
Expedited Permitting to Avoid Delays			

For private Level 2 charging stations	The EV Project	Prior to electric vehicles being released, ensure Dallas-Fort Worth area's municipal electrical inspectors:
		• Electric vehicles are going to arrive and they would see permit requests for EVSE installations
		• Educate on standard level 2 equipment specifications and installation requirements
		• Determine local permitting processes
		  ○ Logistics of obtaining permits
		  ○ Fees involved
		  ○ Processes to get final inspection completed once installation complete
			About 40 percent of inspectors had some knowledge of EVSE prior to discussions
			
			All were invited to building inspector training on May 5, 2011
			
			Created "DFW Area Residential Permitting Process for EVSEs" document compiling the contact information, application process, fees, and turnaround time for permitting

For public or commercial Level 2 or DCFC charging stations	The EV Project	City of Dallas required EVSE installations to go through the same rigorous requirements that a gasoline, diesel, CNG, or LNG fueling station would have to go through to get installed.	In January 2012, worked with City of Dallas Zoning Commissioners to update the requirements to remove onerous regulations being applied to EVSE

			installations
Uniform Signage	EVNT, DFW Clean Cities, NCTCOG	Highway signage is described in the Manual of Uniform Traffic Control Devices (MUTCD) as published by the Federal Highway Administration (FHWA). This is to ensure uniformity throughout the US.	Currently, the Clean Cities Coalitions, including DFW and NCTCOG, are working with FHWA and TxDOT to ensure the EV signage accurately reflects EV charging and not simply a modified gas station. This effort will ultimately affect all alternative fuels and truck stop electrification as well. Current signage in the DFW region that indicates EVSE on-site are uniform to the best of our knowledge and conform to the MUTCD.
Problems Associated with PEV charging in multifamily dwellings and workplaces			
Apartment buildings	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.
Condominiums	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.
Workplace: Prvt	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.
Workplace: Govt	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.
Other issues/barriers	EVNT, DFW Clean Cities, NCTCOG	Plan to address in the near future with stakeholder group to determine local needs in this area.	No action taken to date.

II. Deployment of PEV Public Charging Stations by Vendor			
	Vendor Name (property owner)	**Number of locations[II] actually built or being built with, number of stations[III] and ports[IV] with level of charging**	**Other information regarding PEV charging stations deployment including ADA requirements**
	Blink	78 locations, 165 stations, 165 Level 2 ports	
	Chargepoint	7 locations, 8 stations, 7 Level 2 ports, 6 Level 1 ports	
	eVgo	12 locations, 24 stations, 10 Level 3 ports, 12 Level 2 Ports	
	TXU Energy	3 locations, 4 stations, 4 Level 2 ports	
	Independent	16 locations, 58 stations, 18 Level 2 ports, 40 Level 1 ports	
III. PEV Sales Activity			
	Vehicle Mfr and Model	**Number of Vehicles Sold**	**Data Source/Method**
	Chevrolet Volt	227	Texas Department of Motor Vehicles (TxDMV) registration records through June 30, 2012.
	Nissan Leaf	179	TxDMV registration records through June 30, 2012.
	Mitsubishi i-MiEV	9	TxDMV registration records through June 30, 2012.

Table 3A-2 proceeding is a list of DFW Charging Stations as of October 2012.

Name	Company	EVSE 1		EVSE 2		City	Zip
		Type	No	Type	No		
5th Street Parking Garage	Blink	J1772	3			Garland	75040
7-Eleven - Greenville Avenue	Blink	J1772	2			Dallas	75243
Aloft Hotel - Downtown Dallas	Blink	J1772	2			Dallas	75202
Bell Helicopter	Blink	J1772	2			Hurst	76053
Bishop Arts District Parking Lot	Blink	J1772	2			Dallas	75208
Bolsa Mercado	Blink	J1772	1			Dallas	75208
Carrier Enterprise - Garland	Blink	J1772	2			Garland	75041
Carrier Enterprise HQ	Blink	J1772	2			Carrollton	75006
Cedar Hill Government Center	Blink	J1772	4			Cedar Hill	75104
Chilis - Knox Street	Blink	J1772	2			Dallas	75205
Cinemark Cinema - Frisco Square	Blink	J1772	4			Frisco	75034
Cupboard Natural Food	Blink	J1772	2			Denton	76201
Dallas Executive Airport	Blink	J1772	2			Dallas	75237
Deep Ellum Foundation Center	Blink	J1772	1			Dallas	75226
Deep Ellum Parking Lot- Main Street	Blink	J1772	2			Dallas	75226
EV Autos	Blink	J1772	4			Dallas	75226
Fair Park - Lot 5B	Blink	J1772	2			Dallas	75315
Fairview Town Hall	Blink	J1772	2			Fairview	75069
Gables Park 17	Blink	J1772	3			Dallas	75201
Gables Villa Rosa	Blink	J1772	2			Dallas	75204
Garland Animal Control	Blink	J1772	2			Garland	75040
Garland Building Inspection Office	Blink	J1772	2			Garland	75040
Garland City Hall	Blink	J1772	2			Garland	75040
Garland Environmental Health FuelStop	Blink	J1772	1			Garland	75040
Garland Gasoline Alley	Blink	J1772	2			Garland	75040

Name	Company	EVSE 1		EVSE 2		City	Zip
		Type	No	Type	No		
Green Lotus Spa & Retreat	Blink	J1772	1			Dallas	75205
Green Spot Market & Fuels	Blink	J1772	2			Dallas	75218
Harris Hollabaugh Recreation Center	Blink	J1772	2			Garland	75042
Hickory Creek Plaza	Blink	J1772	2			Denton	76210
Hotel Lumen	Blink	J1772	2			Dallas	75205
Hotel Palomar - Dallas	Blink	J1772	2			Dallas	75206
Hotel ZaZa - Dallas	Blink	J1772	2			Dallas	75201
Irving City Hall	Blink	J1772	4			Irving	75061
Irving Covention Center	Blink	J1772	4			Irving	75039
Kohl's - Arlington	Blink	J1772	2			Arlington	76017
Kohl's - Keller	Blink	J1772	2			Keller	76248
Kohl's - Lewisville	Blink	J1772	2			Lewisville	75067
Kohl's - Mesquite	Blink	J1772	2			Mesquite	75150
Korger - Frankfort Road	Blink	J1772	2			Dallas	75287
Kroger - Arlington	Blink	J1772	2			Arlington	76012
Kroger - Cedar Springs	Blink	J1772	2			Dallas	75219
Kroger - Irving	Blink	J1772	3			Irving	75063
Kroger - Medical Center	Blink	J1772	2			Dallas	75235
Kroger - Mockingbird	Blink	J1772	2			Dallas	75206
Kroger - TCU	Blink	J1772	2			Fort Worth	76109
Let's DO Lunch	Blink	J1772	2			Dallas	75235
Love Field - Terminal A	Blink	J1772	4			Dallas	75235
Love Field - Terminal B	Blink	J1772	2			Dallas	75235
Magnola Green Parking Garage	Blink	J1772	2			Fort Worth	76104

Name	Company	EVSE 1		EVSE 2		City	Zip
		Type	No	Type	No		
McDonald's - Bedford	Blink	J1772	1			Bedford	76022
McDonald's - Centre Port	Blink	J1772	1			Fort Worth	76155
McDonald's - Frisco	Blink	J1772	2			Frisco	75034
McDonald's - Highland Village	Blink	J1772	1			Flower Mound	75077
McDonald's - Irving	Blink	J1772	2			Irving	75060
MidPark Center	Blink	J1772	2			Plano	75093
North Central Texas Council of Governments	Blink	J1772	2			Arlington	76011
Original Pancake House - Addison	Blink	J1772	2			Dallas	75254
Original Pancake House - Grapevine	Blink	J1772	2			Grapevine	76051
Richland College - Garland Campus	Blink	J1772	2			Garland	75040
SoCo Urban Lofts	Blink	J1772	2			Dallas	75202
St. Mark's School of Texas	Blink	J1772	2			Dallas	75230
Telecore	Blink	J1772	1			Richardson	75081
The Ranch at Las Colinas	Blink	J1772	2			Irving	75039
The Shops at Highland Village	Blink	J1772	3			Highland Village	75077
Twin Peaks - Frisco	Blink	J1772	2			Frisco	75034
Twin Peaks - Lewisville	Blink	J1772	2			Lewisville	75067
Twin Peaks - Mesquite	Blink	J1772	2			Mesquite	75150
Twin Peaks - Plano	Blink	J1772	2			Plano	75074
Uptown Village at Cedar Hill	Blink	J1772	3			Cedar Hill	75104
UT Dallas Activities & Recreation Center - Lot J	Blink	J1772	2			Richardson	75080
UT Dallas Clark Center - Lot I	Blink	J1772	2			Richardson	75080
UT Dallas Research and Operations Center	Blink	J1772	2			Richardson	75080
UT Dallas Student Services Building - Lot K	Blink	J1772	2			Richardson	75080

Name	Company	EVSE 1		EVSE 2		City	Zip
		Type	No	Type	No		
Watters Creek at Montgomery Farm	Blink	J1772	2			Allen	75013
West Irving Library	Blink	J1772	2			Irving	75062
West Village - Mi Cocina Valet	Blink	J1772	2			Dallas	75204
West Village - Mothership Garage	Blink	J1772	2			Dallas	75204
Whiskey Cake Kitchen & Bar	Blink	J1772	2			Plano	75039
Elements Hotel	ChargePoint	NEMA 5-20R	1			Irving	75063
Half Price Books	ChargePoint	J1772	1	NEMA 5-20R	1	Dallas	75231
Home Energy Americas	ChargePoint	J1772	1	NEMA 5-20R	1	McKinney	75071
Huffhines Recreation Center	ChargePoint	J1772	2	NEMA 5-20R	2	Richardson	75081
The Centre at Preston Ridge	ChargePoint	J1772	1			Frisco	75034
Trinity Commons	ChargePoint	J1772	1			Fort Worth	76109
Whole Foods	ChargePoint	J1772	1	NEMA 5-20R	1	Fairview	75069
Cracker Barrel - Arlington	eVgo	CHAdeMO	1	J1772	1	Arlington	76006
Cracker Barrel - Burleson	eVgo	CHAdeMO	1	J1772	1	Burleson	76028
Cracker Barrel - DeSoto	eVgo	CHAdeMO	1	J1772	1	DeSoto	75115
Cracker Barrel - Mesquite	eVgo	CHAdeMO	1	J1772	1	Mesquite	75150
Hebron 121 Station	eVgo	J1772	2			Lewisville	75057
Park N' Fly	eVgo	J1772	2			Coppell	75019
Shell - Grand Prairie	eVgo	CHAdeMO	1	J1772	1	Grand Prairie	75050
Walgreens - Belt Line Road	eVgo	CHAdeMO	1	J1772	1	Dallas	75254
Walgreens - Cedar Springs Road	eVgo	CHAdeMO	1	J1772	1	Dallas	75219
Walgreens - Collins	eVgo	CHAdeMO	1	J1772	1	Arlington	76011
Walgreens - Henderson Street	eVgo	CHAdeMO	1	J1772	1	Fort Worth	76102
Walgreens - Hurst	eVgo	CHAdeMO	1	J1772	1	Hurst	76053

Name	Company	EVSE 1		EVSE 2		City	Zip
		Type	No	Type	No		
Bankston Nissan of Dallas	Independent	J1772	3			Dallas	75244
Bankston Nissan of Lewisville	Independent	J1772	1			Lewisville	75067
Clay Cooley Nissan	Independent	J1772	1			Dallas	75237
College Park Garage	Independent	J1772	1			Arlington	76010
Courtesy Nissan	Independent	J1772	1			Richardson	75080
Don Davis Nissan	Independent	J1772	1			Arlington	76018
John Wright Associates	Independent	J1772	1			Arlington	76013
Marriot Courtyard	Independent	J1772	2			Plano	75093
Nissan of Fort Worth	Independent	J1772	1			Fort Worth	76116
Nissan of McKinney	Independent	J1772	1			McKinney	75069
Orr Nissan of Corinth	Independent	J1772	1			Corinth	76210
Orr Nissan of Greenville	Independent	J1772	1			Greenville	75402
Southwest Mitsubishi	Independent	J1772	1			Weatherford	76086
Southwest Nissan	Independent	J1772	1			Weatherford	76087
Texas Nissan of Grapevine	Independent	J1772	1			Grapevine	76051
West Irving Library	Independent	NEMA 5-15R	40			Irving	75062
Dallas City Hall	TXU	J1772	2			Dallas	75201
Roy and Helen Hall Memorial Library	TXU	J1772	1			McKinney	75069
TXU Energy	TXU	J1772	1			Irving	75039

Appendix 3B PEV Readiness Programs and Activities Underway in the Houston-Galveston Area 1

I. PEV Barrier or Readiness Issue Being Addressed	Program or Initiative (Organization leading the effort)	Program purposes and elements	Tangible results through first quarter 2012
PEV Readiness and Promotion Coordinating Group	City of Houston EV Working Group (included OEMs, CenterPoint, Clinton Climate Initiative, Reliant, and others); H-GAC; Houston-Galveston Clean Cities Coalition	Coordinating meetings and conversations allow stakeholders to address specific regional issues. - Monthly City of Houston EV Advisory Committee meetings were held from August 2010 to August 2011. - H-GAC and the Houston-Galveston Clean Cities Coalition (HGCCC) hold periodic calls and event	Robust stakeholder process led by the City of Houston, ECOtality and the Houston Advanced Research Center (HARC) resulted in development of major planning documents to guide the City's deployment of electric vehicle infrastructure. Documents include the Electric Vehicle Charging Infrastructure Deployment Guidelines, Long-Range Electric Vehicle Charging Infrastructure Plan and Micro-Climate Plan. Houston Drives Electric Press Conference – September 8, 2011 – Houston Mayor Annise Parker announced the Houston Drives Electric initiative and NRG eVgo unveiled the first DC fast charge station in the region. HGCCC Regional EV Update Conference Call – October 6, 2011 – Meeting to share stakeholder updates, address the regional EV assessment, and discuss next steps for regional PEV activities. HGCCC Clean Fleet Technologies Conference – October 19, 2011 – This annual conference highlights multiple alternative fuels with various speakers, panel discussions, and breakout

			sessions. This year's event included exhibitors who featured EVSE equipment (Coulomb, Hubbell Wiring Systems, GRIDbot). Ford Power of Choice Tour and Press Event at University of Houston – October 25, 2011 Ford Go Further Event in Downtown Houston – May 10, 2012
Training/Outreach			
Need for training of local building inspectors	H-GAC; City of Houston; CenterPoint Energy; Local government	Local permitting officials and inspectors can facilitate installation of EVSE by providing an appropriate framework to ensure safety. Training is needed across local communities to raise awareness of EVSE design and requirements.	H-GAC and CenterPoint Energy have discussed the need to host training for permitting professionals and inspectors. The training will require funding support and outreach to potential participants. Next Steps: Engage with local community colleges and professional organizations. Collaborate with regional USGBC on green buildings and LEED building certifications and opportunities.
Need for training of local electrical contractors	H-GAC; City of Houston; CenterPoint Energy	Electrical contractors provide essential service to PEV consumers who choose to install home charging. As the market grows, local electrical contractors will provide service for commercial EVSE installs and allow for continued growth.	H-GAC and CenterPoint Energy have discussed the need to host training for electrical contractors. The training could require funding support and will involve outreach to contractors. Next Steps: As PEVs become more common, certified electricians may be the first point of contact for consumers. The region may benefit from a publically-available list of certified electricians with PEV and EVSE experience and/or training. Organizations

			like the International Brotherhood of Electrical Workers (IBEW) could be local resources.
Need for outreach and training of public and private fleet operators	H-GAC Clean Cities / Clean Vehicles program; City of Houston Green Houston effort	Providing information to public and private fleet operators will raise awareness and understanding of the EV technologies.	H-GAC Clean Cities and Clean Vehicles program offers guidance, information, and support for public and private fleet operators. Electric vehicles are eligible for H-GAC Clean Vehicles funding. H-GAC newsletters and funding announcements regarding regional and state funding (e.g. TCEQ TERP Alt Fuel Infrastrucure funding) have reached >500 contacts. EVSE providers (like Coulomb, NRG Energy eVgo and ECOtality) are working cooperatively with municipalities and business across the region to construct and operate EVSE. The City of Houston is leading by example and has actively implemented PEVs into their fleet.
Emergency responder training	H-GAC & HGCCC; CenterPoint; Retail electricity providers	Training will provide an understanding of the EV technologies and allow emergency responders to approach incidents with more confidence. It will also provide an.	The HGCCC is planning to host first responder training in 2012. The Coalition is currently researching various training courses and opportunities. In order to sustain training efforts over the long-term, H-GAC is searching for partners, like local community colleges, who may be able to offer regular training courses and incorporate PEV training into existing professional training courses.

General training and outreach to local officials	H-GAC; Houston-Galveston Clean Cities Coalition; Local governments and municipal entities	H-GAC Houston-Galveston Clean Cities Coalition held meeting in April 2011 and offers ongoing advice and support to local governments and private entities that express interest in electric vehicles and EVSE.	HGCCC EV Workshop – April 13, 2011 – HGCCC hosted an informational meeting for approximately 40 local government contacts and other regional EV stakeholders. The workshop presentations on infrastructure, permitting, recent EV developments, and an overview of EV technologies. Following the EV Workshop, The Woodlands Township, City of Sugar Land, City of Missouri City and other communities have expressed interest in adopting and/or encouraging PEVs and EVSE. City of Galveston Historical Society was an early adopter of PEV charging equipment Spring Independent School District purchased a plug-in hybrid diesel-electric school bus in 2009 The HGAC Buy Cooperative Purchasing program is accepting bids for Electric Vehicle Charging Equipment & Related Services through June 2012. HGAC Buy is expected to award supply contracts to EVSE providers by October 2012.
General information and outreach to consumers	City of Houston; Reliant / NRG / eVgo; CenterPoint, Houston-Galveston Clean Cities; Auto dealerships; OEMs		City of Houston launched Houston Drives Electric program as a comprehensive city-wide electric vehicle program. The region's primary electric transmission service provider, CenterPoint, is conducting electricity reliability studies, planning for future PEV

			deployment, and offering information to consumers. Houston PEV experts spoke at Plug-In 2012 Conference in San Antonio, Texas. Houston area speakers included City of Houston Sustainability Director Laura Spanjian and CenterPoint Energy Manger of Clean Air Technologies David Owen. The eVgo EVs for Trees campaign, available to consumers through December 2012, allows individuals to test drive PEVs. After each test drive, participating auto dealers will donate to the Trees for Houston organization.
Code Revisions			
Progress in amending and adopting city electrical and building codes for PEV charging	City of Houston; Local governments	Adopting current and appropriate building and electrical codes will facilitate growth of EVSE network and ensure safety. Out-of-date codes may delay EVSE permitting.	The City of Houston permitting office has worked diligently to plan and communicate across multiple City departments. The Mayor's Office of Sustainability, the Fleet Management Department, Code Enforcement, and Permitting Center are working together to share information and address barriers. The City is continuing to work with the commercial building codes and permitting processes. Other large suburban communities, including the cities of Pearland, Sugar Land, Katy, and Webster, have worked with EVSE providers to permit and facilitate construction of EVSE stations. Next Steps: As the PEV sector grows, the HGCCC will need to gather

			best practices and develop educational materials for county planners and smaller communities throughout our region.
Expedited Permitting to Avoid delays			
Expedited Permitting to Avoid delays for private Level 2 charging stations	City of Houston; OEMs; auto dealerships; EVSE providers	The City of Houston has coordinated among multiple city departments create a 24-hour permitting process and offers online permit requests. Other regional communities can learn from the City of Houston's experiences.	To facilitate City of Houston's electric vehicle adoption, the Public Works and Engineering department's permitting office has created a 24-hour permitting process. If an electrical contractor has purchased the required permit for the installation and requests an inspection prior to 12:00 PM, the inspection will be performed that same day. For inspection requests made after 12:00PM, inspections will be performed within 24 hours. The vehicle manufacturers and auto dealers in the Houston region have been communicating with and educating consumers about the process for installing Level 2 home charging. NRG Energy offers a home charging dock and equipment for consumers who purchase electricity through the eVgo charging plans.
Expedited Permitting to Avoid delays for public or commercial Level 2 or DCFC charging stations	City of Houston; OEMs; auto dealerships; EVSE providers		Currently, 220 EVSE ports are available at 102 locations in the Houston region. Local communities have been able to share information and effectively issue permits for construction.
Uniform Signage	City of Houston; Local governments; EVSE providers	Regional efforts to develop uniform signage for EVSE infrastructure may enhance recognition of PEVs and EVSE across	City of Houston Parks and Recreation Department is installing "EV Only" signs at EVSE sites.

		the regional and/or state.	Additional efforts will be necessary to develop uniform signage across the region.
Problems Associated with PEV charging in multifamily dwellings and workplaces			
Multi-family Units: Apartment buildings & Condominiums	Houston-Galveston Area Council; Building owners and property developers; City of Houston; CenterPoint; Retail electricity providers; EVSE providers	Installing EVSE at multi-family residential units remains a challenge in Houston. A lack of multi-family charging unit availability, limits consumer accessibility. Addressing the challenge will require participation from building owners and may require education and/or incentives.	Additional efforts will be needed to identify the specific challenges in the Houston region. Next Steps: Multiple regional stakeholders have envisioned "EV Ready" Multi-family charging locations. Funding and advanced planning can enable workplaces and multi-family residential units to have charging "wiring" installed so that EV drivers can have chargers installed (at their own expense) when needed. The region may also want to engage with the regional U.S. Green Building Council to indentify incentives and opportunities.
Workplace: Prvt	Building owners and property developers; EVSE providers	In Houston, workplace charging will be essential for PEV owners commuting to and from work. EVSE are already available in local parking garages and workplaces. Additional outreach may be needed and employees may need resources for approaching their employers to request workplace charging infrastructure.	ECOtality EV Project offers EVSE at low or no cost to eligible entities that agree to allow public access to the charging stations. By the end of the 2012, ECOtality is committed to installing 200 Level 2 charging stations across the Houston region. This effort provides information specifically for workplace charging. Next Steps: Companies, building owners, and corporate leadership are asking questions about fairness to employees and about the potential tax implications of offering charging stations to

			employees. Additional information about various options for offering EVSE as a workplace benefit will be needed.
Workplace: Govt	City of Houston; Local government and municipal entities	The City of Houston has been a leader in adopting EVSE infrastructure and has 40 PEVs and plug-in hybrids. Other communities are expressing interest but have limited funding. Other federal or state fleets may also benefit from additional outreach related to EVSE.	City of Houston announced Houston Fleet Share program in August 2012. This green fleet sharing program will outfit 50 city-owned PEV and hybrid vehicles with ZipCar car sharing technology. City employees in multiple departments will be able to reserve vehicles. City of Houston has a contract with ECOtality to install a total of 66 public EVSE. City of Houston has installed 28 public charging stations at City libraries and parks with funding through SECO and EPA Climate Showcase Communities grant.
Other issues/barriers: Consumer Concerns (e.g. vehicle range)	OEMs; Local businesses	Access to free, readily available, and visible charging across the region will help the regional EV market to develop by giving PEV drivers more confidence and possibly reducing range anxiety. Visible EVSE infrastructure can help educate the public and reduce consumer hesitation towards adopting the new PEV technology.	Many locations (including Whole Foods, Houston Arboretum, hotels, drug stores, restaurants) may offer free charging as an amenity for employees, customers, or residents.
Other issues/barriers: Natural Disaster Preparedness for PEVs and EVSE	H-GAC; Houston-Galveston Clean Cities; Local emergency management	The Houston region will need consider safe operation of EVSE during natural disasters and other emergency situations. It will be necessary to plan	Additional efforts will be necessary to understand and address the effects of natural disasters on PEV and EVSE in Houston.

	professionals; ERCOT	for possible effects of hurricanes, tropical storms and heat waves.	Next Steps: The Houston region will need to consider options to include PEV information into future preparedness information campaigns (e.g. hurricane evacuation)

II. Deployment of PEV Public Charging Stations by Vendor	**Vendor Name (property owner)**	**Number of locations[1] actually built or being built with, number of stations[1] and ports[1] with level of charging**	**Other information regarding PEV charging stations deployment including ADA requirements**
Currently Available	ECOtality	91 Level 2 ports at 35 locations	
	ChargePoint Network	26 Level 1 ports 11 Level 2 ports at 17 locations	
	eVgo	17 Level 1 ports 20 Level 2 ports 17 DC Fast ports at 19 locations	
	Nissan Dealership	24 Level 2 ports at 12 locations	
	Other	2 Level 1 ports 16 Level 2 ports at 9 locations	Owned/operated by Brookfield Properties, Whole Foods, Galveston Historical Foundation, Sand Dollar Autoplex, Element Hotels
	TOTAL	45 Level 1 162 Level 2 17 DC Fast at 102 locations	
III. PEV Sales Activity			
	Vehicle Mfr & Model	**Number of Vehicles**	**Data Source/Method**
	Nissan Leaf	181 (171 in non attainment area)	TxDMV Data (through 6/30/12)
	Chevrolet Volt	148 (139 in non attainment area)	TxDMV Data (through 6/30/12)
	Mitsubishi	2	TxDMV Data (through 6/30/12)
	Ford Focus Electric		
	Tesla Motors		
	Toyota	PEV delivery is not expected until 2012 / 2013.	

Background:

The PEV market and EVSE infrastructure development in the Houston region have developed through City of Houston leadership, proactive EVSE providers, OEM release of PEVs in Houston, participation from local governments, and interest from private companies, employers, and building owners. These active partners have allowed the region to identify opportunities and challenges through aggressive goal-setting and actual deployment of EVSE. Due to the deregulated electricity market, CenterPoint Energy and retail electric providers have also been active stakeholders. For example, NRG Energy, a retail electricity supplier in the Houston region, has deployed EVSE infrastructure in the region through their planned eVgo Network. ECOtality, Coulomb, and eVgo are operating over 100 EVSE in the Houston region. Their "on the ground" experiences have helped identify local permitting challenges and opportunities. Furthermore, CenterPoint Energy has conducted analyses to understand the impact of electricity demand created by PEVs; the analysis found no impacts in the short term. CenterPoint is continuing regional planning and analyses to identify potential for PEV growth in the region with EPRI.

Next Steps:

In addition to the next steps listed in the table above, the region will need to coordinate with other TX cities but also gather regional specific information to provide:

- Training Resources – Access and information about available and reliable training providers.
- Funding Resources – Up-to-date information about funding opportunities and financial incentives available at the federal level and/or state level.
- Handbooks & Outreach Materials – HGCCC has received requests for additional information that can address concerns expressed by building owners and employers who are interested but hesitant about supporting PEVs and EVSE. Helpful resource materials would include case studies, best practices, and answers to FAQs for developers, building owners and managers, and employers.

Regional Resources & Documents:

City of Houston EV Working Group (which included OEMs, CenterPoint Energy, Clinton Climate Initiative, NRG/Reliant, and others) developed a series of guidelines and resources related to the deployment of electric vehicles and infrastructure within the City of Houston and surrounding areas.

a) Recommended Electric Vehicle Charging Infrastructure Deployment Guidelines for the Greater Houston Area
http://www.greenhoustontx.gov/ev/pdf/evdeploymentguidelines.pdf

b) Electric Vehicle Charging Long Range Plan for the Greater Houston Area
http://www.greenhoustontx.gov/ev/pdf/longrangeevplan.pdf

c) Electric Vehicle Charging Micro-Climate Plan for the Greater Houston Area
http://www.greenhoustontx.gov/ev/pdf/micorclimateplan.pdf

Appendix 3B Results of the Task 3 Survey and Meeting of Mid Size Cities and Small Towns in the Texas Triangle

Survey Results

Some 34 cities from around the U.S. were selected from three lists of communities said to be exemplary in terms of their progress toward PEV Readiness.[V] An internet based questionnaire was sent to each followed by telephone calls to either encourage the contact to respond or to follow up on the responses. We received responses from 20 of the 34. These responses are summarized below and the implications for the development of the Texas Triangle PEV Readiness Plan are provided. This survey was conducted early on in the planning process.

Following the survey telephone calls and in person interviews were conducted with small and mid-size city representatives. A meeting was held to gather their ideas on the proposed Texas PEV-Friendly Community. As a result some changes were made in the recommendation that is now part of this Plan.

EV READINESS SURVEY - SUMMARY																				
	City Responses																			
Question	Boulder, CO	Chattanooga, TN	Tampa, FL	Columbus, OH**	Corvallis, OR**	Denver, CO**	Eugene, OR	Knoxville, TN**	Memphis, TN	Normal IL**	Oro Valley, AZ	Orlando, FL**	Phoenix, AZ	Raleigh, NC**	Riverside, CA	Saint Louis, MO**	Salem, OR**	San Francisco, CA**	Seattle, WA**	Tucson, AZ
Does your City use the NEC?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
If not, which Fire Code is used?																	**	(1)	**	
Passed any Ordinances related to PEV's?	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N
Amended any Codes?	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N
Offer any incentives?	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	N	N	Y	N	N
Have fast-track permitting process?	N	N	N	N	Y	N	N	N	N	N		Y	Y	Y	Y		N	Y	Y	Y
Required new const. pre wiring?	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
Purchased or planning to purchase PEV's?	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y
Installed chargers on City property?	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Installed chargers on commercial prop.?	N	Y	N	Y	Y	N	N	Y	Y	N	N	Y	N	N	N	Y	N	Y	N	Y
If chargers installed: Funding source?*	G	G	G	G	G	C	G	G	G	G/C	G	G	G	G	G		G	G	G	G
Have dedicated dept. or person for PEV information?	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	N
Provide basic consumer PEV information?	N	Y	Y	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	N

Some of the implications of these results for our Plan are:

- The National Electric Code (NEC), which has been revised to accommodate PEV charging, is sufficient. No new model electric code will be addressed in the Plan, only the recommendation that communities adopt the most recently updated NEC.

- Similarly, the quest for a model ordinance may be misplaced. Many of the best practices will probably be achievable without new ordinances. Therefore, our Plan will focus on *best practices* rather than *model ordinances*. See Appendix 3N for a model ordinance "tool kit" developed by Austin Energy as part of the Texas River Cities readiness plan.

- In this resource-constrained environment, even the highly touted PEV friendly cities are not adding cash subsidies to those already provided by the Federal, and in some cases, the States.

- Fast tracking of permits for PEV charging may be necessary when either of two circumstances exist: a) the community has a history of delays in obtaining permits, and/or b) the volume of PEV installations creates a demand for inspections and permits that causes delays. By training inspectors and electricians, an expedited permitting process may not be necessary. Thus appropriate training coupled with a case-by-case approach to the permitting process (perhaps with a quantifiable limit on time required for obtaining permits) may be appropriate.

- The installation of public charging infrastructure on municipal property appears to be the result of having received grant funds for that specific purpose rather than a locally funded initiative based on a perceived need. The Plan should focus on the minimization of barriers to such installation.

- The purchase of PEVs for use in municipal operations should be based on the overall economics of PEVs versus conventional internal combustion engine (ICE) vehicles. Therefore, the Plan should ensure that purchasing departments are equipped with the information necessary to make the decision to purchase and use PEVs and that no purchasing "red tape" barriers exist to prevent PEV use when the overall operating and maintenance benefits of the PEV more than offset the initial purchase price (i.e., PEVs are cost effective).

- In line with their accessibility and trust factors with the general public, cities will be sought after for guidance by citizens as part of their purchasing decisions. The interactive consumer program being designed as a part of this Plan will help standardize

some of this information. Nevertheless, having someone on staff who is knowledgeable and can serve as a single point of contact should be a part of the Plan recommendations.

Forum with Mid Size Cities and Small Towns in the Texas Triangle

Some 40 city officials (mayors, city managers or staff involved in fleet purchasing, code enforcement, environment, planning) from small and mid-size cities from along and within the Texas Triangle were invited to a forum on PEV Readiness on March 9, 2012 in College Station, Texas. Figure 3B1 shows the agenda for the meeting.

The City of College Station was the host. City of College Station, Mayor Nancy Berry welcomed everyone to the meeting. ECOtality and General Motors provided charging infrastructure and Chevy Volts respectively for the attendees to see the technology being discussed. The logistics, announcements, and much of the content was arranged by Plug-In Texas under contract to CCET.

With a few exceptions, these cities are outside or on the margin of the transportation planning jurisdictions of the major metropolitan areas where PEV readiness programs are well underway. The purpose of the forum was to introduce the attendees to PEVs, the supporting infrastructure, the challenges and opportunities afforded by PEVs, and to gather feedback on the first drafts of the proposed Texas PEV Friendly Community concept.

Of the more than 40 invitations sent out, only about twenty responded that they intended to participate, but on the date of the event heavy rains and threats of local flooding cut back on participation even more. Counting presenters there were about 25 attendees including representatives from City of Huntsville, Killeen, Bryan, College Station, and Texas A&M transportation planning.

Figure 3B1 Agenda for March 9 Forum

TEXAS TRIANGLE CITY LEADERSHIP
ELECTRIC VEHICLE READINESS MEETING
Agenda
MARCH 9, 2012

9:30 a.m.	Conference Purpose and Overview of Agenda	Milton Holloway, CCET
9:40 a.m.	Welcome	Mayor Nancy Berry, City of College Station
9:50 a.m.	DOE EV Readiness Program	Neil Kirschner, DOE
10:00 a.m.	Introduction of Attendees and Participants	Russ Keene, Plug-In Texas
10:15 a.m.	PEVs 101 (Technology, Texas market penetration and issues)	Lance Spross, Oncor Russ Keene, Plug-In Texas
11:00 a.m.	Charging Station Infrastructure	Dave Aasheim, ECOtality Ronald Steedley, Texas A&M University*
11:30 a.m.	Introducing Local Community Best Practices	Bob Davis, CCET
12:00 p.m.	Break for lunch and Chevy Volt test drives	
1:30 p.m.	Training Program Overview: • Emergency Responders • Electrical installers and code enforcement • City Fleet Operators • Management of Public charging	George Bellino, General Motors
2:30 p.m.	Group discussion: feedback on candidate best practices	Russ Keene, Plug-In Texas
3:20 p.m.	Concluding remarks and Adjourn	CCET

** Following the meeting, there will be an optional viewing of Texas A&M's public charging station for meeting participants a short distance from our meeting location.*

Appendix 3C Incentives for Purchasers and Drivers of PEVs

Incentives, be they cash or convenience, promote PEV use and adoption. While they are not exactly "readiness" measures, they act together with readiness measures to make a state, region, or community more PEV friendly. Examples of state and local incentives are discussed below.

State tax rebates or direct subsidies for PEV purchases[VI]

The following states currently offer PEV purchase incentives

- Hawaii - $4,500 Rebate
- Illinois - $4,000 Rebate (Purchase only)
- Pennsylvania - $3,500 Rebate (Purchase only)
- Tennessee - $2,500 Rebate
- California - $1,500 Rebate ($2500 for BEVs)
- West Virginia - $7,500 Income Tax Credit
- Colorado - $6,000 Income Tax Credit
- South Carolina - $1,500 Income Tax Credit
- Utah - $605 Income Tax Credit (Purchase only)
- Maryland - $2,000 Excise Tax Exemption

EVSE Infrastructure incentives

The expense of purchasing a PEV is primarily the cost of the vehicle. An additional cost is the purchase and installation of the EVSE to charge the vehicle. Some cities, like Austin, provide PEV purchasers funding assistance in the installation of the charging equipment.

The DOE Clean Cities program suggests[VII] that charging infrastructure incentives should grow at a rate that makes sense for the growth in PEV adoption, and that infrastructure incentives should be as simple as possible to execute. For example, following are a few of the many charging infrastructure incentives being offered.

- Federal DOE Program Incentives (EV Project with ECOtality or Coulomb in select areas): Washington, Oregon, California, Arizona, WDC/VA/MD, Orlando/Tampa, Boston, Michigan, NYC/NJ/CT, Tennessee, and Texas,

- Maryland and Louisiana offer stat wide programs.

- The San Antonio municipally owned utility provides incentives for purchasers of EVSE. According to DOE so too does DTE (Michigan), Consumers Energy (Michigan)[VIII], Lansing BL&P (Michigan), Duke Energy (Indiana), Progress Energy (North Carolina), and LADWP (Los Angeles).

High Occupancy Vehicle (HOV) lane exemption for PEVs

According to General Motors, the exemption for a single passenger (i.e. driver only) in California to use an HOV on congested roadways is acting as stronger than expected incentive for PEV purchases. [IX] Apparently, the desire to avoid congested freeways while not having to find another passenger (i.e., car pool) is strong enough to overcome the additional upfront costs of a PEV for some drivers. Thus, this can be a powerful incentive that ranks along with subsidies.

The states currently allowing HOV-lane access for PEVs include: California, Florida, Maryland, Nevada, New Jersey, North Carolina, and Utah. The California exemption is a bit complicated. There are two types of exemption stickers. Some vehicles, such as BEVs and even some CNG vehicles, automatically get the white sticker. Only the first 40,000 purchasers of other vehicles, including the Chevy Volt, will get the green sticker. See table below. Each vehicle model must qualify and be listed. Following is the list for 2012 model vehicles. [X]

2012 Model Year Vehicles Qualifying for State of California HOV Lane Exemptions						
Azure Technologies	Ford Transit Connect Electric	ZEV	Electric	n/a	CAZDT00.0001	
BAF Technologies	Ford F-250, Ford F-350	COUNTED AS SULEV	CNG	6.2	CBAFT06.2CHL	
BAF Technologies	Ford E-150 Club Wagon, E-350 Club Wagon, Ford E-150 Van, Ford E-250 Van, Ford E-350 Van, Ford E-350 Cutaway	COUNTED AS SULEV	CNG	5.4	CBAFT05.4CHK	
BAF Technologies	Ford Transit Connect Van, Ford Transit Connect Wagon	SULEV	CNG	2.0	CBAFT02.0CDW	
Chevy	Volt - Please note that eligible vehicles with the Low Emissions Package will have an E, F, G or H in the 5th position of the VIN	Enhanced ATPZEV	Plug-in Hybrid	1.4	CGMXV01.4011	
Coda Automotive	Coda	ZEV	Electric	n/a	CCDAV00.01UA	
Ford	Focus Electric	ZEV	Electric	n/a	CFMXV00.OVAE	
Honda	Civic Natural Gas	ATPZEV	CNG	1.8	CHNXV01.8BDT	
Impco Technologies	G25, G35 SAVANA	SULEV	CNG	6.0	CZ9XT06.0CDA	
Impco Technologies	G2500, G3500 SAVANA	SULEV	CNG	6.0	CZ9XT06.0CDA	
Impco Technologies	G2500, G3500 EXPRESS	SULEV	CNG	6.0	CZ9XT06.0CDA	
LANDI RENZO USA	E150, E350 CLUB WAGON	COUNTED AS SULEV	CNG	5.4	CLDRT05.4A11	

LANDI RENZO USA	E150, E250, E350 VAN	COUNTED AS SULEV	CNG	5.4	CLDRT05.4A11	
LANDI RENZO USA	E350 CUTAWAY	COUNTED AS SULEV	CNG	5.4	CLDRT05.4A11	
Mercedes Benz	F-Cell	ZEV	Hydrogen	n/a	CMBXV00.0FC1	
Mitsubishi	i-MiEV	ZEV	Electric	n/a	CMTXV00.0EWB	
Nissan	Leaf SL, Leaf SV	ZEV	Electric	n/a	CNSXV0000LLA	
Roush Industries, Inc.	Ford E-150 Club Wagon, Ford E-350 Club Wagon, Ford E-150 Van, Ford E-250 Van, Ford E-350 Van, Ford E-350 Cutaway	SULEV	LPG	5.4	CRIIT05.45HG	
Tesla	Model S, S3	ZEV	Electric	n/a	CTSLV00.0L1 S	
Toyota	Prius Plug-in Hybrid	Enhanced ATPZEV	Plug-in Hybrid	1.8	CTYXV01.8HCU	
Toyota	RAV4 EV	ZEV	Electric	n/a	DTYXV00.0DA9	
Vehicle Production Group	MV-1	SULEV	CNG	4.6	CTVPT04.6CG1	

Waived state sales tax, license fees, and other fees

Many states have considered and enacted a variety of incentives for PEV purchasers including reduced or eliminated state sales taxes and annual registration fees. Arizona has reduced licensing fees for certain electric vehicles. Nevada even has an exemption from parking meters and emission inspections for PEVs[XI]. The combination, level, phase out times, and other limits are many and varied. Each of these must be weighed against the loss of revenues and other, sometimes, unintended consequences. One of the comments at one of our public meetings was that by adding more qualifying vehicles to the HOV lanes, the increasing congestion on those lanes would begin to reduce the benefits to current and future users. The use of a phase out period or the limiting of the number of exemptions (e.g., first 10,000 qualifying) are ways to limit the adverse and unintended consequences.

Reduced or eliminated tolls

The reduction or elimination of tolls for PEVs is yet another type of incentive available. Here the problem is that toll road operators are often private, for-profit entities with contracts that allow them to charge certain rates. It is one thing for a government entity to eliminate certain fees, but the legal implications of trying to retroactively reduce tolls for PEVs is more difficult.

Nevertheless, as new contracts for toll roads are being let by the State, the PEV toll exemption or reduction is an option.

Reduced or free parking and designated PEV parking spots

Treating PEVs similar to drivers of vehicles with a disabled parking sticker or designation is also problematic. It is a problem because of the negative publicity and because many PEV drivers do not want preferential parking. When a PEV only space is unoccupied this can be a source of public frustration and resentment. Based on a variety of discussion groups among various state and local PEV promoters, the prevailing opinion seems to be that PEV only parking should be confined to spots that have a EVSE, and that even then, the use of the spot should be confined to PEVs that are being charged. (i.e., once the charging has been completed, the driver should make way for another PEV user). Stated another way, the parking spot should be exclusively for PEV charging and not as a general incentive.[XII]

Free parking in charging stations is discouraged because it results in people occupying a spot beyond the time required for charging and thus preventing others from using the spot.

Appendix 3D Selected Internet Sites Providing PEV Information

PEV ADVOCACY	
EDTA (Electric Drive Transportation Association)	www.goelectricdrive.com
Electrification Coalition	www.electrificationcoalition.org
Plug In Partners	http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/plug-in%20Partners/index.htm
Plug-In America	www.pluginamerica.org/
Plug-In Texas	www.plugintexas.org
Plug-In Michigan	www.pluginmichigan.com
GreenCarReports	www.greencarreports.com/news/electric-cars
CalCars	www.calcars.org
Plug-In Cars	www.plugincars.com/
EV World	evworld.com/index.cfm
Edmunds.com	www.edmunds.com/fuel-economy/the-true-cost-of-powering-an-electric-car.html
Project Get Ready	www.projectgetready.org
Edison Electric Institute's Electric Vehicle Readiness Guide	http://www.eei.org/ourissues/EnergyEfficiency/Documents/EVReadinessGuide_web_final.pdf

DOE AND OTHER GOVERNMENT WEBSITES	
Electric Vehicles 101	http://energy.gov/articles/energy-101-electric-vehicles
Fuel Economy Guide	http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=644
Fuel Economy Website	www.fueleconomy.gov
Vehicle Cost Estimator	www.afdc.energy.gov/afdc/calc/
Charging Station Locator	www.afdc.energy.gov/afdc/locator/stations/?fuels=ELEC
Alternative Fuel Price Report	www.afdc.energy.gov/afdc/price_report.html
Alternative Fuel Data Center	www.afdc.energy.gov/afdc/applications.html
Hybrid & PEV Vehicles	www.afdc.energy.gov/afdc/vehicles/electric.html
Texas Clean Cities Coalition	www.seco.cpa.state.tx.us/alt_cc.htm

GENERAL INFORMATION	
Description of Electric Vehicles	http://www.fueleconomy.gov/feg/evtech.shtml
Description of Plug-In Hybrids	http://www.fueleconomy.gov/feg/phevtech.shtml
Description of NEVs	http://www1.eere.energy.gov/vehiclesandfuels/avta/light_duty/nev/index.html
Description of Urban Electric Vehicles	http://www1.eere.energy.gov/vehiclesandfuels/avta/light_duty/uev/index.html
Plug In Electric Vehicle Handbook for Consumers	http://www.afdc.energy.gov/afdc/pdfs/51226.pdf
PEV Vehicle Tracker	http://www.pluginamerica.org/vehicles

VEHICLES AND VEHICLE MANUFACTURERS	
Audi	http://www.audiusa.com/us/brand/en/exp/progress/Concept_Vehicles/audi_e_tron.html
BMW	http://www.bmw.com/com/en/newvehicles/1series/activee/2011/showroom/index.html
Chevrolet	http://www.chevrolet.com/volt-electric-car/?seo=goo
Coda	www.codaautomotive.com/
Fisker	www.fiskerautomotive.com/en-us
Ford	www.ford.com/technology/electric/
Honda	http://automobiles.honda.com/fit-ev/
Nissan	www.nissanusa.com/leaf-electric-car/index#/leaf-electric-car/index
Mitsubishi	https://www.mitsubishicars.com/MMNA/jsp/imiev/12/showroom/overview.do
Smart	www.smartusa.com/models/electric-drive/overview.aspx/
Tesla	www.teslamotors.com
Toyota	www.toyota.com/prius-plug-in/
Volvo	www.volvocars.com/intl/campaigns/hybrid/pages/default.aspx

UTILITIES: TEXAS INVESTOR OWNED	
Electric Utility Marketing Managers of Texas (EUMMOT)	http://www.centerpointenergy.com/staticfiles/CNP/Common/SiteAssets/doc/2009%20EUMMOT%20Flyer.pdf
AEP Texas	www.aeptexas.com/save/ElectricVehicles/
CenterPoint Energy	www.centerpointenergy.com/services/electricity/business/plugin/
Entergy	http://www.entergy.com/
eVgo – NRG Energy	www.evgonetwork.com
Oncor	www.oncor.com/community/bettertexas/electric_vehicles.aspx
TNMP	www.tnmp.com/customers/electric-vehicles/emissions.htm
NRG/Reliant	http://www.reliant.com/Welcome.do
TXU	www.youtube.com/watch?v=VDiDdPDw3ek
TXU w eVgo	www.youtube.com/watch?v=ZOtHKijfLHc
UTILITIES: TEXAS MUNICIPALLY-OWNED OR MEMBER-OWNED CO-OPS	
Austin Energy	www.austinenergy.com/About%20Us/Environmental%20Initiatives/Plug-in%20Hybrid%20Vehicles/aboutPEV.htm
Boerne	http://www.ci.boerne.tx.us/index.aspx?NID=160
Bryan	www.btutilities.com
College Station	http://www.cstx.gov/index.aspx?page=501
Georgetown	http://electric.georgetown.org/
Kerrville	http://www.kpub.com/
Lockhart	http://www.lockhart-tx.org/web98/citydepartments/customerservice.asp
CPS Energy	www.cpsenergy.com/About_CPS_Energy/Who_We_Are/Research_and_Technology/Plug_In_Vehicles/
San Marcos	www.ci.san-marcos.tx.us/departments/electric/
Seguin	http://www.seguintexas.gov/utilities/
Bluebonnet	www.bluebonnetelectric.coop
Central Texas Electric	http://www.ctec.coop/
Fayette	www.fayetteelectriccoop.com
Guadalupe Valley	http://www.gvec.org/
Houston County	houstoncountyelec.com
Navarro County	www.navarroec.com
Navasota Valley	www.navasotavalley.com
Pedernales	http://www.pec.coop/Home.aspx
San Bernard	www.sbec.org
Trinity Valley	www.tvec.net

UTILITY REGULATION AND ISO	
PUCT (Public Utility Commission of Texas)	www.puc.state.tx.us
ERCOT (Electric Reliability Council of Texas)	www.ercot.com

UTILITIES OUTSIDE OF TEXAS WITH PEV WEB CONTENT	
Advanced Energy	www.AdvancedEnergy.org/Transportation/EVSE
Consumers Energy	www.consumersenergy.com/content.aspx?id=3363
ComEd	www.comed.com/sites/environment/pages/electricvehicles.aspx
Con Edison	www.coned.com/electricvehicles/
DTE Energy	www.dteenergy.com/residentialCustomers/productsPrograms/electricVehicles/overview.html
Duke Energy	http://www.duke-energy.com/plugin/
PG&E	www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/index.shtml
Portland General Electric	www.youtube.com/watch?v=FeXCnCkHhfo&feature=mfu_in_order&list=UL
	www.portlandgeneral.com/community_environment/initiatives/electric_vehicles/default.aspx?initiatives
San Diego Gas & Electric	www.youtube.com/watch?v=OfyFRuYwkjE&NR=1
Southern California Edison	www.youtube.com/watch?v=YxDIzWDvEDc www.sce.com/pev
Southern Company	www.youtube.com/watch?v=u0ASr4mxdn4&feature=mfu_in_order&list=UL
	http://www.southerncompany.com/planetpower/electricVehicles.aspx
Tennessee Valley Authority	www.youtube.com/watch?v=QrHXE2XeZnE&feature=related
	http://www.tva.com/environment/technology/electric_transportation.htm
Tampa Electric	www.youtube.com/user/TECOEnergyInc#p/c/761EC92C9360DA86/1/j9tiWMm1e5k
	www.tampaelectric.com/electricvehicles/
Westar Energy	westarelectrogo.com
Xcel Energy	www.youtube.com/watch?v=SFlq31dlLnI

PEV CALCULATORS	
Georgia Power	http://www.georgiapower.com/electricvehicles/
ComEd	https://www.comed.com/technology/electric-vehicles/Pages/cost-calculator.aspx
EDTA	http://www.goelectricdrive.com/
DOE	http://www.afdc.energy.gov/afdc/calc/
DTE Energy	http://www.dteenergy.com/residentialCustomers/productsPrograms/electricVehicles/eVCalculator.html
SDGE	http://sdge.com/sites/default/files/documents/ev-pev-costchart.pdf
Kiplinger	http://www.kiplinger.com/tools/hybrid_calculator/
Tampa Electric	http://www.tampaelectric.com/electricvehicles/buying/
Westar	http://westarelectrogo.com/ElectroGoFuelSavingsComparison.html
PEV LIFE CYCLE COST CALCULATOR	
Via Motors	http://www.viamotors.com/vtrux/life-cycle-savings-calculator/
FLEET MANAGER INFORMATION AND CALCULATORS	
Fleet Applications	http://www.afdc.energy.gov/afdc/fleets/fleet_applications.html
Vehicle Cost calculator	http://www.afdc.energy.gov/afdc/calc/
NCTCOG Fleet Spreadsheet	http://www.google.com/url?q=http%3A%2F%2Fnctcog.org%2Ftrans%2Fair%2Fprograms%2Fevnt%2FEVLifecycleCostModeler.xls&sa=D&sntz=1&usg=AFrqEzdSSJ2Gc5xOoSmVAHUKFoqR74gv-A
Via Motors PHEV Pickup Calculator	http://www.viamotors.com/vtrux/life-cycle-savings-calculator/
CHARGING EQUIPMENT, PUBLIC CHARGING NETWORKS	
DOE Developing Infrastructure	http://www.afdc.energy.gov/afdc/fuels/electricity_infrastructure.html
Plugin Recharge EVSE Vendors	http://www.pluginrecharge.com/p/evse-vendors.html
PUBLIC CHARGING STATION MAPS	
DOE	http://www.afdc.energy.gov/afdc/locator/stations/?fuels=ELE
NREL	http://maps.nrel.gov/transatlas
ChargePoint	http://www.chargepoint.net/find-stations.php
Blink Network	http://www.blinknetwork.com/

Charging Equipment Manufacturers

EVSE manufacturing is a vibrant industry presently. Many firms are appearing, some are being bought and merged into other firms, and some are disappearing. Below are links to websites that try to maintain a periodically updated list of vendors and a non-exhaustive list of EVSE equipment makers for sale in the U.S. market.

CHARGING EQUIPMENT MANUFACTURERS	
Plugin Recharge EVSE Vendors	http://www.pluginrecharge.com/p/evse-vendors.html
Plug In America	http://www.pluginamerica.org/accessories
AeroVironment	www.avinc.com/
Clipper Creek	http://www.clippercreek.com/
Chargepoint – Coulomb Technologies	http://www.chargepoint.com/
Eaton	http://www.eaton.com/Eaton/index.htm
ECOtality	http://www.ecotality.com/
GE	http://www.ge.com/innovation/electric_vehicles/index.html
GRIDBot	http://www.gridbot.net/
Leviton	http://www.leviton.com/OA_HTML/SectionDisplay.jsp?section=37818&minisite=10251&LCR123P_pses=ZG2422AFED1F2208599924582A02373713E8BD30D95EDFDFFD6C722E72DB86BFC46E1433F27DE2F80D2C3C4C2DAA4202A2A745332550E30DE5
PEP Stations	http://www.pepstations.com/
Schneider Electric	http://www.schneider-electric.us/sites/us/en/solutions/energy-efficiency/electric-vehicles/electric-vehicles.page
Shorepower	http://shorepower.com/komfortkits.html
Siemens	http://www.energy.siemens.com/us/en/power-distribution/e-car.htm
CHARGING EQUIPMENT INSTALLERS	
SPX	http://www.spx.com/en/industries/vehicle-and-transit/
AeroVironment	http://evsolutions.avinc.com/services/

Appendix 3E EVSE Permit Streamlining

A threshold question for owners of PEVs --especially PHEVs-- is what level of charging will be needed. GM reports that more than half of Volt owners use 120 V or Level 1 charging by using the cord set that comes with the vehicle and an existing 120 V household outlet to provide overnight charging.[XIII] A prudent first step for PEV owners who are budget constrained is to determine if Level 1 charging will meet their needs. [XIV] For those that will need faster charging, a local permit will usually be required in most incorporated areas.

Unfortunately for PEV readiness, cash strapped cities in some parts of the U.S. are viewing the permitting of PEV EVSE as an opportunity to collect additional revenues rather than having the permit process reflect the relative simplicity of the installment (similar to installing an extra 240 Volt outlet in the garage for a clothes dryer).[XV] According to the National Electrical Contractors Association (NECA), the cost of the permit fee from cities for Level 2 EVSE ranges from $14 to $624 across the U.S. with an average of $174.[XVI] This is the fee alone and does not include the electrical contractor's fee, materials, and, of course, the Level 2 EVSE. Total costs of $1500 are not uncommon for the entire installation process. The time and cost of local permitting can be a major barrier to PEV readiness.

A generic set of recommendations for streamlining the process is provided below by the Plug In Electric Vehicle Collaborative[XVII]

- Expedited solutions, such as creating an online application in place of an initial office visit, or same-day "over-the-counter" approvals to move projects forward, can save time and cost, alleviate PEV owner frustration, and bring goodwill toward the local government's efforts.

- Minimize permit fees for charging equipment installation. Permit fees will vary by jurisdiction, and may vary by project type and scope. Some communities are implementing a flat fee for charging station installations. Fixed, low fees can be implemented if the installation follows an approach that is consistent with or common to other community upgrades, or if the municipality wants to incentivize charging infrastructure.

- Some communities are using existing permits for 240-volt electrical service upgrades. Although this may not capture as much unique information, it allows a community to move forward without implementing new permit types (or until new types are implemented).

- Reduce the number of on-site inspections. In most cases, the installation of a charging station will only require one inspection. However, each time an additional inspection is required adds scheduling delays to the project. Where appropriate, consider requiring only a final inspection and avoiding project progress inspections.

The City of Houston has a five step process described below

Step 1 Customer signals intent to install EVSE
Step 2 Site audit--electrician evaluates home and assesses if panel is adequate for a 240V connection
Step 3 Permit issued. Local permitting office gives electricians immediate on-line approval to install charger as-is or perform necessary upgrades.
Step 4 Electrician installs charger in home/garage.
Step 5 Local permitting office certifies installation is functional and meets safety standards.[XVIII]

A detailed description of streamlining the permit process is provided in Appendix 3F for the City of San Antonio.

Appendix 3F Expedited PEV Permitting Process for City of San Antonio

The City of San Antonio's Development Services Department provides for certain one and two family dwelling electrical repairs and installations to be permitted in an expedited fashion. In 2009 this Limited Service and Repair (LSR) permitting program was amended to allow PEV charging.

According to the City's Information Bulletin 121b to participating electrical contractors the program is described as follows:

Eligible Projects: The LSR permit program allows minor projects to be completed by licensed electrical contractors prior to obtaining the associated permit, and allows the contractor to certify that the completed work complies with the San Antonio Code (SAC) as amended in lieu of scheduling an inspection to be conducted by the Planning and Development Services Department (PDSD). The program further allows for a full PDSD inspection, as an option for the property owner, at no additional cost to them. The licensed contractor shall obtain the required permit after and within three working days from the completion of the work to avoid a penalty fee.

Benefits: The LSR permit program benefits property owners, contractors, and PDSD. It ensures property owners that the work is performed by licensed contractors in compliance with the SAC and allows licensed contractors to quickly respond to the needs of their customers without violating the SAC permit requirements. It has the potential to reduce PDSD inspection requests for LSR eligible work, to minimize the number of "no access" inspections trips typical for LSR eligible work and to free up time to PDSD for making inspections at other locations.

The following items are allowed under the LSR program only when electrical wiring systems on existing residences have a 4-wire feeder to the inside branch circuit panel and when the inside electric panel is in compliance with National Electrical Code and Chapter 10 of City Code.

- Installation of one new 20 amp or less circuit to supply associated outlets/fixtures
- Installation of one new 20 amp or less circuit to supply hard-wired smoke detectors
- Installation of ceiling fans to outlets (approved boxes required)
- Extension of an existing 20 amp or less circuit to install new outlets (total number of outlets new plus existing not to exceed 8 total outlets on 15 amp circuits and 10 outlets on 20 amp circuits)
- Installation of one new 110 or 220 volt dedicated circuit to supply outlets/equipment used to charge electric vehicles (emphasis added)

- Installation of the bonding conductor required whenever Corrugalated Stainless Steel Tubing (CSST) gas piping systems are utilized and no other scope of electrical work is to be done on structure.

The bulletin continues by describing the procedure:

The following procedures are to be followed by the contractor, property owner and PDSD under the LSR permit program.

1. The contractor performs the eligible work and obtains an LSR permit within three (3) working days after completing the work.

2. When PDSD issues the LSR permit, the property owner is notified in writing that an LSR permit was issued indicating that the completed work complies with the San Antonio Code as amended. The property owner is given the option of either accepting the completed job as certified by the licensed contractor or requesting an inspection by PDSD within 30 days of the date of notification. The property owner, not the contractor, is required to coordinate job access for the PDSD inspector if a PDSD inspection is requested.

3. PDSD closes the permit either 30 days from the date of the LSR permit or through the standard inspection procedure if a PDSD inspection is requested by the property owner.

Appendix 3G Neighborhood Electric Vehicles (NEV)

An NEV is an all-electric or battery electric vehicle that meets National Highway Safety Administration (NHSA) guidelines applying to vehicles with a top speed of 25 mph. Nearly all states to operate on roads where the speed limit is 35 mph or less.[XIX] (Texas SB 129 which took effect in September 2009, allows licensed drivers to operate NEVs on streets up to *45* mph.)[XX] To satisfy federal safety requirements for manufacturers, NEVs must be equipped with three-point seat belts or a lap belt, windshield wipers are not required, running lights, headlights, brake lights, reflectors, rear view mirrors, and turn signals. In many cases, doors may be optional.[XXI]

This NEV, the GEMe2, is used as police fleet vehicle for urban area parking enforcement in France. It was produced by GEM, a US company, formerly owned by Chrysler that has produced and sold over 45,000 NEVs since 1998.

According to Pike Research there were 14,737 NEVs sold in the US in 2011. Worldwide there are approximately one half million. They are particularly popular for short haul fleets in dense urban areas, use on college campuses, and use by retired adults in planned communities. Most NEVs use the flooded lead acid batteries.[XXII] Charging is done through a regular 110 V outlet. In 2011 typical prices for NEVs averaged around $9000, less than one third that of fully functioning BEVs. [XXIII] For those who are willing to give up comfort (especially in extreme weather conditions) but want the environmental and fuel savings benefits at one third the front end cost of a BEV, NEVs represent a new market niche in electrification of transportation. By allowing NEVs to operate on streets with posted speeds not to exceed 45 mph in Texas and cross streets with higher speed limits, NEV operators in small towns and suburban and urban areas have extensive access to shopping and most destinations.

Appendix 3H National Electric Vehicle Infrastructure Training Program

DOE's Clean City Coalition has developed the EVITP to provide training and certification for people who install electric vehicle supply equipment (EVSE).

National Electric Vehicle Infrastructure Training Program

Phase One Training Class

Course Description: This 24-30 hour class comprehensively addresses the requirements, regulations, products and strategies which will enable electrical contractors and electricians to master successful, expert, and professional customer relations, installation, and maintenance of Electric Vehicle (EV) and Plug-in Hybrid Electric Vehicle (PHEV) infrastructure.

Course Objectives: Upon completion of this class, participants will have gained thorough knowledge and practical application of all covered Electric Vehicle infrastructure subjects including the critical areas of customer experience, protection of utility systems, and vehicle charging technical applications.

Course Plan: This Phase One class focuses on Level One and Level Two charging systems and related subjects. The Phase Two class, which will cover Level Three/Fast charging systems and related subjects, will be delivered later in early 2012.

The EVITP Phase One Class Outline

1. Overview of Electric Vehicles

- History of electric vehicles
- Advantages and disadvantages of electric vehicles
- Present status and future trends of electric vehicle technology
- Hybrid technology
- Electric vehicle (EV) technology
- Plug-in hybrid electric vehicle technology (PHEV)
- Electric vehicle definitions
- Pertinent renewable energy definitions and usage

2. Types of Electric Vehicles – Present and Future

- Hybrid electric vehicle
- Pure electric vehicles
- On and off road electric vehicles
- Military vehicles

3. Electric Vehicle Manufacturers

- General Motors
- Nissan
- Smith
- Tesla
- Ford
- Mitsubishi
- BMW

4. Electric Vehicle Charging Unit Manufacturers

- General Electric
- Leviton
- Schneider
- Pep Stations
- Clipper Creek
- AeroVironment
- Hubbell
- Legrand/Pass & Seymour
- Milbank
- EATON Corporation
- SPX

5. Electrical Vehicle Charging Stations and Charging Load Requirements

- Level 1 requirements
- Level 2 requirements *(Level /Fast Charging requirements in Phase Two Class)*

6. Electrical Vehicle Charging Site Assessment

- Electrical load analysis
- Electric vehicle charger locations
- Energy surveys, assessments and audits

7. Electric Vehicle Rules and Regulations

- Permits and plan review of EV related systems
- Authority Having Jurisdiction (AHJ) role and responsibilities
- Electrical contractor's role and responsibilities
- Qualified electrician's role and responsibilities

8. Code Officials and Inspection

- Role of NFPA
- Role of NEC
- Role of IAEI
- What customers can expect from the inspector
- Training available for inspectors through IAEI

9. First Responders

- First Responder's Roles & Responsibilities
- Working with First Responders
- Training Available for First Responders

10. Utility Policy & Integration

- Utility's role and responsibility
- Metering and grid integration
- Protecting the grid
- Local utility service area rates and customer notification requirements

11. Renewable Energy and Electric Vehicles

- Smart grid applications
- Renewable energy power sources

12. Customer Code of Excellence / Contractor's Role; Electrician's Role

- Review of required electrical permits, possible electrical plan review, local codes and AHJ
- Electrical contractor's role and responsibilities
- Qualified electrician's role and responsibilities
- Start-up of electrical vehicle charging stations
- Commissioning of electrical vehicle charging stations
- Financing
- Rebates
- Tax Credits
- The Customer Experience
- Customer satisfaction
- Customer Code of Excellence

13. Electrical Codes, Electrical Safety Requirement, Other Regulations and Standards

- 2011 NEC Article 625
- 2011 NEC Article 220
- 2011 Chapters 1-4
- NECA 413
- NECA 90- Recommended Practice for Commissioning Electrical Systems
- SAE J1772- EV Charging Coupler
- UL 1998 - Software in Programmable Components
- UL 2202- Electric Vehicle (EV) Charging System Equipment
- UL 2231-Personnel Protection Systems for Electric Vehicle Supply Circuits
- UL 2251- Plugs, Receptacles, and Couplers for Electric Vehicles
- UL 2594- Electric Vehicle Supply Equipment
- ISO 6469 - Standard on safety issues of electric vehicle batteries
- ADA requirements
- OSHA
- NFPA 70E- Standard for Electrical Safety in the Workplace

14. Electric Vehicle Charging Installations

- GFCI
- Grounding requirements
- Wiring methods
- Overcurrent protection
- Conductor sizing and ampacity

Field Installation Practicum (Lab)

- Level 1 Charging Station installation
- Level 2 Charging Station installation

Electric Vehicle Certification Phase One

- Electric vehicle charging site assessment (Lab)

Written final exam

Course Materials

An EVITP Course Binder Including

- Case studies
- PowerPoint presentations
- Instructor Notes

Also Included

- Promotional materials from EV Makers
- Marketing materials from EVSE manufacturers
- Web-based Calculators from Utilities
- Information from US Green Building Council

Appendix 3I First Responder Training

Training

The National Alternative Fuels Training Consortium (NAFTC is a nationwide alternative fuel vehicle and advanced technology vehicle training funded in part by DOE. The NAFTC is headquartered at West Virginia University and consists of National Training Centers (NTCs) located nationwide including one at Tyler Junior College in Texas.[XXIV] Following is a brief description of the training courses available and written and on line materials for first responders.

Written and Electronic Resources

Electric Drive Vehicle First Responder Safety Training Instructor Manual

The Instructor Manual covers hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs). This curriculum addresses vehicle history, operations, infrastructure, and first responder procedures, such as vehicle identification, personal protective equipment, and extrication. It also includes teaching suggestions and tips, PowerPoint slides, answer keys to module review questions, and other supplemental resources.
ISBN 978-1-933954-41-7

Electric Drive Vehicle First Responder Safety Training Participant Manual

In cooperation with the Instructor Manual, the Participant Manual also covers all electric drive vehicles while detailing what first responders need to know when responding to accident involving one of these vehicles. It will address vehicle history, operations, battery technologies, infrastructure, and first responder procedures, such as vehicle identification, personal protective equipment, and extrication.
ISBN 978-1-933954-42-4

Quick Reference Guide (QRG)

The quick reference guide is a durable flipbook for emergency personnel to use at the scene of an

accident. It details various makes and models of advanced electric drive vehicles, alerting first responders to such items as high-voltage cables, cut zones, and other safety information.

QRG Mobile App

The mobile app version of the quick reference guide allows emergency personnel to have at their fingertips all the advanced electric drive vehicle information contained in the hard copy flipbook. The app is available on Apple and Android devices.

Online Course

The online course is a self-paced class that gives first responders the technical knowledge they need to safely respond to an incident involving an advanced electric drive vehicle. The training includes quizzes, tests, interactive learning activities, animations, and other online-based educational tools to best educate first responders.

For pricing, schedule, or to register
Please Contact
Micheal Smyth or call 304-293-7882

Appendix 3J A Suggested First Generation Approach to Work Place Charging

It is generally agreed that next to home charging, the work place is the second most likely and reasonable place for PEVs to be charged. Having the capability to charge their vehicles at work will be most important for drivers of BEVs that have long commutes for and/or additional drives between home charging (such as shopping, pick up children at school, etc). Indeed, workplace charging may be absolutely critical to BEV owners who live in multifamily housing where home charging is not available.

Barriers to work place charging include:

- Costs to the employer to install and maintain the EVSE,
- Complications in cost allocations in those instances where a third party owns the office building and the employer leases the space,
- Concerns over compensation disparities and taxes related to employer subsidies for employees driving PEVs,
- The logistics of how to monitor and enforce the parking to assure that vehicles not being charged are not occupying a space needed by a vehicle that does need to be charged where spaces are limited.
- Costs associated with retrofit of electrical systems and permitting in addition to the capital costs of Level 2 EVSE.
- Possible opposition from regulators, utilities, or others that might contend that if the employer does charge a fee for the use of the EVSE, that employer is, in effect, reselling electric power and therefore is a Retail Electric Provider (REP), and must be subject to regulation by the Public Utility Commission of Texas.

Faced with such concerns, it is not surprising that many small businesses are not interested in providing work place charging. Eventually, these concerns will be worked out, business models developed, and services will be available that most employers will find acceptable given their employees' demands for this benefit.

A major focus of this Plan has been short- term, practical solutions that might appeal to small and mid-size communities. One of the eleven elements in the proposed Texas PEV-Friendly

Community Program is the encouragement and eventual provision of work place charging. Following is a concept that addresses the above-mentioned barriers, particularly cost. This concept is explained in the numbered items below.

1. Consider the PEV charging benefit analogous to the standard "break room" or "snack area". While work places have always had restrooms for employees, the provision of a break room with a variety of vending machines is something that was once a luxury. Generally, the drinks and snacks from the vending machine are sold without subsidy to the purchasers who enjoy having the convenience of the snack machines without the expectation of free food. If the charging equipment (EVSE) is provided as a convenience, but not as a "freebie", the cost to the employer (or the third party owner of the office building) can be offset partially or completely. The rental of the space might even generate a small profit to provide an incentive to the building owner to undertake the costs required.

2. To reduce the costs of providing EVSE, the employer would limit the EVSE to a simple 110 Volt outdoor outlet to which the PEV owner would plug in his charge cord that comes with the vehicle as a standard accessory. Most employees spend 8 to 10 hours at their place of employment. This is adequate time to provide a substantial charge to the PEV batteries.

3. To avoid the appearance of being a REP, the parking space would be rented by the half day rather than having a meter to determine and bill for the amount of power consumed. The charge to the PEV driver would incorporate all of the estimated costs incurred by the employer including the infrastructure (provision of 110 Volt AC power that meets code requirements), enforcement and administration of the parking, any costs of permitting, and as noted above a possible profit margin. Just as the electricity used to operate a vending machine and keep the food cold (or make it hot) is part, but not all, of the costs associated with providing the break room, so too is the provision of electric power for the dedicated parking and EVSE to PEV owners.

4. The rent of the space could be a side payment of the employee to either the employer or the building owner on a monthly basis. Because the spaces would be dedicated there would be no need for expensive communication or billing procedures—thus keeping costs low. By renting the space, the enforcement issue is simplified.

The validity of this approach depends upon it being visualized as analogous to what is already accepted, rather than something radically different requiring high tech solutions. In time, the addition of Level 2 charging and automatic billing to credit cards and other high tech features can be added as the employee demand for spaces increases and cost-effective services become available.

The time lag for this to happen will result in a delay that affects PEV readiness. The suggested concept is realistic, requires simple and cost effective solutions, and can be implemented immediately.

As with all parking lots, the work place charging must comply with accessibility standards for the disabled. The Texas Department of Licensing and Regulation has established regulations. At least one and 20 percent of parking spaces for PEVs must meet these signage and set back/siting requirements.

Appendix 3K Fleet Manager Decision Tree Process for PEV Charging[xxv]

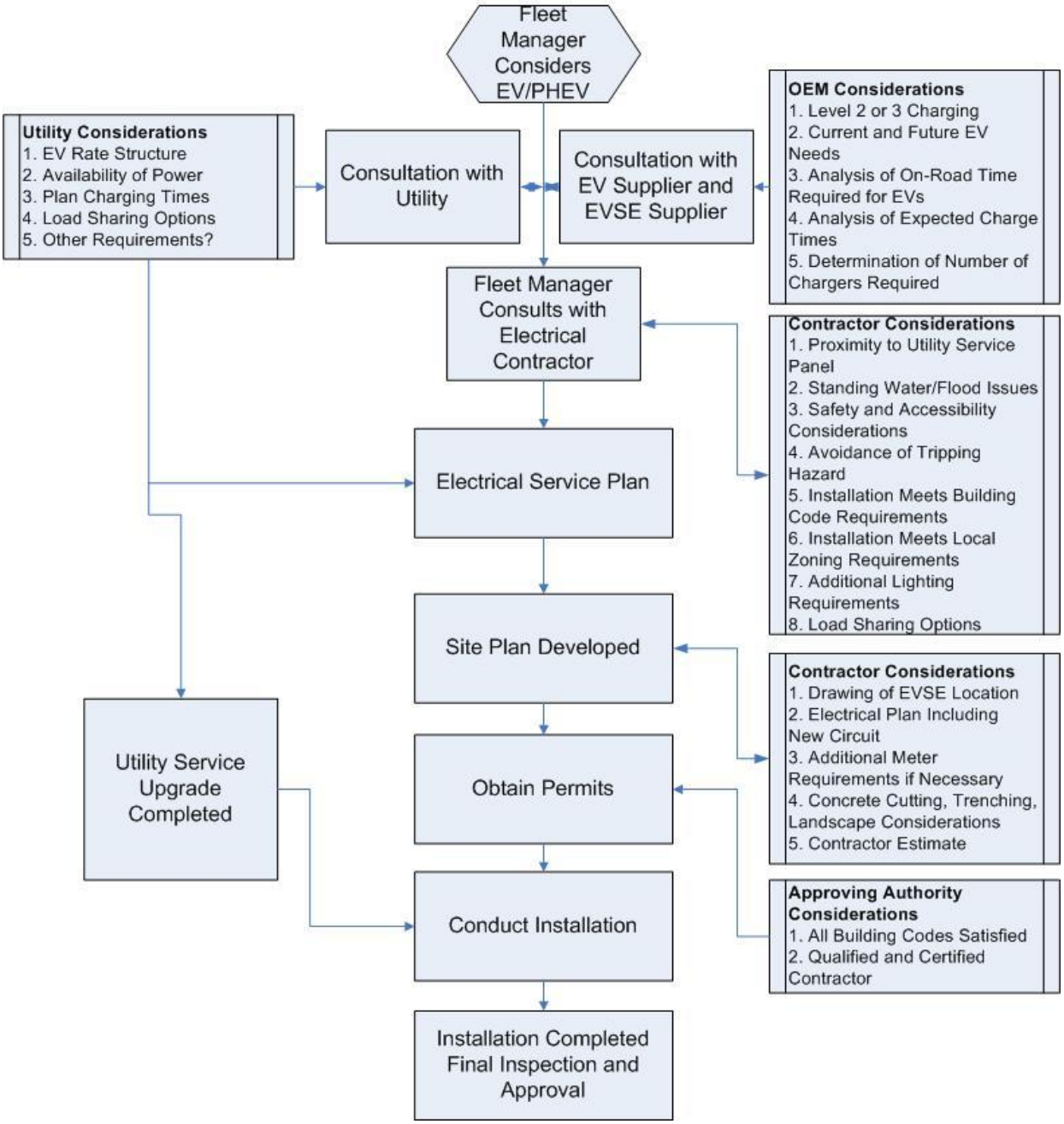
Commercial fleet managers are discovering that PEVs are often a cost effective solution to rising fuel and maintenance costs. Although some firms are using their PEV purchases to demonstrate their concern for the environment, typically commercial fleet managers earn their living by coming up with the most economic decisions for their employers.

The figure on the next page illustrates the process by which ECOtality, our contractor for the EVSE analyses in this Plan, recommends for determining whether and how a PEV purchases are cost effective over the long term (i.e., life time costs).

The first step is the iterative process of considering a variety of factors associated with the electric power purchases and with the determination of what type and make of PEV to purchase. Fleet managers have a good data for comparing their ICE vehicle costs with that of an alternative fuel or technology.

The various considerations shown in the top-most boxes must match the commercial (or government) fleet requirements. An example would be whether the fleet operates during typical work day hours (e.g., a courier service in a downtown area) or during the night (e.g., bread deliveries from a large bakery to individual retailers for morning sales). The length of time and length of trips are important for the critical threshold decisions as to whether to buy a BEV or a PHEV or to stick with the ICE vehicles.

The flow of decisions down the page illustrate the sequence of activities that occur and key factors involved once the threshold type purchasing decisions have been made. Our Texas PEV Friendly Community program includes as an option the promotion and use of these type of analyses so as to ensure that PEVs are not overlooked because of their lack of familiarity by smaller fleet managers.


Fleet Manager Considers EV/PHEV
Utility Considerations
1. EV Rate Structure
2. Availability of Power
3. Plan Charging Times
4. Load Sharing Options
5. Other Requirements?
Consultation with Utility
Consultation with EV Supplier and EVSE Supplier
OEM Considerations
1. Level 2 or 3 Charging
2. Current and Future EV Needs
3. Analysis of On-Road Time Required for EVs
4. Analysis of Expected Charge Times
5. Determination of Number of Chargers Required
Fleet Manager Consults with Electrical Contractor
Contractor Considerations
1. Proximity to Utility Service Panel
2. Standing Water/Flood Issues
3. Safety and Accessibility Considerations
4. Avoidance of Tripping Hazard
5. Installation Meets Building Code Requirements
6. Installation Meets Local Zoning Requirements
7. Additional Lighting Requirements
8. Load Sharing Options
Electrical Service Plan
Site Plan Developed
Contractor Considerations
1. Drawing of EVSE Location
2. Electrical Plan Including New Circuit
3. Additional Meter Requirements if Necessary
4. Concrete Cutting, Trenching, Landscape Considerations
5. Contractor Estimate
Utility Service Upgrade Completed
Obtain Permits
Approving Authority Considerations
1. All Building Codes Satisfied
2. Qualified and Certified Contractor
Conduct Installation
Installation Completed Final Inspection and Approval

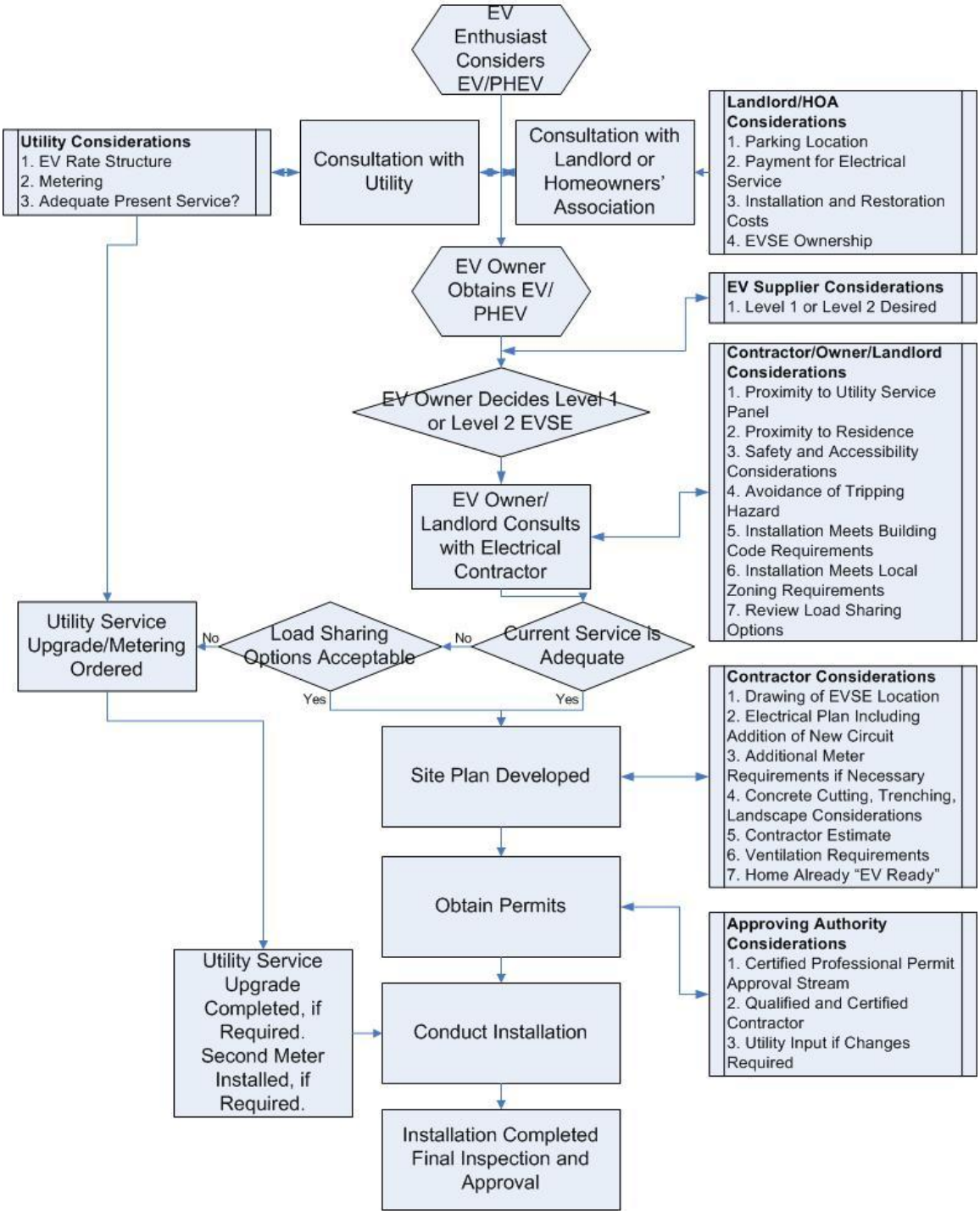
Appendix 3L PEV Charging in Multifamily Housing

According to the U.S. Census Bureau approximately one third of the nation's housing units are classified as multifamily. Most of these are condos and apartments. A major barrier to PEV readiness is the difficulty this fraction of households face in obtaining home charging because a third party (either a building owner or a property owners' association controls the space where a homeowner would normally locate EVSE (a garage or outdoor charging unit). As with most of the issues surrounding PEVs, the market will eventually remedy this. For example, if PEVs do indeed become much more popular, the demand for home charging will lead building owners and managers to offer this capability as an inducement to tenants and condo owners, much as swimming pools and laundry rooms are provided currently.

To promote readiness however, a few steps may be in order in the meantime. San Diego Gas & Electric suggests the following for multiunit occupants who want to purchase a PEV but face the barrier of where to charge (see www.sdge.com). These include taking a poll of residents to see how much demand there might be (e.g., how many other residents have similar interests). Second, those who are interested should educate themselves on the types of EVSE that might best fit their needs. Third, SDGE suggests that given the variety of situations that arise, the residents should meet with the property owners or managers and run through a list of challenges and opportunities. These may include the following:

- How well will the property layout – including the location and type of metering, wiring and parking spaces – accommodate the desired charging equipment?
- What existing rules in the covenants, conditions and restrictions (CC&Rs) would affect the installation of charging stations in common areas and private areas?
- Which assigned and unassigned parking spaces could accommodate EV charging equipment?
- What state or local regulations relate to common area use of charging infrastructure?
- Will some charging units, sidewalks or parking spaces need to meet Americans with Disabilities Act (ADA) standards for accessibility?
- How should property owners deal with initial equipment and service costs versus future tenant demands and needs?

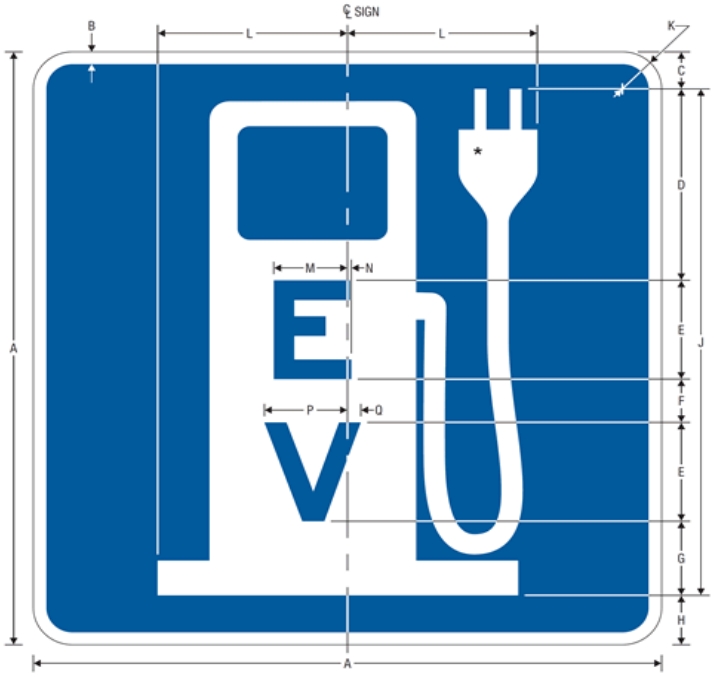
Once these issues have been worked out, the next step is to have a qualified contractor do the work. ECOtality, our contractor for the EVSE analyses in this Plan, has provided the following decision tree that can be used by a prospective PEV driver in his or her multifamily dwelling arrangement.


EV Enthusiast Considers EV/PHEV
Utility Considerations
1. EV Rate Structure
2. Metering
3. Adequate Present Service?
Consultation with Utility
Consultation with Landlord or Homeowners' Association
Landlord/HOA Considerations
1. Parking Location
2. Payment for Electrical Service
3. Installation and Restoration Costs
4. EVSE Ownership
EV Owner Obtains EV/ PHEV
EV Supplier Considerations
1. Level 1 or Level 2 Desired
EV Owner Decides Level 1 or Level 2 EVSE
Contractor/Owner/Landlord Considerations
1. Proximity to Utility Service Panel
2. Proximity to Residence
3. Safety and Accessibility Considerations
4. Avoidance of Tripping Hazard
5. Installation Meets Building Code Requirements
6. Installation Meets Local Zoning Requirements
7. Review Load Sharing Options
EV Owner/ Landlord Consults with Electrical Contractor
Utility Service Upgrade/Metering Ordered
No
Load Sharing Options Acceptable
No
Current Service Is Adequate
Yes
Yes
Contractor Considerations
1. Drawing of EVSE Location
2. Electrical Plan Including Addition of New Circuit
3. Additional Meter Requirements if Necessary
4. Concrete Cutting, Trenching, Landscape Considerations
5. Contractor Estimate
6. Ventilation Requirements
7. Home Already "EV Ready"
Site Plan Developed
Obtain Permits
Approving Authority Considerations
1. Certified Professional Permit Approval Stream
2. Qualified and Certified Contractor
3. Utility Input if Changes Required
Utility Service Upgrade Completed, if Required. Second Meter Installed, if Required.
Conduct Installation
Installation Completed Final Inspection and Approval

Appendix 3M Local and State Level PEV Signage

Roadways that are funded through the U.S. Department of Transportation grants must have signage that conforms to the Federal Highway Administration's (FHA) Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). Last year the FHA provided interim approval for the following sign similar to that which is used in Texas. As shown on the next page, a variety of signage is used on private property or non-federal thoroughfares.

D9-11b (Alternate)
Issued 4/1/2011



D9-11b (Alternate)
Electric Vehicle Charging (Alternate Symbol)

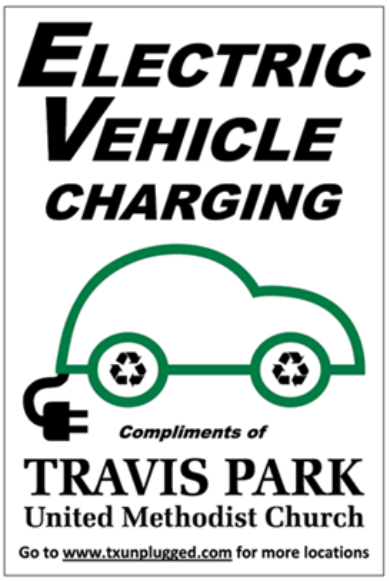
	A	B	C	D	E	F	G	H	J	K	L	M
C	24	0.5	1.5	7.75	4 E(m)	1.75	3	2	20.5	1.5	7.25	2.814
	30	0.75	1.875	9.625	5 E(m)	2	4	2.5	25.625	1.875	9.063	3.518

N	P	Q
0.148	3.174	0.507
0.185	3.968	0.635

* See page IA-13-2 for symbol design

COLORS: LEGEND, BACKGROUND – BLUE (RETROREFLECTIVE)
SYMBOL, BORDER – WHITE (RETROREFLECTIVE)

IA-13-1



At left: Example of a private parking sign directing the driver to a charge station on the lot.

At right: Example of a PEV charging station sign used by City Public Service of San Antonio.

Courtesy: Bill Barker, San Antonio

Appendix 3N Model Ordinance – Provided by Texas River Cities

ELECTRIC VEHICLE SUPPLY EQUIPMENT

ORDINANCE TOOLKIT

SPONSORED BY THE

TEXAS RIVER CITIES PLUG-IN ELECTRIC VEHICLE INITIATIVE

October 2012

TEXAS RIVER CITIES
Plug-In Electric Vehicle Initiative

Acknowledgments

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Center for the Commercialization of Electric Technologies (CCET)	Bob Davis
Travis County	Mark Gilbert
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Oncor Electric Delivery Company	Lance Spross
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Special acknowledgment and appreciation are given to Michael Donohue, member of the Kane County, Illinois, Board and Heidi Files, Senior Executive Planner for Kane County, for their leadership in shaping the initial Kane County Electric Vehicle Ordinance, upon which this toolkit was based. That ordinance, developed in 2011 and accepted by the Kane County, Illinois, Board in February 2012, was itself based upon plug-in electric vehicle (PEV) ordinances previously developed in Auburn Hills, Michigan, and Puget Sound, Washington.

How to Use This Electric Vehicle Supply Equipment Ordinance Toolkit

This document contains a basic starter set of electric vehicle supply equipment (EVSE, or charging station) codes, ordinances, and permits that local governments may use for the purpose of modifying or creating an Electric Vehicle Supply Equipment Ordinance. Some cities or counties may not require ordinances, but those that do can take this ordinance starter kit and customize it to fit their particular needs.

Here are some quick guidelines to determine if ordinances are necessary:

Q: WHEN are electric vehicle ordinances necessary?

A: An ordinance for EVSE may be needed in one or more of the following situations

- Demand from customers or local residents asking for plug-in electric vehicle (PEV) charging stations
- Insufficient electrical permitting processes that do not account for PEV charging station installations
- An interest in providing incentives to install EVSE to increase demand
- A need to streamline EVSE permitting and installation processes to reduce processing time and increase consistency
- A need for consistent signs or parking space markings for electric vehicles compliant with the Americans with Disabilities Act (ADA) or interim designations
- A desire to prepare for electrical infrastructure necessary for electric vehicles

Q: WHY should EVSE (charging station) ordinances be put in place?

A: For the following reasons

- Safety – so electrical inspections can be done to protect the public
- Standardization – to reduce complexity, cost, and confusion by using consistent guidelines
- Reliability – to protect the electrical grid and keep the local utility involved and informed
- Strategy – to promote marketing and economic development

Q: WHO should be involved?

A: A local champion is usually required to lead the effort. This may be a board member or community leader who steps forward determined that there is sufficient need to develop an ordinance for PEVs. Local officials may be asking if the community is ready for PEVs. Local grass roots organizations, such as an electric auto association, may also lead the initiative to instill an ordinance for PEVs.

Potential Audiences

- Applicable city or county management, sustainability, and/or environmental offices
- Public safety officials: fire, emergency medical services (EMS), police
- Power utilities
- Public works, planning, code, and/or transportation departments
- Local government officials, planning commission members, and building code officials

- Local utility contact in charge of PEV planning
- Representative of a local PEV auto association or PEV owners club
- Vehicle manufacturing representatives and dealers
- Employees of EVSE- or PEV-related services
- Electrical contractors with experience installing charging stations
- Electrical inspectors
- Transportation planners
- Private single- and multifamily builders, and real estate developers
- Others interested in helping promote the rollout of PEVs

Q: WHEN should an area begin developing electric vehicle ordinances and guidelines?

A: It is better to start the ordinance process sooner rather than later, although each community needs to decide when it is appropriate for their own jurisdiction. Communities want to be prepared to ensure the safety of the community and to provide guidance to community members who may be thinking about installing electric vehicle charging stations.

One indication that electric vehicle ordinances may be needed is the appearance of electric vehicle charging stations with different types and styles of signs. Here are a variety of electric vehicle signs observed in one region of Texas – demonstrating the need for standardization at the state or federal level.

Finally, as you review the ordinance information below, note the following opportunities to include customization language for your region:

- Information between the brackets < > represents information that should be modified to reflect the specific circumstances of the locality or region developing the ordinances.
- This document contains blue comments that help explain terminology or provide links to helpful information. They may be removed for your final ordinance or left in for educational purposes.

Comments or feedback on this document may be directed to: info@texasrivercities.com

ORDINANCE NO.____

DATE

ORDINANCE NO.___

AN ORDINANCE CREATING A NEW APPENDIX < x > OF THE <Location> CODE, ELECTRIC VEHICLE INFRASTRUCTURE ORDINANCE

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Article I.
Development/Zoning Regulations and Guide

1.1. Definitions

Comment: Ordinances should have a set of common definitions to provide a consistent base understanding of electric vehicles, hybrids, and their variations. Please note that the Society of Automotive Engineers (SAE) is working to update its Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology definitions in a new standards document, J1715, at http://standards.sae.org/j1715_200802/. Many definitions here are based on the preliminary SAE work.

1.1.1 AC: Alternating current (electricity).

1.1.2. Battery: An energy storage system consisting of a cell or cells onboard an electric vehicle used for storing and furnishing electrical energy for the purpose of propelling the vehicle.

1.1.3. Battery Electric Vehicle (BEV): An electric vehicle that operates exclusively on electrical energy stored in an on-board energy storage system ("battery") designed to be recharged from an external, off-vehicle source of electric energy.

1.1.4. Charging Level: The standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged. Typical Society of Automotive Engineers (SAE) electric vehicle charging levels and specifications are:

A. Level 1 – AC slow battery charging. Voltage is 120 volts AC, limited to16 amps on a 20-amp circuit breaker.

B. Level 2 – AC medium battery charging. Voltage is between 208 and 240 volts AC, limited to 32 amps on a 40-amp circuit breaker, up to a limit of 80 amps on a 100-amp circuit breaker.

C. Level 3 – AC

Comment: Level 3 technology was targeted for high-voltage AC battery charging with voltages higher than 240 volts, but the category is currently undefined by SAE. More commonly this level has been referred to by owners and vendors as DC Fast Charge or DC Quick Charge, which the SAE now defines separately below as DC Level 2 See International Association of Electrical Inspectors (IAEI) Magazine article on DC Chargers http://www.iaei.org/magazine/2012/01/have-any-electric-vehicle-ev-level-3-dc-fast-chargers-been-ul-certified-listed/.

D. DC Charging - voltages greater than 240 volts DC.

1. Level 1 – DC limit is 80 amps, at up to 450 volts DC
2. Level 2 – DC limit is 200 amps, at up to 450 volts DC
3. Level 3 – DC limit is 400 amps, at up to 600 volts DC

1.1.5. Charging Station: Equipment that has as its primary purpose the transfer of electric energy by conductive or inductive means to a battery or other energy storage device located onboard an electric vehicle. Also known as electric vehicle supply equipment (EVSE). Types of charging stations include:

A. **Accessible Charging Station:** A charging station incorporated into or immediately adjacent to a handicapped parking space as a "handicapped parking space" or an "accessible parking space" as defined by the <STATE> Vehicle Code.

B. **Fast-Charge Station:** (formerly referred to as "Level 3" now DC Level 2) Please refer to Section 1.1.4. Charging Level.

C. **Private Charging Station:** A charging station that is (1) privately owned and has restricted access (e.g., single-family home, executive parking, designated employee parking) or (2) publicly owned and restricted (e.g., fleet parking with no access to the general public).

D. **Public Charging Station:** A charging station that is (1) publicly owned and publicly available (e.g., park & ride, public parking lots, on-street parking) or (2) privately owned and publicly available (e.g., shopping center parking, non-reserved parking in multifamily parking lots).

1.1.6. Charging Station Equipment: The conductors, including ungrounded and grounded, and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, charging stations, or apparatus installed specifically for the purpose of delivering electrical energy from the charging station to the electric vehicle.

1.1.7. Charging Station Space: A dedicated, marked space that identifies the use thereof as exclusively for the charging of electric vehicles.

1.1.8. DC: Direct current (electricity).

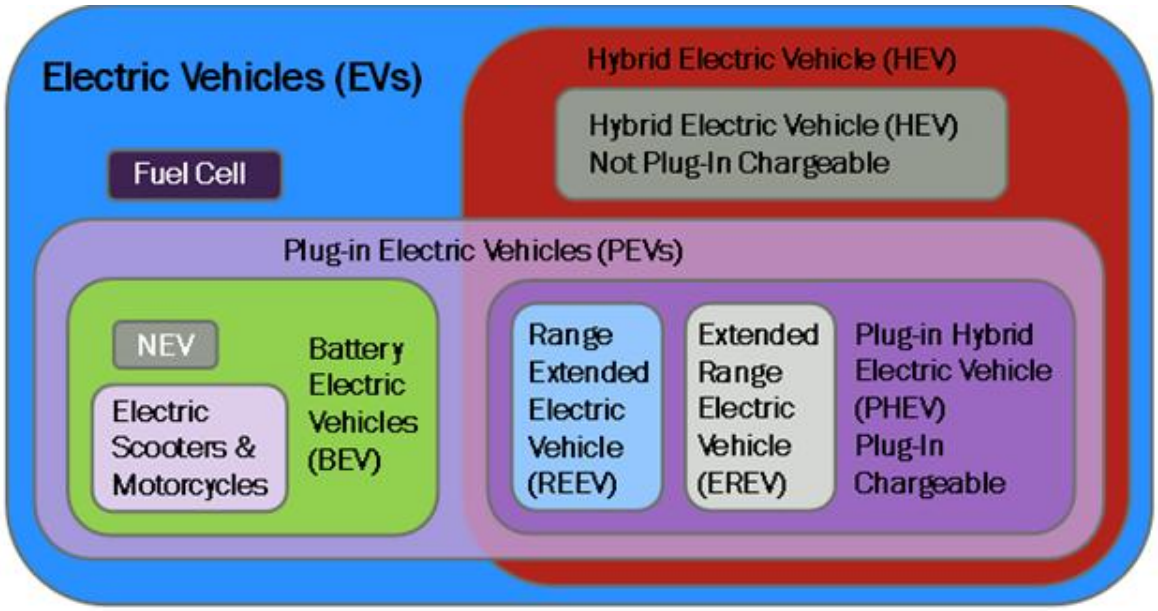
1.1.9. Electric Scooter and/or Motorcycle: A two- or three-wheel electric vehicle that operates exclusively on electrical energy stored in the vehicle's energy storage system (battery).

1.1.10. Electric Vehicle (EV): A vehicle powered in whole or in part by electricity. Includes a battery electric vehicle (BEV), a plug-in hybrid electric vehicle (PHEV), a neighborhood electric vehicle (NEV), and electric scooters or motorcycles, among others.

Figure 1-1. Example Electric Vehicle Charging Station

Electric vehicle charging stations, Howson Library, Austin, Texas

Figure 1-2. Select Types of Electric Vehicles



Comment: Figure 1-2 is for educational purposes and shows how different kinds of electric and hybrid electric vehicle categories compare with one another; it is based on preliminary SAE J1715 documentation.

1.1.11. Extended-Range Electric Vehicle (EREV): A type of plug-in hybrid electric vehicle (PHEV) that runs primarily on electrical energy stored in batteries. It has at least one electric motor and a secondary power source, usually an internal combustion engine (ICE). In some modes of operation or after batteries are drawn down, the ICE engages, turning an on-board generator to power the motor. In other modes, the ICE engages to assist the electric motor(s) by connecting directly to the power train to help propel the vehicle.

Comment: EREV is a term Chevrolet uses to describe the Volt, which runs in electric mode at all times in four different drive modes using one or both of its two electric motors. The Volt's ICE drives a generator to charge the battery when the battery is low or during hard acceleration. In its high-speed mode, the Volt runs off of both electric motors and closes a clutch allowing engine power to go directly to the wheels, as well. It is this unique combination of drive modes that makes the Volt a little different than other range-extended electric vehicles (REEVs), which typically use the ICE to just power the on-board generator. For a detailed explanation of the Volt's four driving modes, refer to:

http://media.gm.com/content/Pages/news/us/en/2010/Oct/1011_volt/_jcr_content/rightpar/sectioncontainer_1/par/download/file.res/Chevrolet%20Volt%20Electric%20Drive%20Unit%20operating%20mode.doc.

1.1.12. Hybrid Electric Vehicle (HEV): A vehicle with two or more propulsion systems, both of which provide power, either together or independently. HEVs typically include an electric motor and an internal combustion engine (ICE).

Comment: In practice, hybrid vehicles typically require both energy sources to provide full vehicle capability. The engine is usually the larger of the two propulsion sources, being sized to provide most of the power during high-power vehicle events. The electric motor is typically the smaller of the two

propulsion sources and sized to maximize the amount of energy that can be captured during braking and for limited low-speed electric vehicle operation.

1.1.13. Neighborhood Electric Vehicle (NEV): Categorized as a type of low-speed vehicle, the NEV is an electric vehicle with four wheels that conforms to federal regulations under Title 49 CFR Part 571.500, which can, from a stand–still, attain a speed of 20 miles per hour (mph) within one mile, but cannot exceed a speed of more than 25 mph and is limited to streets with a speed limit of 35 mph or less.

Comment: For updates on NEVs see http://www.iihs.org/laws/lowspeedvehicles.aspx. As of May 2012, four states (Connecticut, Mississippi, Montana, and Pennsylvania) did not have statutes allowing the use of low-speed vehicles on their public roads. Many states allow their departments of transportation or local jurisdictions to restrict their use (for instance as of July 2012, San Antonio, Texas, did not allow the use of NEVs).

In Texas, the NEV is defined as a type of BEV that operates at a maximum speed of 35 mph and has a maximum weighted load of 3,000 pounds. NEVs in Texas cannot operate on roadways with posted speed limits above 45 mph, but can cross them. Unlike golf carts, which are also a form of BEV, NEVs have a valid 17-digit vehicle identification number (VIN), must be titled and registered, and must have the following safety equipment: seat belts, lights, windshield, turn signals, parking brake, reflectors, turn signals, and brake lights.

For more on Texas NEVs see http://www.txdmv.gov/vehicles/drivers/golf_carts.htm.

1.1.14. Plug-In Electric Vehicle (PEV): An electric vehicle with an energy storage system (battery) that is designed to be recharged from an off-vehicle source of electricity; includes both battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).

1.1.15. Non-Electric Vehicle: A vehicle that does not meet the definition of electric vehicle as provided herein.

1.1.16. Plug-In Hybrid Electric Vehicle (PHEV): A hybrid electric vehicle with an energy storage system (battery) that is designed to be recharged from an external, off-vehicle source of electric energy.

1.1.17. Range-Extended Electric Vehicle (REEV): Also referred to as a series hybrid vehicle, the REEV is a plug-in hybrid electric vehicle (PHEV) that runs primarily on electrical energy stored in batteries. It has least one electric motor and a secondary power source, usually an internal combustion engine (ICE). After the batteries are drawn down, it operates in range-extended mode using the ICE to turn an on-board generator, allowing the electric motor(s) to continue to propel the vehicle.

1.1.18. Vehicle: Has the same meaning as provided in <your STATE Vehicle Code 625> <Reference>

1.2. Permitted Locations

Comment: The following section may or may not be applicable, or can be reworded depending upon the use of zoning in the community.

1.2.1. Level 1 and Level 2 charging stations are permitted in <every zoning district> when accessory to the primary permitted use <of said district>. Charging stations located at single-family, multiple-family, and mobile home park dwellings for use only by residents shall be designated as private-use only. Installation of Level 2 charging stations shall be subject to building permit approval.

1.2.2. Level 3 charging stations are permitted in <zoning locations> when accessory to the primary permitted use. Installation thereof shall be subject to building permit approval.

1.2.3. If the primary use of a parcel is the retail charging of electric vehicle batteries, then the use shall be considered <describe for zoning purposes>. Installation of charging stations shall be subject to Special Land Use approval and located in <zoning locations>.

1.3. Station Requirements and Design Criteria

1.3.1. General Charging Station Requirements for Multifamily Residential, Non-Residential Development, and Public Rights-of-Way

A. Charging Station Space Requirements

1. **Minimum requirements:** A charging station space may be included in the calculation for minimum parking spaces that are required pursuant to other county and state regulations.
2. **Number:** No minimum number of charging station spaces is required.
   Comment: See also Section 1.4: Quantity and Location

B. Charging Station Space Location and Design Criteria

1. Where provided, spaces for charging station purposes are required to include the following:
   a. **Signage:** Each charging station space shall be posted with signage indicating the charging station space is only for use by electric vehicles for charging purposes. Days and hours of operations shall be included if time limits or tow-away provisions are to be enforced.
   b. **Maintenance:** Charging station equipment shall be maintained in all respects. A phone number or other contact information shall be provided on the charging station equipment for reporting purposes when the equipment is not functioning or other equipment problems are encountered.
   c. **Accessibility:** Where charging station equipment is provided within a pedestrian circulation area, such as a sidewalk or other accessible route to a building entrance, the charging station equipment shall be located so as not to interfere with accessibility requirements of the <State> Accessibility Code or other applicable accessibility standards.
   Comment: in Texas, please refer to Texas Department of Licensing and Regulation, "Electric Vehicle Charging Stations" at http://www.tdlr.state.tx.us/ab/info/TM11-01.pdf. The Texas Department of Licensing and Regulation has issued technical clarifications until formal federal accessibility guidelines addressing electric vehicle charging stations become available and are adopted. These guidelines pertain to electric charging stations provided in new or existing parking lots, parking garages, or other locations containing parking spaces.
   d. **Lighting:** Where charging station equipment is installed, adequate site lighting shall be provided in accordance with <Location> ordinances and regulations.

e. **Charging Station Equipment:** Charging station outlets and connector devices shall be no less than 36 inches and no more than 48 inches from the ground or pavement surface where mounted, and shall contain a retraction device and/or a place to hang permanent cords and connectors a sufficient and safe distance above the ground or pavement surface. Equipment mounted on pedestals, lighting posts, bollards, or other devices shall be designated and located as to not impede pedestrian travel or create trip hazards on sidewalks.

f. **Charging Station Equipment Protection:** Adequate charging station equipment protection shall be used, unless the manufacturer of the EVSE specifically indicates it is unnecessary. This may include concrete-filled steel bollards, or non-mountable curbing in lieu of bollards if the charging station is set back a minimum of <24><36> inches from the face of the curb.

Comment: 36 inches may be specified for further protection from vehicles or snow accumulation, as appropriate in certain locations. Some charging stations claim to be sturdy enough not to need concrete-filled bollards, but most charging stations will require some form of protection to help prevent vehicles impacts.

g. **Usage Fees:** In accordance with federal, state, and local regulations, an owner of a charging station <is><is not> prohibited from collecting a fee for the use of a charging station. <Fees shall be prominently displayed on the charging station.>

Comment: Most areas allow fees to be charged, but some state or local laws may prohibit certain owners from collecting fees for the resale of electricity. Please check state and local regulations and adjust statement accordingly. For example, as of August 2012, in Austin Texas, which is a home-rule municipality, the utility is the only entity that can charge for electricity, including electricity distributed from public EVSE. The EVSE owner pays the cost to install the EVSE and maintains ownership of the device, but transfers the EVSE billing and maintenance functions related to the sale of electricity to the utility.

2. Those providing charging station spaces should consider the following:

a. **Notification:** Information on the charging station, identifying voltage and amperage levels, and time of use, fees, or safety information.

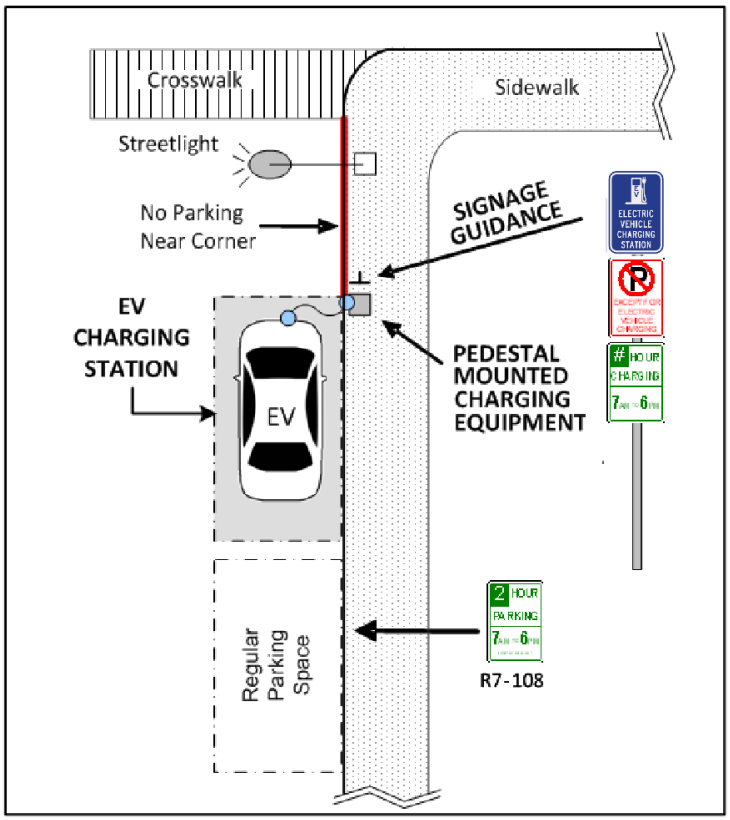
b. **Signage:** Installation of directional signs at appropriate decision points to effectively guide motorists to the charging station space(s).

c. **Location:** (Specific to On-Street Parking) Placement of a single charging station is preferred at the beginning or end stall on a block face.

C. **Data Collection:** To allow for maintenance and notification, the <Location> shall require the owners of public charging stations to provide information on the charging station's geographic location, date of installation, equipment type and model, and owner contact information.

Figure 1-3 shows an example of an on-street electric vehicle charging station.

Figure 1-3. Electric Vehicle Charging Station — On Street



On-street charging near end of block.

Comment: On-street charging stations should first be installed at either end of a row of regular on-street parking spaces. Subsequent charging stations should be installed in the space next to the existing charging stations. Several factors that suggest an end-stall as the preferred location include proximity to electrical service, adjacency to existing no-parking zone, better accessibility for all users, higher lighting levels, and less clearance and obstruction issues with existing parking spaces. The charging station equipment should be installed in a well-lit area, on a hard surface, and near the front of the designated space, have adequate clearance (36") from the face of curb, and leave a barrier-free sidewalk clearance (36"). Signage shall be at or near the charging station. All regulatory signs shall comply with visibility, legibility, size, shape, color, and reflectivity requirements contained within the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD), http://mutcd.fhwa.dot.gov/. It is also recommended the charging station be located in an area with sufficient drainage, and not in an area subject to "ponding" or accumulation of pools of water.

1.4. Quantity and Location

1.4.1. Residential: In order to proactively plan for and accommodate the anticipated growth in market demand for electric vehicles, it is <strongly encouraged, but not required><mandatory> that all new one-family and multiple-family homes with garages be constructed to include <roughed-in> conduit, panel space, and electrical capacity to install a 220- to 240-volt, 40-amp outlet on a dedicated circuit in

close proximity to designated vehicle parking, to accommodate the potential future hardwire installation of a Level 2 charging station.

Comment: Modify the above statement for your particular community. At a minimum, roughing-in the conduit and basic panel space helps avoid much higher costs to add a charging station later.

In 2010, Hawaii passed Senate Bill 2231 stating that one cannot prevent the installation of an electric vehicle charging station on or near the parking stall of any multifamily residence or townhouse. See http://www.capitol.hawaii.gov/session2010/Bills/SB2231_cd1_.pdf.

1.4.2. Non-Residential: In order to proactively plan for and accommodate the anticipated future growth in market demand for electric vehicles, it is <strongly encouraged, but not required><mandatory> that all new and expanded non-residential development parking areas be constructed to include <roughed-in> conduit, panel space, and electrical capacity to accommodate the future hardwire installation of Level 2 charging stations in close proximity to designated vehicle parking.

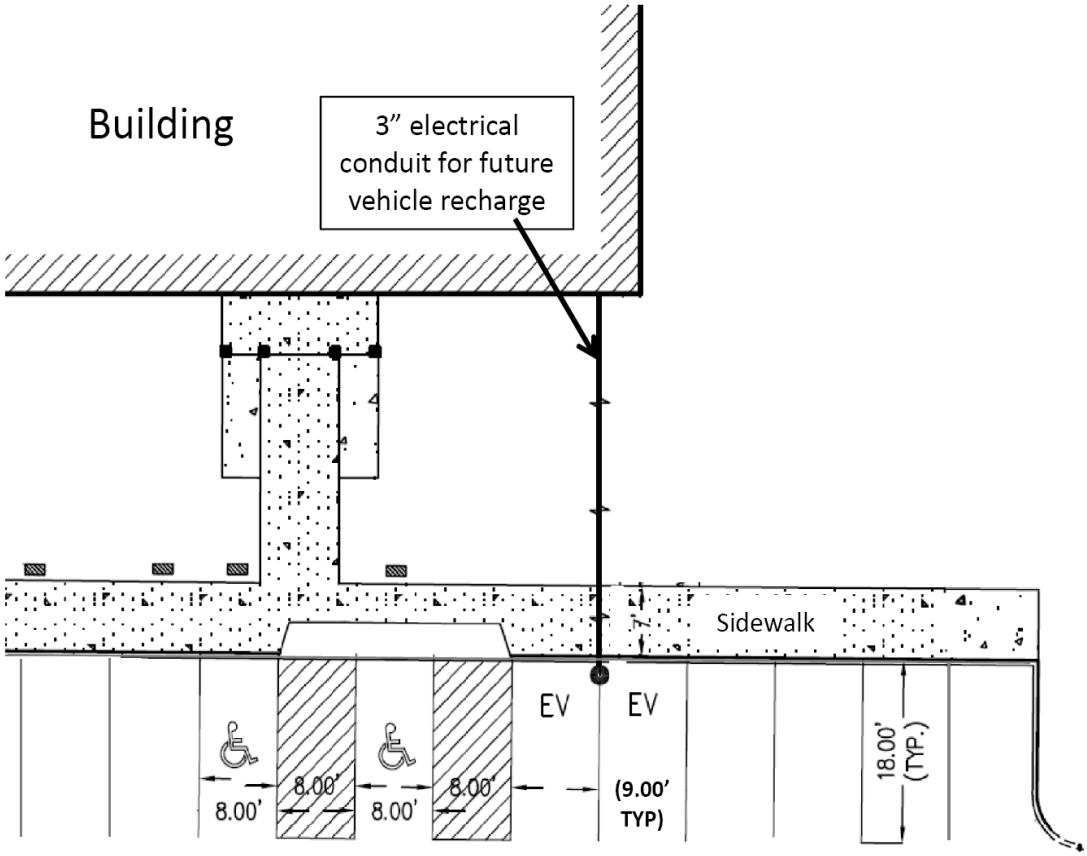
It is <recommended but not required><mandatory> that a typical parking lot that installs EVSE provide 20% (or one fifth) as accessible parking spaces.

Comment: Laying basic conduit from parking areas to the circuit panels during construction is a low-cost method that avoids high-cost trenching or cutting of concrete when adding charging stations later.

Quantities: As of March 15, 2012, the U.S. Department of Justice had not issued formal accessibility guidelines addressing electric vehicle charging stations. The Texas Department of Licensing and Regulation issued technical clarifications until such time as federal standards become available and are adopted. If electric charging stations are provided in a parking lot or garage, 20 percent but not less than one shall meet the accessibility standards specified. See interim guidance provided by Texas: http://www.license.state.tx.us/ab/info/TM2012-01.pdf.

Figure 1-4 shows an example of a site plan that includes a rough-in for electric vehicle charging stations.

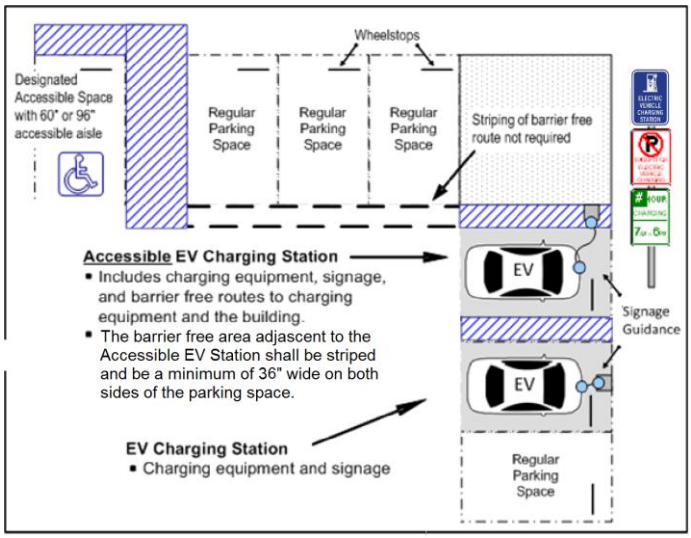
Figure 1-4. Example Site Plan – "Rough-In" of Electric Vehicle Charging Stations



1.4.3. Accessible Charging Stations: It is <strongly encouraged, but not required,><mandatory> that a minimum of one accessible charging station be provided anywhere charging stations are installed. Accessible charging stations shall be located in close proximity to the building or facility entrance and shall be connected to a barrier-free accessible route of travel to and from the building or facility. It is not necessary to designate the accessible charging station exclusively for the use of disabled persons.

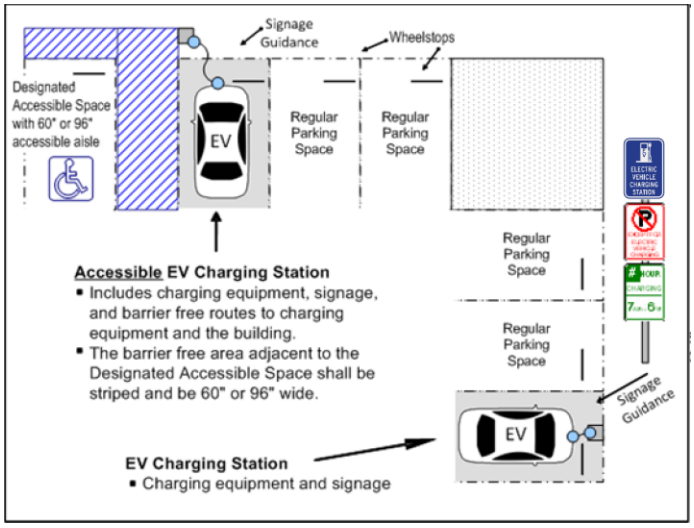
Figures 1-5 and 1-6 show two options for providing accessible electric vehicle charging stations.

Figure 1-5. Off-Street Accessible Charging Station Example - Option 1



Austin, Texas, City Hall parking garage with accessible parking spaces.

Figure 1-6. Off-Street Accessible Charging Station Example - Option 2



Fashion Island Shopping Mall, Newport Beach, CA.
Photo by LightMoves.

Comment: The illustrations and photos above show two options for providing accessible charging stations. Option 1 is a likely scenario for installation in existing parking lots. An accessible charging station may be installed more cost-effectively by using an existing, wider, end parking stall or by restriping. Where feasible, a wider (60") clear area around the equipment is preferable. Additionally, since the accessible charging station is away from prime parking areas near the building, it is more likely the space will be available for those needing a charge, including persons with disabilities. Option 2 provides a location that has a shorter travel distance for persons with disabilities and can be easily installed in a new parking lot. This option may allow the installer to provide a wider, more fully compliant aisle.

While other options are likely, depending on the specific layout of the new or reconfigured parking area, at a minimum, an accessible charging station must be located within accessible reach of the barrier-free access aisle and the electric vehicle and connect to a barrier-free route of travel. However, because the charging station facility is not a parking facility, the accessible charging station does not need to be located immediately adjacent to the building entrances or reserved exclusively for the use of disabled persons.

1.5. Signage

1.5.1. Directional – Off-Street Parking Lot or Parking Garage Charging Stations: The following signs shall be used to designate electric vehicle charging equipment in a parking facility.

Comment: The two EV signs in Figure 1-7 below are the interim approved symbols per the FHWA as of April 20, 2012. See "Lessons Learned – The EV Project EVSE Signage Prepared for the US Department of Energy Award #DE-EE0002194" Section 5-1 on page 9,

http://www.theevproject.com/downloads/documents/Signage%20Initial%20Issue%204-20-2012.pdf.

It is recommended that these interim signs be adopted, with the expectation that they will ultimately be approved at the federal level and become the uniform standard nationally.

As of May 2012, there appears to be no official federal guidelines for other signs that are needed for electric vehicles. See article http://www.nytimes.com/2012/05/06/automobiles/pointing-the-way-to-where-ev-drivers-can-plug-in.html.

Figure 1-7. Recommended Directional Off-Street Electric Vehicle Charging Signs

12" x 6"

The directional sign for an on-site parking lot or parking garage should be used in the parking facility with a directional arrow at all decision points.

Comment: These signs are compliant with the FHWA MUTCD.

1.5.2. Off-Street Charging Station Space Signage: The following signs shall be used to designate off-street electric vehicle parking. The use of time limits is optional.

Figure 1-8. Recommended Combination of Off-Street Electric Vehicle Charging Signs

12” x 18”

12” x 18”

Comment: Combination of signs identifying the space as a charging station space, prohibiting non-EVs, and imposing a charging time limit. These signs are compliant with the MUTCD.

1.5.3. Directional Signage – Highways and Freeways: The following signs shall be used to designate direction of travel to reach electric vehicle charging stations.

Figure 1-9. Recommended Directional Highway Electric Vehicle Charging Signs

30” x 12”

The directional sign (MUTCD D9-11b) for highways and freeways should be installed at a suitable distance in advance of the turn-off point or intersecting highway. If used at an intersection or turn-off point, it shall be accompanied by a directional arrow. The symbol on the sign above may be supplemented with the sign below (MUTCD D9-11bP) to help early PEV drivers avoid confusion with liquid fueling stations.

Comment: *These signs are compliant with the MUTCD.*

Figure 1-10: Proposed Electric Vehicle Charging Station Signs

30” x 24”

Comment: Dimensions. As mentioned previously, it is anticipated that a federal standard for electric vehicle signs is forthcoming, but these are the interim recommended signs. See dimensions for interim electric vehicle signs at http://mutcd.fhwa.dot.gov/resources/interim_approval/ia13/ia13evcaltd911bimg.pdf.

The long-term objective of these electric vehicle signs is to have a consistent symbol from the federal highways, to state highways, to local streets, and finally at the charging station. Use of one federal symbol is the simplest way to accomplish this end. Recognizing that the experimentation process may result in revisions, the current interim approved federal signs shown above should be utilized by local governments and installers until federal signs are approved. One potential revision that may be proposed from Washington State is that the sign include information on the charging level (i.e., AC Level 1 or Level 2, or DC Level 1, Level 2, or Level 3).

1.5.4. Directional Signage for Local Streets: The following signs shall be used to designate and direct traffic to electric vehicle charging stations on local streets.

Figure 1-11. Recommended Local Street Directional Signs

24” x 24”

24” x 9”

The directional sign for local streets should be installed at a suitable distance in advance of the intersection or charging station facility. If used at an intersection or parking lot entrance, it should be accompanied by a directional arrow. The symbol on the sign above may be supplemented with the sign below (MUTCD D9-11bP) to help early PEV drivers avoid confusion with liquid fueling stations.

Comment: These signs are compliant with the MUTCD.

Figure 1-12. Optional Supplemental Charging Station Sign

24” x 18”

1.5.5. On-Street Parking Space with Charging Station: The following signs shall be used to designate on-street electric vehicle charging stations. The use of time limits is optional.

Figure 1-13. Recommended Sign Combination for an On-Street Parking Space with Charging Station

12” x 12”

12” x 18”

12” x 18”

Comment: This is a combination sign identifying the space as a charging station space with charging time limits, prohibiting non-EVs. Time limits allow the charging equipment to be available for more than one use during the day. For example, a jurisdiction may want to utilize time limits in areas where the on-street charging station spaces would turn over consistent with whatever time limits might otherwise be posted on a block (e.g., two-hour time limits). The design of the time limit charging sign is modeled after the existing R7-108 sign in the federal MUTCD. If time limits are used, suggested enforcement

regulations are provided in Section 2.2. Electric Vehicle Charging Station Regulations. If the jurisdictions wish to allow dual use of the space (i.e., the spaces is for electric vehicles only during a certain period of time, but then allow all vehicles to park after specified hours), the time limits would need to be added to the red/black/white sign rather than the green sign. These signs are compliant with the MUTCD.

1.6. Battery Recycling and Handling Provisions

Comment: At the time of this publication, no federal laws or regulations were regulating PEV batteries except less-used lead-acid batteries and regulations pertaining to the air shipment of lithium and lithium batteries. Additional educational information on lithium batteries is also provided in Addendum A.4.

1.6.1. Battery Handling and Storage: EV batteries shall be properly managed in accordance with any local, state, and federal laws. Dismantling a battery is extremely dangerous and should always be done by the manufacturer. In the event that the battery needs to be removed, dismantling guides are available from the manufacturer.

Comment: In rare instances if a lithium battery is pierced, depending upon the design, specific chemical composition, cold temperatures, and other factors, crystallization of the electrolyte may occur over time, causing a short, possibly resulting in a fire. If the hole is small, that reaction could take days or weeks to occur. The important point is that after an electric vehicle has been involved in an accident or the battery has sustained damage in some other way, or when the electric vehicle is being stored or dismantled, its battery systems must first be properly de-energized according to manufacturer specifications. Such battery de-energizing can be done by following the manufacturer's instructions, which typically consist of stabilizing the car in a safe place, and turning on various features to drain the battery. In all cases, please refer to specific instructions from the manufacturer.

1.6.2. Solutions for End of Battery Life: End-of-life information for most PEV models is available from the End of Life Vehicle Solutions Corporation at http://www.elvsolutions.org/battery_home.html. The site includes information on processes and batteries for the disposal of many makes and models of electric vehicles. It is recommended that batteries be taken to the car dealership for removal if ever necessary. If a dealership is not available, the manufacturer's telephone number listed in the owner's manual should be able to offer guidance on disposal.

Comment: Included in the end-of-life vehicle solutions documentation at the URL above are links to specific end-of-life information from each of the various EV manufacturers.

1.6.3. Air Shipment: Follow the guidelines governing the air shipment of lithium and lithium batteries. Refer to the International Air Transportation Association (IATA) guidance document, "Transport of Lithium Metal and Lithium Ion Batteries: Revised for the 2012 Regulations," at:

http://www.iata.org/whatwedo/cargo/dangerous_goods/Documents/Guidance-Document-on-the-Transport-of-Li-Batt-2012-V1.1.pdf.

1.6.4. Other Battery Technologies: Documentation for handling of lead-acid and other battery types, which still may be used in some older PHEVs, is described in the Mercury-Containing and Rechargeable Battery Management Act, PUBLIC LAW 104–142—MAY 13, 1996, http://www.epa.gov/osw/laws-regs/state/policy/p1104.pdf.

Article II.
Charging Station/Parking Regulations

2.1. Laws and Permits, Listing, Codes, and Inspections

2.1.1. Federal and State Laws:

Comment: Specific information on federal and state laws pertaining to electric vehicles may be found at the DOE Alternative Fuels Data Center, "Federal and State Laws and Incentives," http://www.afdc.energy.gov/afdc/laws/.

2.1.2. Permits: A permit for the installation of a charging system is required from the authority having jurisdiction. DOE's Alternative Fuels Data Center provides an example permit that may be used as a template for charging equipment installation and modified for use in the local jurisdiction at http://www.afdc.energy.gov/afdc/pdfs/EV_charging_template.pdf.

2.1.3. Jurisdiction: Each jurisdiction should consider adding to and/or modifying the permit to include additional information such as:

A. Date utility is notified of work completed
B. Installation information sent to tax assessor
C. Indoor/outdoor location
D. Modification to existing service required
E. Public or private
F. Charging station level
G. Permit details to be shared with the following authorities: <local utility, etc.>
H. Other items as determined by the jurisdiction

2.1.4. EVSE "Listing" or "Recognition": EVSE should be "listed" or "recognized" and installed according to the Occupational Health and Safety Administration (OHSA) by nationally recognized testing laboratories (NRTLs). Such listings are required by the National Fire Protection Association's NFPA 70, also referred to as the National Electrical Code® (NEC®) Code 625, Electric Vehicle Charging System Equipment, at http://www.nfpa.org/assets/files/pdf/a625-675.pdf.

Comment: Please refer to the Addendum below for additional information on testing laboratories, "Listing," or "Recognition," and information on testing standards for EVSE.

2.1.5. Codes: EVSE installations shall comply with applicable building codes and energy requirements according to the applicable state laws.

Comment: A good reference for building code, energy, and accessibility requirements in all 50 states, major cities, and some counties is offered by Reed Construction Data's® Building Code Reference Library, which can be found at http://www.reedconstructiondata.com/building-codes/.

2.2. Electric Vehicle Charging Station Regulations

2.2.1. Charging Station Spaces — General:

A. Charging station spaces are reserved for use by electric vehicles only.

B. Electric vehicles may park in any parking space otherwise designated for parking, subject to the restrictions that would apply to any other vehicle generally.

2.2.2. Prohibitions: Pursuant to <Reference>, when a sign authorized under <Reference> provides notice of a designated charging station space, no person shall park or stand a non-electric vehicle therein <or park an electric vehicle that is not charging>. Any vehicle parked or standing in a charging station space that is not <an EV><charging> is subject to fine and/or impoundment of the offending vehicle.

2.2.3. Notice of Electric Vehicle Charging Station: Upon adoption of an ordinance by <Location> establishing a charging station space(s), the <Location> Engineer shall cause appropriate signs and markings to be placed in and around the designated charging station space(s), indicating prominently thereon the parking regulations. The signs shall define time limits and hours of operation, as applicable, and shall state that the parking space is reserved for the charging of electric vehicles only.

2.2.4. Violations and Penalties: Violations of any provision of this chapter shall be punishable as an ordinance violation. Punishment shall be by a fine not to exceed the fine prescribed in accordance with <Reference> of the <Location> Code. Each hour such violation continues shall constitute a separate offense and shall be punishable as such.

2.2.5. Texas Vehicle Towing and Booting: The vehicle towing and booting occupations code for Texas is provided under Title 14, Regulation of Motor Vehicles and Transportation, Chapter 2308, as administered by the Texas Department of Licensing and Regulation, effective September 1, 2009, except where noted, and specifically subchapter G, Signs Prohibiting Unauthorized Vehicles and Designating Restricted Areas, available at http://www.tdlr.state.tx.us/towing/towinglaw.htm#tsubg.>

Addendum A – Additional Educational Material

The information in Addendum A is offered to the reader as additional educational material and may or may not be included in an ordinance as appropriate.

A.1 Nationally Recognized Testing Laboratories (NRTLs)

Nationally recognized testing laboratories (NRTLs) provide safety certification and develop standards and test procedures mainly dealing with product safety for electric appliances and devices that plug into an outlet on the inside of a house.

Below is a list of NRTLs used for testing equipment like EVSE. Refer to the Department of Labor for updated information on NRTLs: http://www.osha.gov/dts/otpca/nrtl/index.html.

- CSA Canadian Standards Association
- CCL Communication Certification Laboratory, Inc.
- CSL Curtis-Straus, LLC
- FM FM Approvals LLC
- ITSNA Intertek Testing Services NA, Inc.
- MET MET Laboratories
- NSF NSF International
- NTS National Technical Systems, Inc.
- SGSUS SGS U.S. Testing Company, Inc. (formerly UST-CA)
- SWRI Southwest Research Institute
- TUVAM TUV SUD America, Inc.
- TUV TUV Reinland of North America
- UL Underwriters Laboratories, Inc.
- WL Wyle Laboratories, Inc.

In order to be covered by a listing service, charging station products must have been tested by an NRTL and will display a “Mark” along with the word “Listed” plus a control number and product name. That mark on a product provides evidence it has been “Listed” as required by the NEC®.

A.2 National Electrical Code® (NEC®)

A. Article 625 of the NEC® covers the installation of electric vehicle charging stations. The NEC® is also referred to as the National Fire Protection Agency 70 (NFPA 70), a U.S. standard for the safe installation of electrical wiring and equipment. It is a stand-alone document that does not have binding authority, meaning it must be legally adopted by a jurisdiction and can be altered as necessary. It is not a U.S. law, but it has been adopted in all 50 states and is the commonly used electrical code. The following describes some of the sections related to EVSE:

1. Section 625.5 requires "Listing" of all electrical materials, devices, fittings, and associated equipment.
2. Section 625.18 requires EVSE to include an interlock to de-energize an electric vehicle connector and its cable when the connector is detached from an EV.
3. Section 625.19 requires that the EVSE have a method to automatically de-energize the cable conductors and electric vehicle connectors when exposed to stress that could result in cable rupture or separation of a cable from the electrical connector and potentially expose live parts.
4. Section 625.22 requires the EVSE have a "listed" system to protect users from electric shock.

For more information please refer to http://www.nfpa.org/assets/files/pdf/a625-675.pdf.

A.3 Listing, Recognition, or Equivalent

All EVSE to be installed require "listing" or "recognition" by an NRTL since they are electrical devices that plug into an outlet on the inside of a house.

Two good references on the subject are "EVSE Update" by John Halliwell, Electric Power Research Institute (EPRI), available at the following site:

http://mydocs.epri.com/Docs/PublicMeetingMaterials/1009/4FNWWJ9XQWB/407584_E234984_Halliwell_EVSE_Update.pdf and "Electric Vehicle Supply Equipment (EVSE) Certification" by Intertek, available at

http://www.intertek.com/uploadedFiles/Intertek/Divisions/Commercial_and_Electrical/Media/PDF/Battery/Electric-Vehicle-Supply-Equipment-EVSE-Certification.pdf.

A description of testing is offered in UL's "Electrical Connections," November 2010, at

http://ul.com/global/documents/corporate/aboutul/publications/newsletters/electricalconnections/November10.pdf.

Many EVSE have the Underwriters Laboratories (UL) listing, but EVSE do not require specific listing by UL. They are one of many nationally recognized testing laboratories that are able to test EVSE.

Sources of information on UL's electric vehicle standards include

http://www.ul.com/global/eng/pages/offerings/industries/powerandcontrols/electricvehicle/evstandards/.

Also see the article in the International Association of Electrical Inspectors (IAEI NEWS, January-February 2012, page 98, http://digital.ipcprintservices.com/publication/?i=93653) on certification of Level 3 chargers.

A.4 Batteries

Lithium-ion Battery: Batteries in electric vehicles differ from batteries used with ICE vehicles. ICE vehicles typically require a 12-volt battery to provide cranking power to start the engine, as well as to provide power for the accessories like lights, horn, sound systems, ignition, and the like. The ICE battery is recharged by an alternator when the engine is running. The larger, more powerful battery in an electric vehicle or PHEV powers the vehicle itself. Most electric vehicles and PHEVs also have a separate battery to power the accessories. Many battery chemistries are undergoing research and development but lithium-ion batteries are currently the most common battery technology for electric vehicles and PHEVs and will be the main focus of this section.

Batteries used in electric vehicles and PHEVs discharge energy during vehicle use and are primarily recharged by connecting to an off-board electrical source, and in some cases are able to sustain a charge using an on-board ICE-driven generator. Because an electric motor powered by a battery pack is up to three times as energy efficient as an ICE, an electric vehicle can travel much farther than a conventional gas-powered car on an equivalent amount of energy. Lithium-ion batteries also provide the benefit of multiple reuse options and high recyclability.

Battery Chemical Composition: In contrast to lead-acid batteries used to power the accessories, lithium-ion batteries do not contain lead, mercury, cadmium, heavy metals, or federally defined toxic materials. However, large quantities of the batteries may contain potentially dangerous materials so they are regulated under the Standards for Universal Waste Management (40 CFR PART 273). Please refer to

http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?type=simple&c=ecfr&cc=ecfr&idno=40&region=DIV1&q1=273&rgn=Part+Number.

Battery Recycling: The parts, chemicals, and components of lithium-ion batteries are highly recyclable. Given the toxicity of lead-acid batteries, state law tightly regulates their recycling and disposal. These laws and regulations do not apply to lithium-ion batteries. Once a lithium-ion battery reaches its ultimate end of life, it can be processed at an experienced battery recycler's commercial facility by being shredded and separated into its recyclable components. Metals and other compounds can be sold and the lithium may either be recycled back to battery manufacturers or disposed of as a nonhazardous material. Efforts are underway by industry groups and the federal government to develop increased capabilities for recycling lithium from electric vehicle batteries.

See http://www.toxco.com/ and http://www.call2recycle.org/ for example resources for lithium battery recycling.

Battery Re-use: When an electric vehicle battery reaches the end of life in its primary application, it may be possible to use it for a time in other purposes. These include standby

power and utility load leveling where battery performance is not as demanding as a vehicle application. Opportunities for the reuse of lithium-ion batteries after the end of their normal vehicle life are expected to be widely established in the future. Automobile manufacturers can determine when a battery is no longer able to carry a sufficient charge to be used in the vehicle. It is anticipated that lithium-ion batteries will still retain 70-80% of their residual capacity at that point and could be reused for other energy storage purposes. Additionally, the electric vehicle industry is looking to reduce the cost of electric vehicles by giving the lithium-ion batteries a second life through re-use, resale, re-fabrication, and recycling.

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Appendix 4A PEV Survey Responses and Methodology

Survey and Interview Implementation

Frontier reached out by phone and email to rural electric co-operatives, municipal utilities, members of EUMMOT, and REPs with service territories within the Texas Triangle corridor. Municipal and rural coops within the Triangle were selected based on load size, taken from the top 50 LSEs in ERCOT. To avoid overlapping research, we did not contact utilities affiliated with the Texas River Cities project. We surveyed project participants on a variety of topics relevant to the expanded use of PEVs, including internal planning efforts, transmission infrastructure, peak demand, ancillary services, pricing programs, direct load control, and other issues. We also asked utility representatives to identify any regulatory, legislative, or other actions that would help facilitate the introduction of PEVs in their service territory.
The following organizations were contacted by Frontier:

- **Rural Electric Cooperatives**: Central Texas Electric Cooperative, Guadalupe Valley Electric Cooperative, Navarro Country Electric Cooperative, Navasota Valley Electric Cooperative, San Bernard Electric Cooperative
- **Municipal Utilities:** Boerne, Kerrville, Brenham, Bryan, College Station, Lockhart, Seguin
- **EUMMOT Members:** AEP, CenterPoint, Entergy, Oncor, TNMP
- **Retail Electric Providers**: NRG/Reliant, TXU

PEV Impacts Given a Specific Timeline

Participants were asked to identify whether certain PEV issues will arise for their utility imminently, within 5 years, within 10 years, many years into the future, or never. Simplified questions and answers are as follows:

Q. Do you anticipate having to upgrade transmission infrastructure?		
Relevant timescale	Maybe many years in the future	This will not be an issue
Answer distribution	50%	50%

Q. Do you foresee an increase in peak demand caused by PEV charging?					
Relevant timescale	Imminent Concern	Within 5 Years	Within 10 years	Maybe many years in the future	This will not be an issue
Answer distribution	0%	20%	10%	50%	20%

Q. Are you concerned about utilities' role in approving, inspecting, and installing charging equipment?					
Relevant timescale	Imminent Concern	Within 5 Years	Within 10 years	Maybe many years in the future	This will not be an issue
Answer distribution	20%	20%	0%	40%	20%

Q. Is your utility interested in dispatching power from PEV batteries?					
Relevant timescale	Imminent Concern	Within 5 Years	Within 10 years	Maybe many years in the future	This will not be an issue
Answer distribution	0%	0%	20%	10%	70%

Q. Is your utility interested in the use of PEVs in the ancillary services market?					
Relevant timescale	Imminent Concern	Within 5 Years	Within 10 years	Maybe many years in the future	This will not be an issue
Answer distribution	0%	0%	10%	40%	50%

Q. Do you plan on owning public charging equipment?			
Relevant timescale	No	Within 10 Years	Within 5 years
Answer distribution	60%	20%	20%

Q. Do you plan on offering separate metering equipment for use with PEVs?				
Relevant timescale	No	In the Distant Future	Within 10 years	Within 5 Years
Answer distribution	50%	20%	0%	30%

Additional Comments: in the near term the majority of utilities were most concerned with cost recovery from providing metering infrastructure, transformers, distribution lines, and services. Other imminent concerns included creating an environment to manage PEV load, including metering, in-home monitoring, control technologies, and power storage. Customer education and incentives should be a priority.

Mitigating Peak Charging Concerns

Survey participants were asked to rank the effectiveness of several methods for mitigating peak period PEV charging. The results are as follows:

	Least Effective		**Most Effective**	
Pricing Programs	20%	40%	20%	20%
Direct Load Control	0%	40%	30%	30%
Smart Charging Infrastructure	0%	20%	40%	40%

Additional Comments: Several utilities, including munis and coops, were against the incorporation of direct load control, citing that anything that interfered with customer convenience would hamper PEV penetration. Pricing programs were also criticized as potentially ineffective, due to the general low-cost of power in Texas. Local (not centrally managed) smart charging was deemed to be the best method, presuming it doesn't negatively affect battery life.

Regulatory and Legislative Actions

Most municipal utilities and coops had little to add at this point, stating that there currently is no demand for PEVs in their area and they don't anticipate any regulatory change affecting that in the near term. The most commonly mentioned legislative and regulatory actions to incentivize PEV adoption given by EUMMOT members are listed as follows:

- Subsidizing vehicles and charging stations along transportation corridors;
- Government programs and efforts to educate customers about benefits;
- Guidance on cost recovery of metering infrastructure and upgraded infrastructure, i.e. who pays? the specific customer or the rate base;
- Timely cost recovery for capital improvements;
- If regulatory body would allow utilities to divert costs of public charging infrastructure to the rate base it would foster PEV adoption, given that the current DOE funding programs will expire;
- Allow PEVs to access HOV lanes, special toll road rates, special parking;
- Point of sales rebates and other incentives to offset cost;
- Adopt consolidated annual vehicle registration, inspection, and road tax sticker;
- Expand the Texas Emissions Reduction Plan to include PEVs;
- Clarify the utility's role in providing public charging capability and cost recovery.

Appendix 4B Texas Deregulated Electricity Market and ERCOT Overview

Introduction

The Texas Legislature restructured the Texas electric market in 1999 and gave the Electric Reliability Council of Texas (ERCOT), the region's independent system operator, four primary responsibilities:

- System reliability – planning and operations
- Open access to transmission
- Retail switching process for customer choice
- Wholesale market settlement for electricity production and delivery.[XXVI]

Deregulation and the Competitive Electricity Market in Texas

Prior to 1999, electric utilities operated as vertically integrated regulated monopolies, providing all parts of electricity service to customers within certain parts of the state. With the passage of Senate Bill 7 during the 1999 Legislative Session, these monopolies were broken up into three separate types of companies, each providing a different aspect of electricity service: power generation, transmission and distribution, and retail sales.

Utility Roles in the Competitive Market

- **Power Generation:** Power generation companies own and operate power plants, including plants fueled by coal, nuclear power, natural gas, wind, water, solar power, or other renewable sources. Power generation companies sell this power at wholesale to Retail Electric Providers (REPs), who package the power with transmission and delivery service for sale to retail customers. Wholesale power prices are determined by a competitive market process based on day-ahead auctions. Retail electric providers are not permitted under Texas law to own power plants; however, they can be affiliated with a power generation company.

- **Transmission & Distribution Utility:** Transmission & Distribution Utilities (TDUs), also referred to as Transmission & Distribution Service Providers (TDSPs) or the "wires companies," provide the actual delivery of electricity. The TDUs are responsible for maintaining the poles, wires, and meters that deliver and measure the electricity consumed by a home or business. In addition, the TDUs read the meters and restore service when there is a power outage. The TDUs are regulated by the Public Utility Commission of Texas (PUC). The PUC sets the rates for transmission and distribution services, establishes reliability and safety standards, and ensures that all customers and

REPs are treated the same when it comes to the delivery of electricity to homes or businesses.

- **Retail Electric Provider:** Retail Electric Providers (REPs) buy electricity wholesale, in a competitive market process and sell it directly to the end-users, who may be residential, commercial, industrial, or institutional. Responsible for customer service and billing, REPs compete for a customer's business by offering a variety of different pricing structures, renewable energy options, added customer service benefits, or other incentives. REPs determine load profiles for their customers and buy energy accordingly.

Non-Competitive Areas

Some geographical areas of the state are not open to competition. The Public Utility Commission (PUC) has delayed retail competition for customers of Entergy Gulf States, Southwestern Public Service Company (SPS or Xcel Energy), El Paso Electric Company, and Southwestern Electric Power Company (SWEPCO) because it has determined that there is not adequate competition in the wholesale electricity market for retail competition to work successfully in these areas. [XXVII] Also, rural electric cooperatives and municipally-owned utilities are not in competition but may "opt-in" to competition if they choose; so far none of the municipal or coop utilities have opted in.

ERCOT Overview and History

ERCOT manages the flow of electric power to 23 million Texas customers - representing 85 percent of the state's electric load. As the independent system operator for the region, ERCOT schedules power on an electric grid that connects 40,500 miles of transmission lines and more than 550 generation units. ERCOT also performs financial settlement for the competitive wholesale bulk-power market and administers retail switching for 6.7 million premises in competitive choice areas. ERCOT is a membership-based 501(c)(4) nonprofit corporation, governed by a board of directors and subject to oversight by the Public Utility Commission of Texas and the Texas Legislature. ERCOT's members include consumers, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities (transmission and distribution providers), and municipal-owned electric utilities.[XXVIII]
The following timeline gives an overview of the events leading to the establishment of ERCOT in its current role as well as the deregulation of the Texas electric market.[XXIX]

- 1941 – Utilities in Texas band together as the Texas Interconnected System (TIS) to support the war effort, sending excess power generation to Gulf Coast manufacturing companies.
- 1970 – TIS forms ERCOT to comply with North American Electric Reliability requirements; ERCOT is staffed by two retired utility employees.
- 1981 – ERCOT assumes role of Central Operating Coordinator for Texas and opens first office in 1986.
- 1995 – Texas Legislature deregulates wholesale generation with an amendment to the Public Utility Regulatory Act (PURA) and begins to expand ERCOT's responsibilities to include wholesale competition and facilitate efficient grid use for all market participants.
- 1996 – ERCOT becomes the first Independent System Operator (ISO) in the US, with the responsibility of ensuring impartial, third-party oversight for equitable access to the grid for market participants.
- 1999 – Deregulation of Retail Electric Market.
- 2001 – Ten existing control areas in ERCOT are consolidated into a single control area.
- 2002 – Retail market opens with customer choice for 6.1 million Texans
- 2010 – ERCOT implements Nodal Market structure
- Presently, ERCOT has over 600 employees and an annual budget of over $170M

ERCOT's Role in the Market

ERCOT 'directs traffic' on the grid to maintain reliability and ensure supply of electricity through the following activities:

- Coordination of scheduling of power by market participants
- Continuous analysis of grid conditions in real time
- Dispatch of generation to ensure power production matches load at all times
    - Balancing Energy Service
    - Load Frequency Control
- Securing available generation capacity to meet reliability requirements including contingencies
- Coordination of planned outages of generators and transmission lines
- Relief of transmission system congestion
- Coordination of emergency actions and recovery
- Operation of markets to meet regional energy and capacity requirements not met through bilateral agreements.[xxx]

ERCOT's Ancillary Services Market

ERCOT runs ancillary services (AS) markets to ensure system reliability to continuously balance the demand and supply for electricity at all times. Commercial and industrial customers with interruptible loads that can meet certain performance requirements can qualify to become Load Resources and provide operating reserves in the ERCOT AS markets. In the AS markets, the value of a Load Resource's load reduction is equal to that of an increase in generation by a generating plant. Load Resources that are scheduled or selected in the ERCOT Day-Ahead AS Markets are eligible to receive a capacity payment regardless of whether they are actually curtailed.[XXXI]

There are four Ancillary Services that could potentially be furnished by PEVs. They are:

- **Regulation Up (Reg-Up):** An Ancillary Service that provides capacity that can respond to signals from ERCOT within three to five seconds. Controllable Load Resources providing Reg Up must be capable of being curtailed by ERCOT in response to a drop in system frequency.

- **Regulation Down (Reg-Down):** An Ancillary Service that provides capacity that can respond to signals from ERCOT within three to five seconds. A controllable load resource providing Reg Down must be capable of ramping up in the event of an increase in system frequency above 60 Hz.

- **Responsive Reserve (RSS):** An Ancillary Service that provides operating reserves that is intended to:
    - Arrest frequency decay within the first few seconds of a significant frequency deviation on the ERCOT Transmission Grid using Primary Frequency Response and interruptible Load;
    - After the first few seconds of a significant frequency deviation, help restore frequency to its scheduled value to return the system to normal;
    - Provide energy or continued Load interruption during the implementation of the Energy Emergency Alert (EEA); and
    - Provide backup regulation.

- **Non-Spinning Reserve (Non-Spin or NSRS)**
    - 30-Minute Non-Spinning Reserve Service (30MNSRS): A service that is provided through utilization of the portion of Off-line generation capacity capable of being synchronized and ramped to a specified output level within thirty (30) minutes (or Load that is capable of being interrupted within thirty (30) minutes) and that is

capable of running (or being interrupted) at a specified output level for at least one (1) hour. [XXXII]

Electric Vehicles as an Ancillary Service

There has been considerable public discussion of the possibility of plug-in electric vehicles (PEVs) acting as an ancillary service. For an examination of feasibility, please see Chapter 4: Electric Utilities.

Appendix 5A Discussion of PEV Charging Technology

Additional Information on Charging Components and Terminology

A PEV requires direct current (DC) to recharge its battery. The electric utility delivers alternating current (AC) to the charging equipment so AC power must be converted to DC before it can charge a battery. This can be accomplished either through the charger on board the vehicle or by a charger off-board the vehicle. This is the source of the common terms AC charging and DC charging. In either case, the vehicle has a Battery Management System (BMS) that controls the current into and out of the battery. The terminology used to identify the components in the delivery of power to the vehicle is shown in Figure 5A-1 and Figure 5A-2.

As shown in Figures 5A-1 and 5A-2 for AC and DC power respectively, electric power is delivered to the PEV's onboard battery through the PEV inlet to the charger. The charger and PEV inlet are considered part of the PEV. A connector is a device that is inserted into a PEV inlet to establish an electrical connection to the PEV for charging and information/data exchange. The PEV inlet and connector together are referred to as the coupler. The EVSE consists of the connector, a cord, and the interface to the utility's power. For AC charging, the Society of Automotive Engineers (SAE) has published a standard for vehicles produced by automakers in the U.S. known as the J1772 Standard[XXXIII]. Most U.S. and foreign automotive manufacturers adhere to this standard as do the EVSE suppliers. Thus, all vehicles equipped with this inlet can charge at most charging stations. This provides great convenience for PEV drivers and establishes one measure of interoperability across the EVSE industry. The J1772 Standard PEV coupler is designed to satisfy the safety requirements associated with the PEV charging. The SAE has not established a standard for DC charging as yet.

Figure 5A-1 AC Charging Schematic

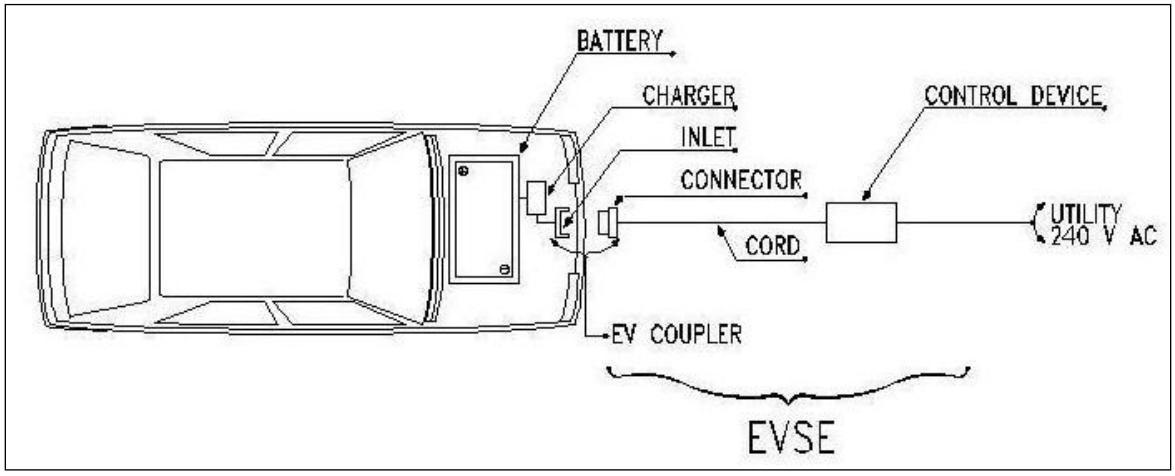
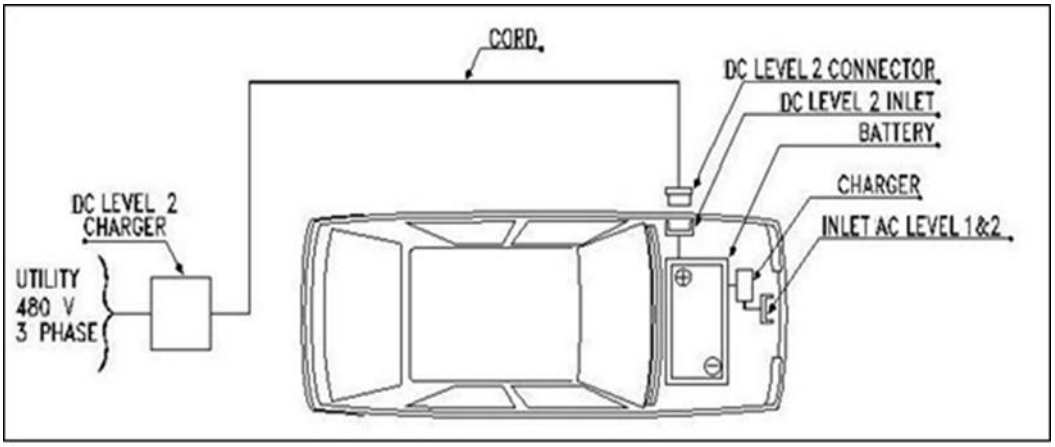


Figure 5A-2 DC Charging Schematic



EVs are generally classified as either being a fully battery electric vehicle (BEV) or a plug-in hybrid electric vehicle (PHEV). A BEV relies fully on the battery for its motive power, whereas the PHEV also has an internal combustion engine (ICE) that can assist the battery in its motive power. Together, these are called plug-in electric vehicles (PEV). The range of a BEV is typically identified as the distance the vehicle can travel before depleting its battery and a recharge is required. While PHEVs can continue to travel past the depleted battery stage on its ICE, manufacturers typically identify the range the PHEV can travel on battery power only. Thus the discussion of "range" is important. Individuals seeking to purchase a PEV do need to consider the vehicle's range to make sure it meets their requirements.

"Range" is of particular importance in these plans for Regional PEV infrastructure in the Texas Triangle. The placement of AC or DC charging equipment in publicly available locations increases the allowable trip distance of the PEV by providing recharge stations along the way. There are many factors involved in selecting these recharge sites as discussed in chapter 5 and associated appendixes. Public EVSE infrastructure enhances the PEV driving experience by promoting range confidence for drivers. They can be assured that they will not deplete their battery while far from their home recharge stations. The visibility of this EVSE infrastructure also enhances the image of PEVs among persons considering purchasing one, since stations are provided by hosts who enthusiastically anticipate their usage.

Additional Technical Description of AC Level 2 and Direct Current Fast Chargers (DCFC)

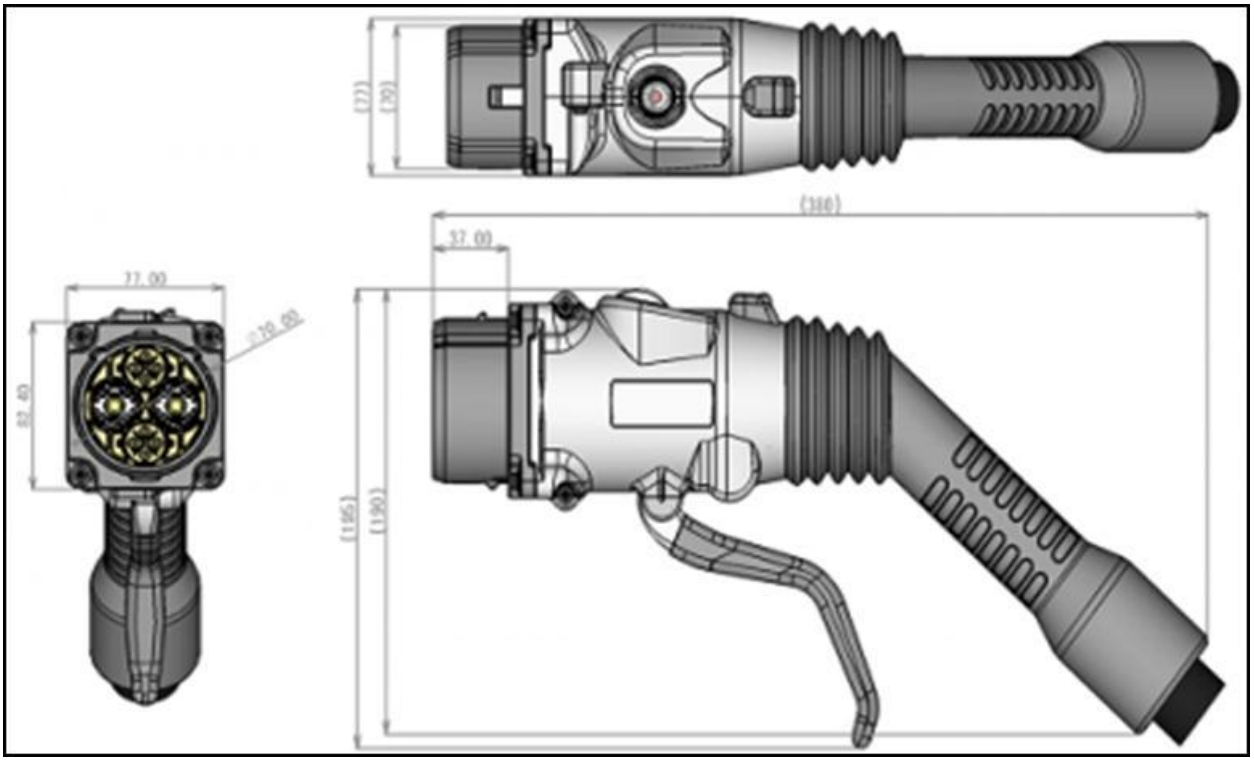
As noted above, for AC charging, the conversion of the utility AC power to the DC power is required for battery charging that occurs in the vehicle's on-board charger. AC Level 1 is typically provided through a cord set that plugs into a standard 120 volt outlet. The cord set is generally provided by the PEV manufacturer as part of the original equipment. AC Level 2

equipment is optional equipment that can be purchased and installed in a residential or commercial setting. The most common circuit for AC Level 2 is 240 volts alternating current (VAC), 40 amps which can deliver approximately 6.6 kilowatt (kW) power to the PEV. DC charging can be set to deliver much higher power to the battery but also typically requires much higher AC line voltages of 480 volts (V).

The SAE committee desires to specify a single connector, called the J1772 combo connector, which would provide a common interface for AC or DC charging. At the time of this writing, such a standard has not been completed so no approved SAE standard DC connector exists. This standard is expected to address three phase AC power supply as AC Level 3, as well.

A DC connector has been specified in Japan and several Japanese PEV manufacturers have provided vehicles with the DC inlet on their vehicles. This connector follows the CHAdeMO standard. Many EVSE suppliers in the U.S. are presently providing equipment with connectors of the CHAdeMO standard.

Figure 5A-3 CHAdeMO Standard Connector[XXXIV]



The discussion of AC or DC charging levels is important because it affects the recharge rate the PEV driver can expect. Generally, the higher the power supplied, the greater the recharge rate for

the PEV. The vehicle's BMS has ultimate control over the recharge rate up to the maximum limits of the EVSE, which can be used to derive an estimate of the time to charge a battery for various vehicle types and power delivery levels. PEV manufacturers typically designate vehicles with the typical range on battery only. For example, a PEV-40 is comparable to a Chevy Volt which can be expected to have a *battery only* range of 40 miles.

DC Fast Charging has following three primary purposes:

1. It is included in metropolitan areas as a backup to the AC Level 2 convenience charging network. In this role, it provides additional range confidence in that the PEV driver knows that if the battery charge is low, a fast recharge can be found to restore the range to complete his/her trip.

2. In addition, DC Fast Charging is used by drivers that may not have an assigned or specific overnight parking location. A nearby DCFC can restore the battery state of charge very quickly.

3. DC Fast Charging is also particularly important for corridor charging. PEV drivers transiting between metropolitan areas along the Texas Triangle corridor will want to complete their trips in the shortest possible time. Consequently, the fastest recharge rates will be desired.

Along with the fast recharge at the higher power advantage, comes an issue with the electrical supply. It is more difficult to deploy 480 VAC than 240 VAC and many electric utilities charge their customers not only for the amount of energy that is used but also on the peak power that is required. The power demand charge is typically set based upon the highest power required during any 15 minute interval for the month. Many electric utilities set a threshold power level below which no demand charge is assessed. However, the amount charged when power is required above that threshold can be significant. DCFCs will exceed that threshold. Those electrical service charges will be paid by either the charging site host or the EVSE provider. Strategies may be invoked to offset these demand charges such as limiting the recharge rate to just below the threshold – which can lengthen the recharge time, limit the recharge so that the average for the 15 minute period does not exceed the threshold – i.e. provide a 40 kW charge for 7 minutes if the threshold is 20 kW, provide a local battery storage to assist in the recharge so that a 50 kW charge can be accomplished by using 20 kW from the grid and 30 kW from the battery. This storage assisted recharging method adds capital cost and complexity to the design. It would be desirable for the local electric provider to give special rates for DC Fast Charging that eliminates the demand charges in order to promote the adoption of PEVs.

DCFC suppliers provide either single port or dual port EVSE. Dual port EVSE can be designated to charge PEVs sequentially. For example, the ECOtality Blink dual port unit shown in Figure 5A-4 supports sequential charging. If one port is connected and charging one PEV, then the

driver can connect to the second port. When the first vehicle completes the charging at a programmed time, the charge shifts automatically to the second port. In this way, the power required for the two ports is half that required for two separate single port units. When the SAE completes its work on the J1772 combo connector to provide DC Fast Charging, it will be possible for the dual port unit to include one CHAdeMO connector on one port and the J1772 combo connector on the other.

Figure 5A-4 Blink DCFC (Dual Port Unit)

Appendix 5B Discussion of PEV Charging Business Model Factors and Costs

This appendix is in two parts: Part 1 describes business model factors and Part 2 deals with costs.

Part 1 Business Model Factors

Table 5B-1 lists the business factor models in developing PEV infrastructure models. These are discussed below by each of the 15 characteristics or variables.

Table 5B-1 EVSE Business Model Factors

Characteristic	Business Model Options
Usage Accessibility	Private, Semi-Public or Public
Active Ports per Station	Single, Dual Sequential or Dual Simultaneous
Billing Systems	Credit Card, Smart Card, RFID or Parking Meter
Cable Management	Simple or Sophisticated
Charging Level	AC Level 1, AC Level 2 or DCFC
Complementary Services	Truck stop, Post Office, Nighttime Fleet Charging or Grid Storage
Connection Type	Unidirectional or Bidirectional
Costs to Site Owner	Installation and Maintenance
Energy Provider	COOP, MUNI, REP, or Investor Owned Utility
EVSE Site Owner	Private, Semi-Public, Utility, Workplace or Government
Metering	No metering, Separate metering for station, or Use current on-site meter In vehicle
Ownership	Site Owner, EVSE Company, Utility, Government
Profit Sharing Between Site Owner & EVSE Provider	Percentage split or Fixed rate to owner
Revenue Sources	Electricity, Parking, or Advertising
Type of Billing	Fixed energy rate, Fixed rate subscription, or Pay per use
Wholesale Energy Processing	Day-ahead, Intra-day, and Real-time

Usage Accessibility

Accessibility is the EVSE control function that assures that the person connecting and charging is authorized to do so. Some accessibility is controlled through the installation of the EVSE in secure or private locations. Garage and behind-the-fence workplace or fleet charging locations are examples. Some charging stations are located where both a private fleet and the general public may have access. A university may require that the general public pay a fee for charging, but provide it at no cost to their faculty. EVSE generally available to the public would typically control access for revenue generation. Accessibility involves identification of the individual or vehicle, comparison to an approved database, and activation of the EVSE once authentication is complete. This typically involves a communications system between the EVSE and a provider network.

Methods for accessibility may involve subscriptions or memberships in an EVSE provider's network for which an activation card is waved by a radio frequency identification (RFID) reader in the EVSE. A credit card on file in the network is charged the access fee. Some providers may allow credit card payments at the EVSE. See also profit sharing noted below.

Active Ports per Station

In the design of EVSE, manufacturers have selected to produce equipment that is designed to charge a single vehicle and some have equipment that may charge more than one vehicle. Most multiple units will charge two vehicles either simultaneously or sequentially. Design is driven by the providers' business plans and location applications.

Billing Systems

Multiple options for billing exist. Revenue can be collected using mechanisms such as RFIDs, smart cards, credit cards, or parking meters. The first two of these options require communication to verify that a driver can begin charging, whereas parking meters can be locally controlled.

Cable Management

Cables must be managed to ensure that they do not create a tripping hazard or that they are damaged. Simple techniques involved simply wrapping a cable at a station, whereas more sophisticated techniques involve retraction.

Charging Level

Section 5.2 discussed the differences between AC Level 2 and DCFC. Along with the technical differences, there is also a significant difference in equipment costs. AC Level 2 delivers the 240 VAC power from the electric utility directly to the vehicle. The conversion to DC for battery charging occurs in the on-board vehicle charger. These chargers are typically 3.3 or 6.6 kW chargers. Higher power ratings of the on-board charger add size, weight and cost to the vehicle price. The cost of the EVSE then is in providing the safety circuits and other features for

accessibility and data recording. In DCFC, the conversion occurs off-board where size and weight are not as significant a factor. Power ratings of up to 10 times or more the power of AC Level 2 are possible. Along with that power is the added cost of the unit. Part 2 of this appendix gives further discussion on factors that affect costs.

The strategy surrounding the placement of AC Level 2 or DCFCs is also involved. An AC Level 2 can provide a significant recharge of the BEV battery in two to three hours. A typical site host for an AC Level 2 would then be a destination where the driver would stay two to three hours. Such places include restaurants, movie theaters, golf courses, professional business offices, etc. The BEV is recharged conveniently while the driver is in the location. A DCFC provides a significant recharge in 15 minutes. Thus, the destinations for DCFC users may include fast food restaurants, convenience stores, gas stations, etc. These businesses are designed around high turnover of people who do not stay long periods of time.

Complementary Services

In order to enhance the potential profitability of EVSE, additional services can be combined, other than common charging for light duty vehicles, to more efficiency utilize the EVSE. For example, stations can be used to electrify trucks and delivery vehicles. In addition, grid storage can be provided to help reduce electricity costs and power requirements.

Connection Type

At the present time, all connectors are unidirectional. Power flows only from through the EVSE and into the PEV. Bidirectional power flow would allow the stored energy in the battery to be used to reverse power through the EVSE to power other vehicles, the local building, or back to the power grid. This is called V2B (vehicle to building) or V2G (vehicle to grid). Power flow from the battery to the electric grid may be useful as a generation source if sufficient numbers of connected batteries can be aggregated. Power flow to the grid can also be useful in voltage and frequency regulation for grid stability. For both of these functions, it is possible that sufficient revenue can be generated to make a business a case for bi-directional flow. However, at the time of this writing, the communication and equipment standards have not been created to identify the specific business advantages of bidirectional power flow.

Costs to Site Owner

Equipment costs are an important consideration for the business case. Ownership of the EVSE is addressed in further below, but in general, a charging site host must consider the capital cost of the equipment, the cost of installation of the electrical circuit and related construction, anticipated maintenance costs, costs associated with the parking location devoted to PEV parking, signage, vandalism and insurance. Some or all of these costs can be negotiated in a services contract with an EVSE supplier or third party, depending on specific locations. The charging site host must also consider other advantages of hosting the EVSE which may result in increased business revenue. Preliminary information from the EV Project suggests that users of

charging stations may stay longer inside a retail location. Retailers know that this means increased sales. In addition, the host can advertise the EVSE at their location and gain new business.

Energy Provider

Under electricity market restructuring, millions of Texans can choose their electricity provider. The restructured electric utility market allows for competition in the retail delivery of power to much of Texas. The municipally and publically owned utilities (including electric cooperatives that cover much of the Texas Triangle) are not part of the competitive market. For those in the competitive market, there is an opportunity for EVSE providers to couple their equipment with the electrical supply service. The electrical supply services can be provided by the private EVSE company or through agreements with independent providers.

Electricity distributors can also be the electricity energy utility or municipal provider. This more traditional role for power providers is independent of the EVSE. They may offer special rates for PEV drivers to encourage off-peak charging.

In many locations, the electric retail provider may specifically provide special rates for PEVs. This would require a means of measuring the electricity usage for charging the PEV independent of the balance of the load. This would be accomplished by the installation of a second utility meter in-line with the EVSE or by using an embedded meter within the EVSE, if provided. The embedded meter would need to be certified as a revenue grade meter.

EVSE Site Owner

The availability of EVSE to the general public may be classified as private, semi-public or public. Private use includes to a single family home environment, some multi-family dwelling applications, fleet operations and employer workplace charging. In these cases, access to the EVSE is controlled either by its physical unavailability to the public or by controlling the access through the network authentication. Other than a private owner in a private location, the employer or multi-family dwelling owner may charge access fees for the equipment use even though it is not in a public location. The employer may wish to avoid concerns over preferential treatment of PEV drivers over internal combustion vehicle drivers or questions related to taxable benefits. The multi-family dwelling owner may install EVSE for the shared use by their tenants. The access fee provides for the common equipment installation, maintenance and operational costs.

Semi-public applications include sites that may serve two purposes such as a fleet operator making his/her equipment available for general public charging when not in use by the fleet. Access control authentication would select whether the user is charged a fee for service or the charge is part of the fleet operations.

Publicly accessible units may be operated by retailers, government, private owners or the electric utility. In general, access will be controlled for these units although some may elect to provide the recharge at no cost for a time. Retailers may elect to provide the free service as an enticement to customers to shop. Many retailers know specifically how much time spent in their store relates to the amount of purchase. Longer dwell times result in higher purchases. Municipal governments may provide charging at no cost to the consumer but pay for the costs from a general budget citing the common good provided. Regulated electric utilities may want to request permission from the Public Utility Commission of Texas to provide charging stations for the general good which are paid for by all the rate payers. In these cases, access fees may or may not be charged.

Metering

Metering refers to the collection of data regarding the amount of electrical energy transferred during the recharge process. This data can be collected through a submeter located within the EVSE, by a separate meter installed in line with the EVSE (if provided), by the meter that serves the whole premise and does not specifically collect EVSE energy information, or through the vehicles' on-board meter (if provided by some PEV manufacturers). In general, EVSE access fees are not directly tied to the cost of the electricity provided to the vehicle. This is a cost to the host, and other costs identified above need to be considered as well. The metering provides a measure so that the host can be assured that this part of the cost is covered by the access fee or other contracts with EVSE or third party providers. In some locations, the electric utilities are testing the embedded sub meter within the EVSE to verify accuracy for billing purposes. If accepted, this meter will take the place of the in-line meter to provide accurate energy usage information.

Ownership

EVSE ownership can be retained by the EVSE provider or transferred to the charging site host. The traditional sale method would make the host, whether residential or commercial, the owner and operator of the EVSE and responsible for the operation and maintenance of the equipment. Under some contracts, the EVSE provider may retain ownership of the EVSE and provide compensation to the host for the use of the site. The EVSE provider then may be responsible for the maintenance and operation of the equipment. More information on non-host ownership models is provided below.

Profit Sharing Between Site Owner and EVSE Provider

As noted previously, few business models relate to providing charging at no cost to the driver. Access fees, whether through the subscription method or pay-per-use generate revenue discussed below, are expected to be charged at most publicly available EVSE. This revenue may be shared with the charging site host. Some models will provide a percentage split with the host based upon negotiated terms. This method would encourage the host to maximize the utilization of the

equipment. Other contracts may provide a fixed rate to the host. This fixed rate may be designed to compensate for the host's identified costs associated with hosting that EVSE or rent for the space. The balance of any revenue then would be retained by the EVSE provider.

Type of Billing

When access fees are assessed, they may be set on a fixed fee, a fixed rate or a pay per use basis. Fixed fee would mean that each connect has a set cost. It would not matter how long the connection is made or how much energy is charged into the battery, since the set connection fee is charged. The fixed fee may be assessed by an employer in a workplace setting or when charging is provided as part of a parking lot fee. It may be expected that the owner will be parked for a significant period of time in this location. A fixed rate fee may be charged if high utilization and turnover of vehicles is desired. Fees may be charged per hour or other intervals for AC Level 2 charging and a per minute basis for DC Fast Charging. It would be desirable for the PEV driver to be aware of the time the vehicle is charging to maximize the charge with the convenience of gaining range.

Membership or subscription programs may offer the same type of services. A fixed rate may be charged to the driver on a monthly basis for an unlimited number of connects or time connected at any publicly available EVSE. Discounts on the fixed rate may be provided by the membership program for a tiered membership fee. In most cases, a pay per use is generally available although restrictions may apply based upon the membership program.

Wholesale Energy Processing

Electric utilities are very aware of their costs in providing electrical services. They know their costs to generate or purchase power. The costs can vary from day to day, during the day and in real time. Some EVSE are designed to be responsive to pricing signals from the local electric utility, if provided. When convenient, the PEV owner may set the EVSE to only charge when the pricing signal is below a certain threshold and to stop charging should that threshold be exceeded. Real time communications between the electric utility and the EVSE will be required to implement these features.

The remainder of part 1 of this section highlights additional characteristics which are likely to be necessary in many business models, but on which the industry is still in the process of determining the most viable approaches.

Networks, Communications and Data Collection

Several of the EVSE providers support their EVSE through networked communications. This communication is required not only for access control and authentication, but also allows for remote monitoring of the unit, data collection and reporting as well as software updates over the air. This capability results in fewer maintenance trips for the supplier at keeps the equipment up to date. The data reporting capabilities provide valuable information related to equipment

utilization and driver behavior. Such information is useful in determining whether additional units should be provided to augment the existing station.

Examples of Membership Programs

ECOtality has announced a membership program for subscribers that contain tiered levels.[XXXV] An RFID card is required for access and authentication at their Blink® brand public EVSE. The card holder registers the card on the Blink network and associates a credit card with that account. There are several tiered levels of membership with the basic level at no cost to the member who pays the basic pay per use at each connect. Two additional levels of membership provide discounts and other features.

NRG has announced a membership program with multiple levels, which also uses an RFID card for access at their eVgo® EVSE.[XXXVI] The levels are differentiated by whether the driver can charge at home, or at home and at public stations. In addition, the various levels give the option to pay a fixed monthly rate or a fixed fee per energy use.

Coulomb has announced a membership program for its ChargePoint® EVSE, for which they provide RFID cards or users can use contactless credit cards.[XXXVII] Charging prices vary depending on Coulomb's agreement with the site owner.

Reservation Systems

Networked EVSE providers have announced plans for adding the capability for reservations with their equipment. The programs have not been specifically identified but it is expected that a fee for the reservation and penalties for failure to comply with the reservations made will exist. This again involves fees to be charged to the owner's credit card and interoperability is again in question. It is likely that mapping service companies may also offer the reservations capability and will work out the rules and payment systems with each of the networked EVSE providers.

This is of particular importance in corridor charging. The PEV driver will plan the trip in advance and plan on locations for recharging. It would not be desirable to arrive at a station expecting to charge and find the station occupied. ECOtality and Coulomb have announced reservation plans to assist the driver in completing the trip.

For the Texas Triangle corridor charging systems, it is expected that the stations will provide the dual function of supporting the corridor travel of those traveling to and from the metropolitan areas. This will likely require DCFCs in these locations. At the same time, these stations can serve as backup to the local AC Level 2 charging network. This may mean that the station contains an AC Level 2 EVSE as well. There are several examples where the DCFC and AC Level 2 equipment are installed at the same site.

In the Texas Triangle corridor public charging stations, it can be expected that several EVSE suppliers will seek charging site hosts. There is risk for these companies in the early years while

the adoption of PEVs is still in its infancy. The business plan for success will be based upon utilization and PEV adoption. It is therefore likely that the EVSE companies will retain ownership of the units for the near future. Revenue systems will likely be employed as outlined above. Placement of these stations will be important to be convenient to the corridor driver as well as for the local community. The site will likely contain a destination feature, such as a restaurant, to be convenient to the driver while the PEV is charging and to be of interest to the facility to be the host.

Part 2 Costs

Given the array of business model options for EVSE, installations require planning on the macro scale, such as throughout a mega-region or a large city, and on the micro level, such as a major employer, retailer or restaurant. The costs associated with installing a charging infrastructure can, likewise, be categorized. Part 2 of this section outlines the key cost factors that are considered when deploying charge infrastructure and some estimates of EVSE installation costs. These factors are categorized and outlined below for large-scale deployment programs for AC Level 2 and DCFC installation scenarios.

Geographical Cost Factors

Investment made into EVSE deployment across large geographic areas requires planning and data analysis. For example, deployment across a large city, a highway corridor or a large retail mall involves multiple stakeholders. A list of key factors considered in large scale deployment projects can be seen below:

- Consumer Interest
- Employment Density
- Security and Vandalism Risk
- Retail Density
- Traffic Corridors
- Hills / Level Parking for Accessibility
- Proximity to Destinations
- Proximity to other EVSE stations
- Visibility
- Residential Population Density
- Future Growth Areas
- Demographics Ownership Models
- Availability to Drivers Reserved Parking
- ADA Compliance
- EV Charging Signage

AC Level 2 Cost Factors

Narrowing down to the individual charger commercial building or public facility, the cost factors involved relate to equipment, labor and ongoing operation of the charging stations. Variables such as whether the site is a newly constructed project or renovation, the electric panel's location and size, and underground conduit and wire requirements affect the price of the installation. Other costs like service upgrades, wiring costs, and permit fees also add to the installation price. Publicly available charging stations and commercial charging station locations share many of the same cost factors. A list of these factors can be seen below:

- Appropriate Voltage and Amperage
- Electric Rates / Time of Use
- Spare Capacity or Electric Service Upgrades
- EVSE Features and Equipment Costs
- Nearby Power Access
- Concrete/Asphalt – patchwork for trenching
- Transformer Upgrade
- Communications systems
- Panel boards – possible subpanels, panel upgrades and additional circuits
- Above Ground vs. Trenching
- Access – shared or single user
- Shelter
- Lighting
- Barriers / Bollards / Wheel Stops
- Concrete Boring

As with all EVSEs, the cost of installation can range significantly due to the site-specific conditions. Currently, the base cost of an AC Level 2 charging station is approximately $750-$3000, and grid and wiring updates can cost up to about $1500. The advanced communication systems in EVSE stations, if equipped, must also be considered. Some communications are cellular and others are internet serviced. As long as cellular service is available in the area, those EVSEs, if equipped, should be able to complete the communications path. EVSEs which rely on internet access either through a wireless or networked system may require additional conduit and cable to reach a local modem. While most charging equipment is designed to be maintenance free, components such as the connector and cable may wear. Methods are employed by the EVSE suppliers to discourage vandalism and it has not been an issue with the units installed thus far. The cost of yearly maintenance is estimated to be around $50-$250.[XXXVIII] Table 5B-2 provides a generic cost worksheet for an AC Level 2 location with the two stations.

Table 5B-2 Estimate Cost for Public Electric Vehicle Charging Station

Public Charge Station- AC Level 2 (Quantity 2)			
Description	**Quantity**	**Estimated Cost**	**Total**
Labor (hours)			
Consultation with Property Owner/Tenant	4	$ 75.00	$300.00
Initial Site Visit	2	$ 75.00	$150.00
Engineering Drawings	16	$ 90.00	$1,440.00
Permit Application/Acquisition	2	$ 75.00	$150.00
Installation	24	$ 75.00	$1,800.00
Approval	2	$ 75.00	$150.00
Labor Sub-Total			$3,990.00
Materials			
Distribution Panel (400 amp)	1	$250.00	$250.00
EVSE-40amp	2	$780.00	$1,560.00
EVSE Pedestal	2	$450.00	$900.00
40amp Breaker	2	$35.00	$70.00
#12 THHN Wire	400	$0.30	$120.00
Conduit – ¾ EMT	100	$3.00	$230.00
40amp Fused Disconnect	2	$115.00	$250.00
Signage	2	$250.00	$500.00
Miscellaneous	2	$60.00	$120.00
Material Sub-Total			$4,300.00
Trenching & Repair	100	$45.00	$4,500.00
Permit	1	$85.00	$85.00
		TOTAL	**$12,875.00**

DCFC Installation Cost Factors

Many of the same cost factors exist for the installation of DCFC stations. The voltage and amperage of the DCFC station may also require a new electrical service and additional coordination with the local utility company for grid reinforcement and transformer replacement. These decisions depend on the grid infrastructure which is present and demand expected at the DCFC station.

The base cost of a DCFC station can range from $10,000 to $50,000. Generally, a location where the installation costs exceed $25,000 is not likely to be approved by either the host or the EVSE supplier without additional subsidy. If transformer replacement and/or grid reinforcement is required, cost estimates are approximately $35,000 for the former and $20,000 for the latter. Again the design of the DCFC provides units relatively free of maintenance. Yearly maintenance cost has been estimated to be up to about $5,000.[XXXIX] It should be noted that although these costs are significantly higher than those of an AC Level 2 station, the cost per kWh provided are comparable for a well-utilized station, since cars spend much less time at a DCFC station. This makes DCFC stations far more beneficial for and for intercity corridors such as those in the Texas Triangle.

Appendix 5C BAU PEV Charging Scenario

How to read the figures in Appendix 5C:

Fig. 5C-1 shows the projected organic growth (i.e., no additional federal or outside funding, only private sector growth) of PEV AC Level 2 and DC Fast charging stations along I-45 beginning in Conroe (0 miles) and continuing through Corsicana (just under 150 miles). The vertical axis shows the number of charge ports per mile (density) and the horizontal axis shows the distance north of Conroe. The color code shows the density for a given future year. Because these estimates assume a rather aggressive growth in PEV sales, they tend to overestimate (the contractor was told to use the Obama Administration's 1 million vehicles on US roadways by the end of 2017 at the beginning of this project, whereas actual sales are trending below this number).

Figure 5C-2 and 5C-3 show the same data, for 2017 only, in a map form and includes the Huntsville to College Station link. The remaining figures show the other corridors covered by this Plan.

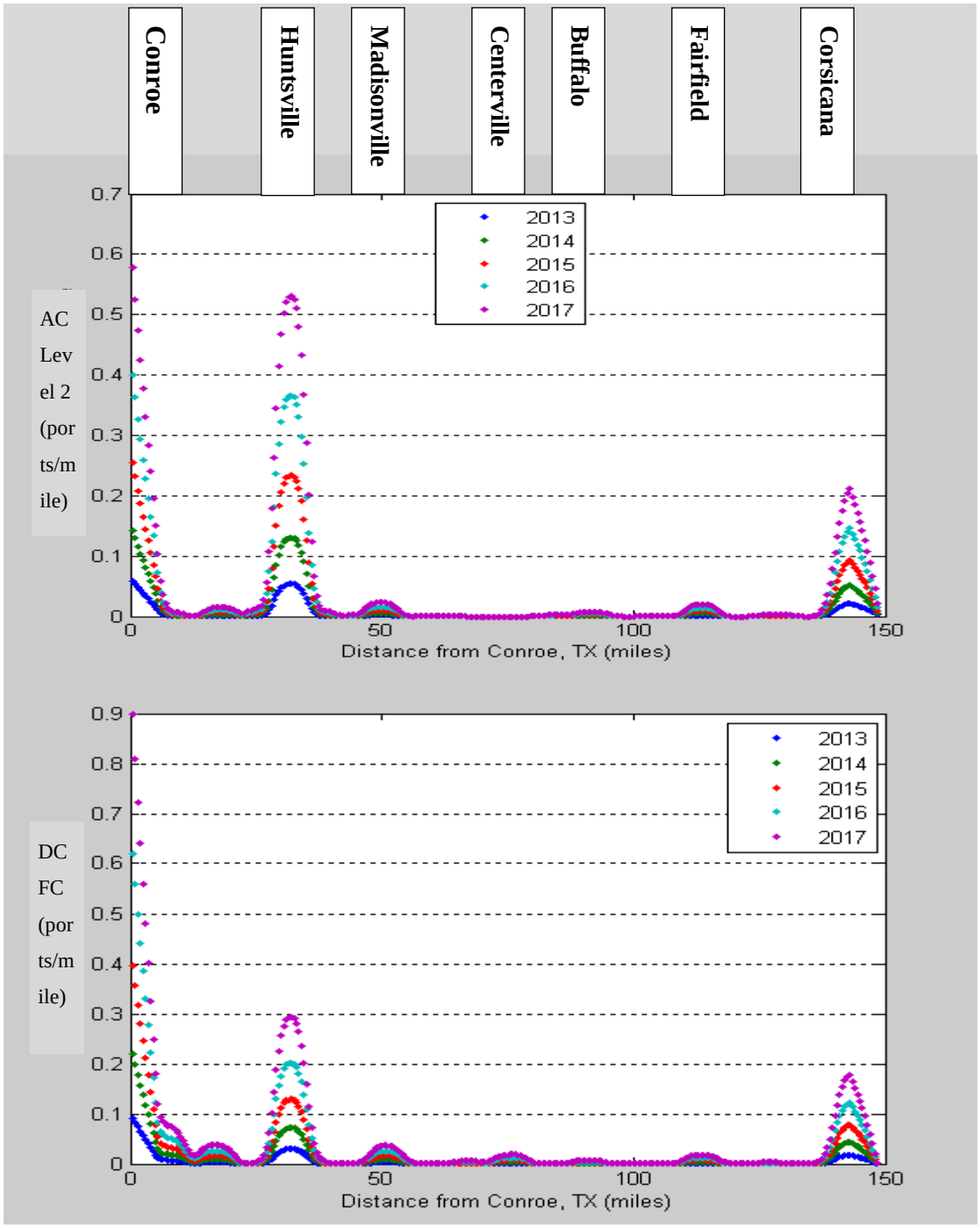


Figure 5C-1 Interstate 45 Conroe to Corsicana: Station Density due to Private Industry $s_{pjk}(x)$

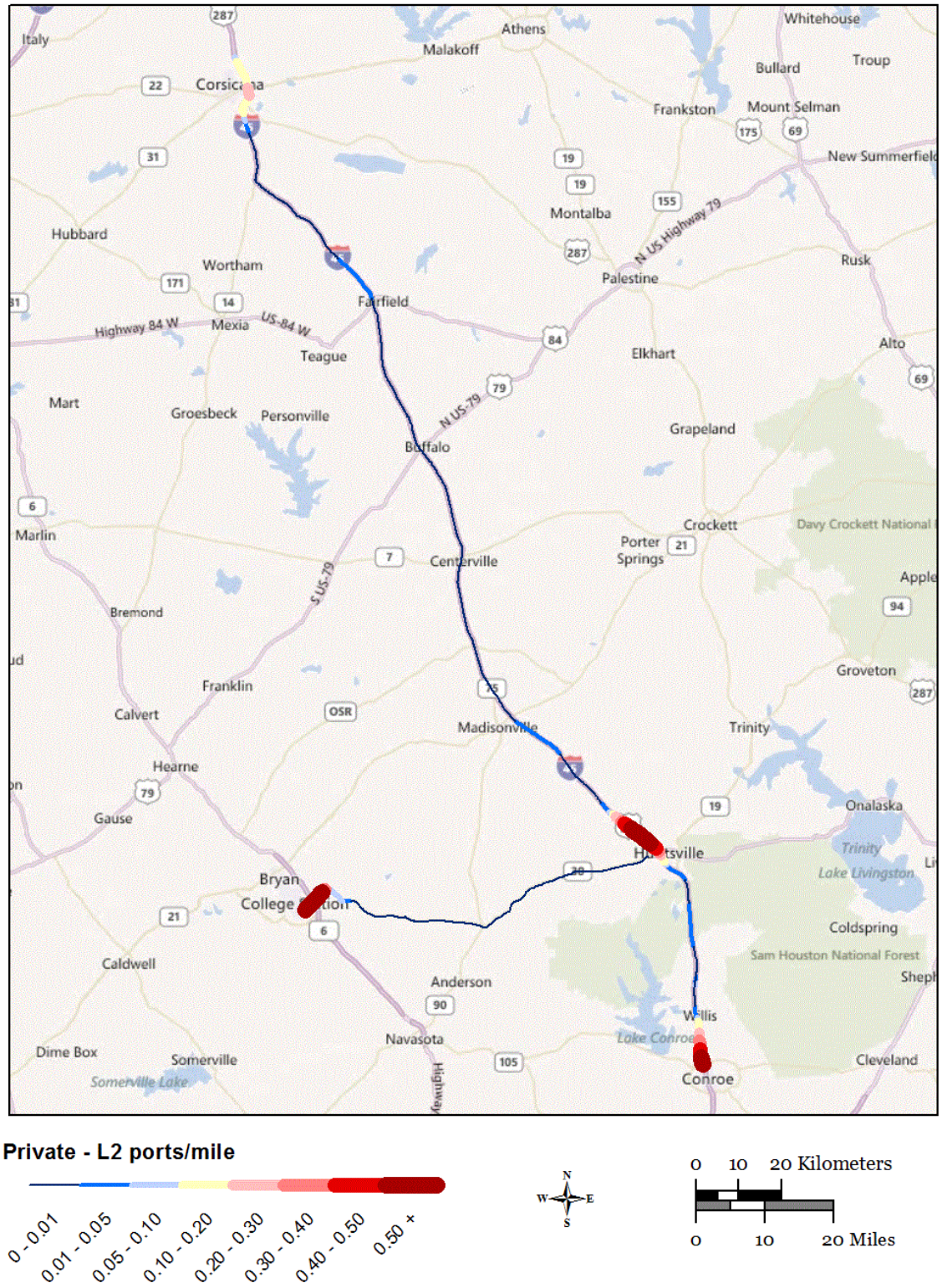


Figure 5C-2 Interstate 45, Conroe to Corsicana and State Route 30, College Station to Huntsville:

AC Level 2 Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

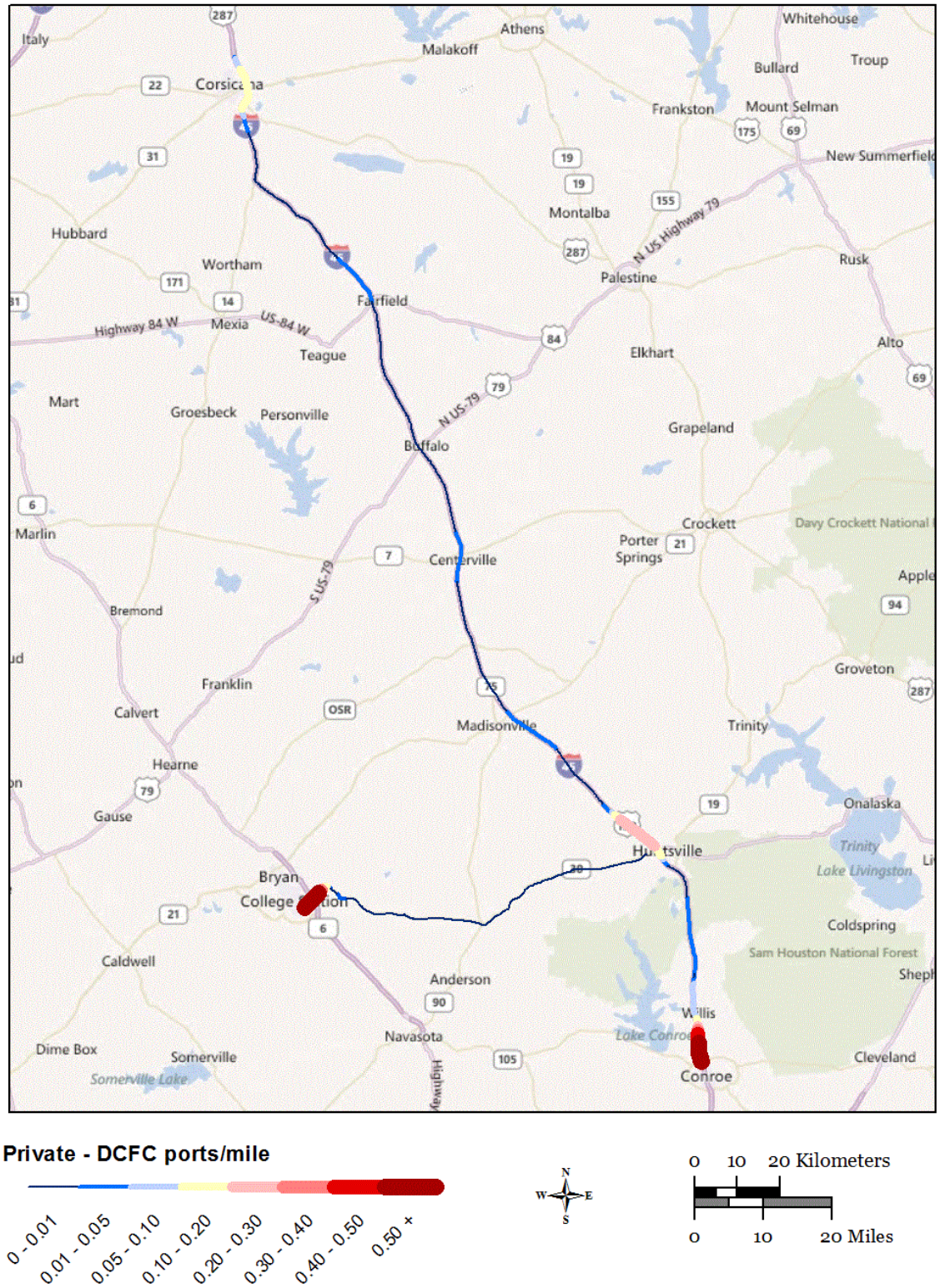


Figure 5C-3 Interstate 45, Conroe to Corsicana and State Route 30, College Station to Huntsville:

DCFC Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

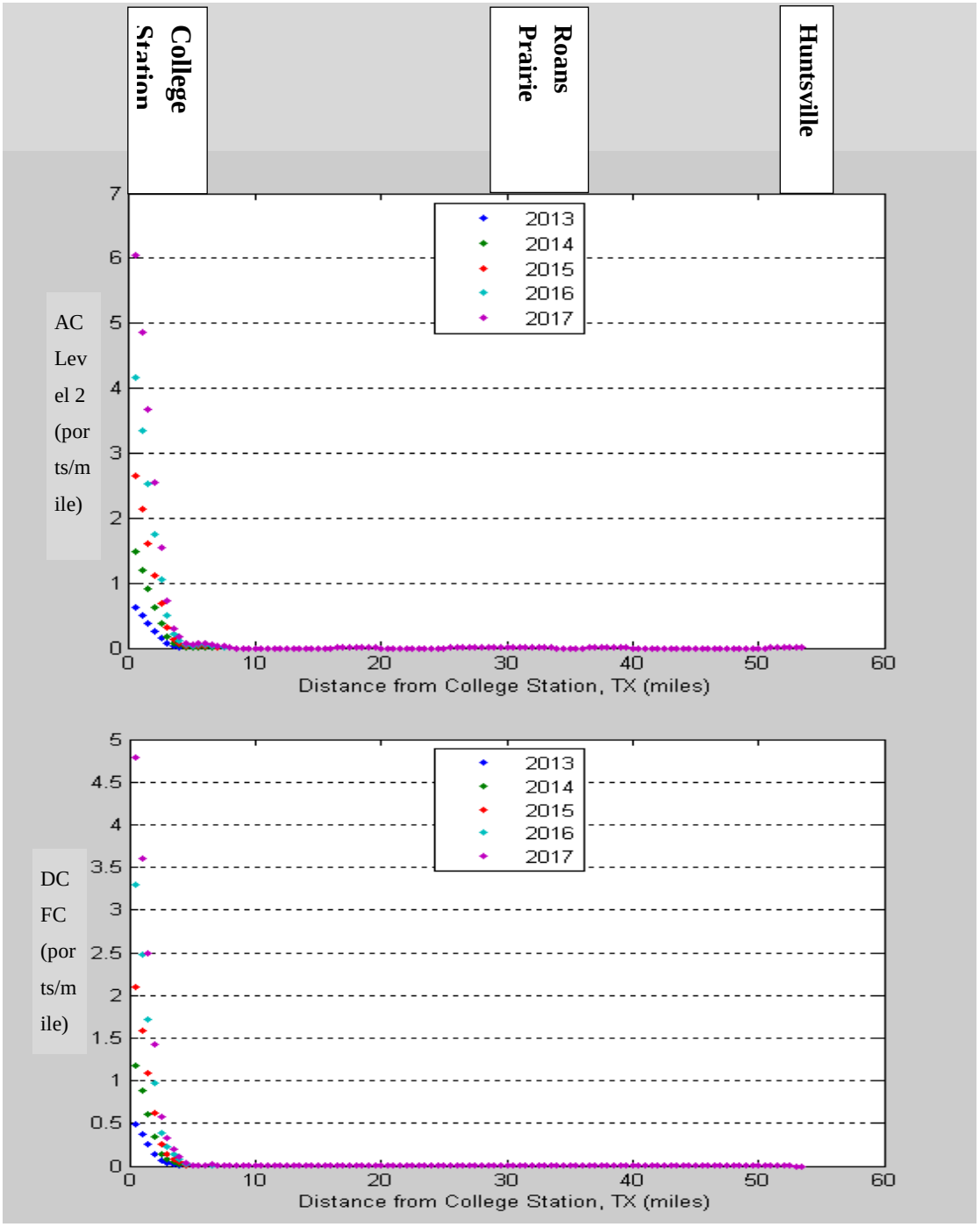


Figure 5C-4 State Route 30, College Station to Huntsville:

Station Density Due to Private Industry $s_{pjk}(x)$

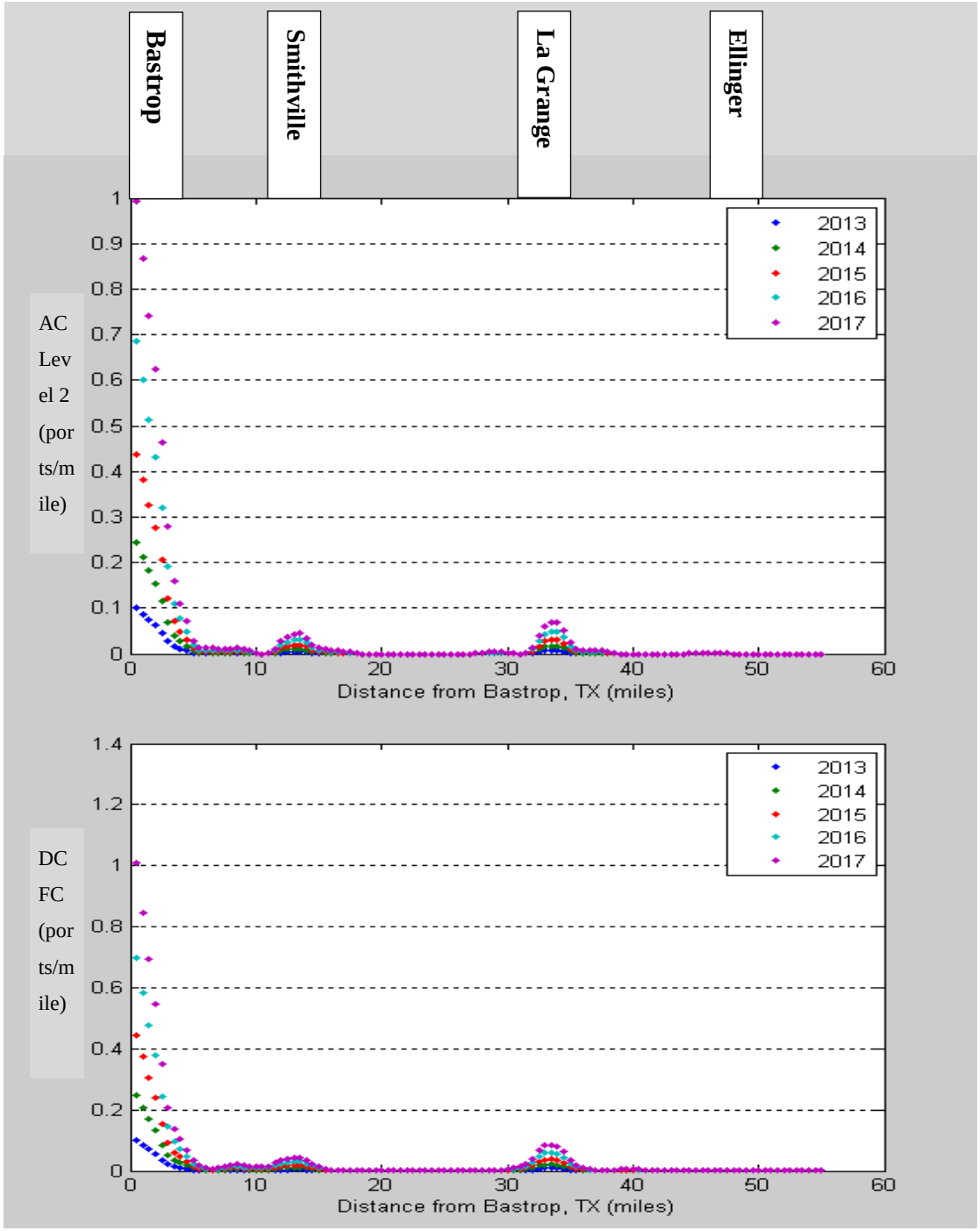


Figure 5C-5 State Route 71, Bastrop to Columbus:

Station Density Due to Private Industry $s_{pjk}(x)$

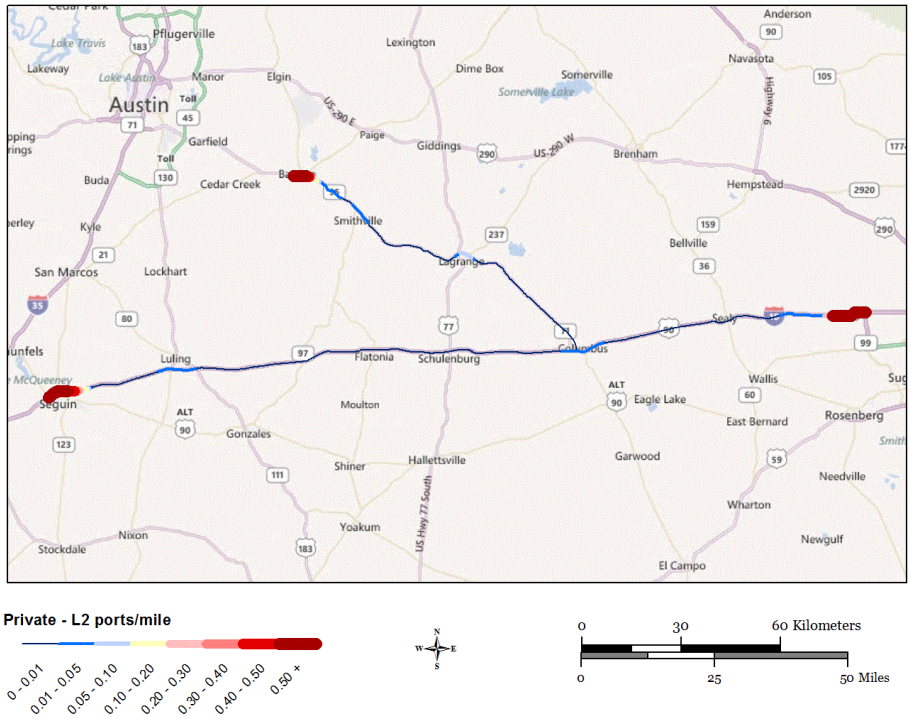


Figure 5C-6 Interstate 10, Seguin to Katy and State Route 71, Bastrop to Columbus: AC Level 2 Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

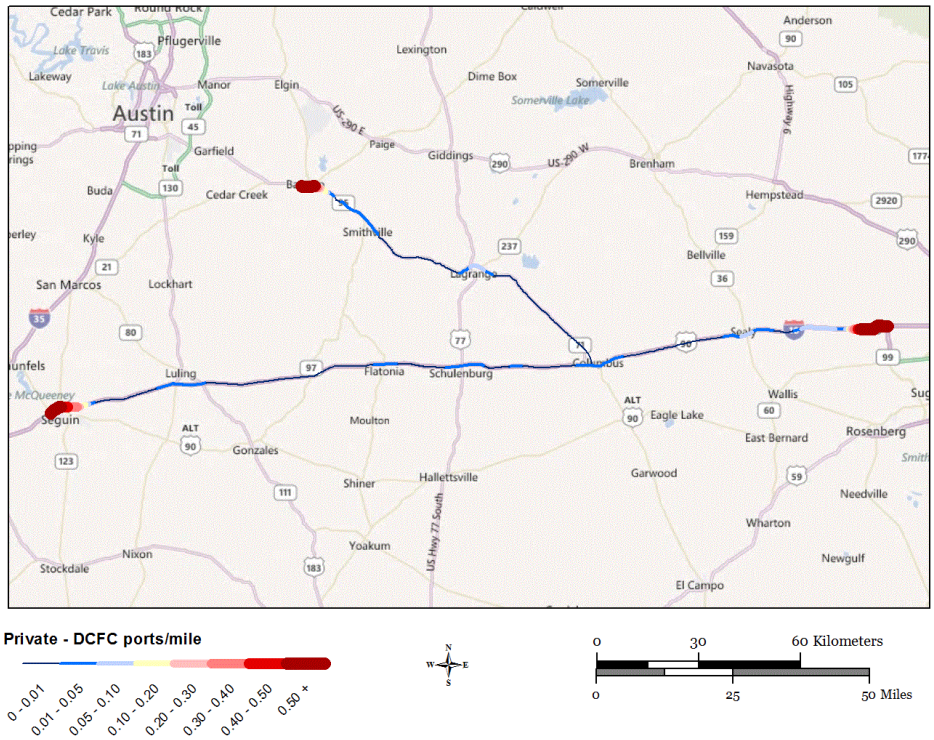


Figure 5C-7 Interstate 10, Seguin to Katy and State Route 71, Bastrop to Columbus: DCFC Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

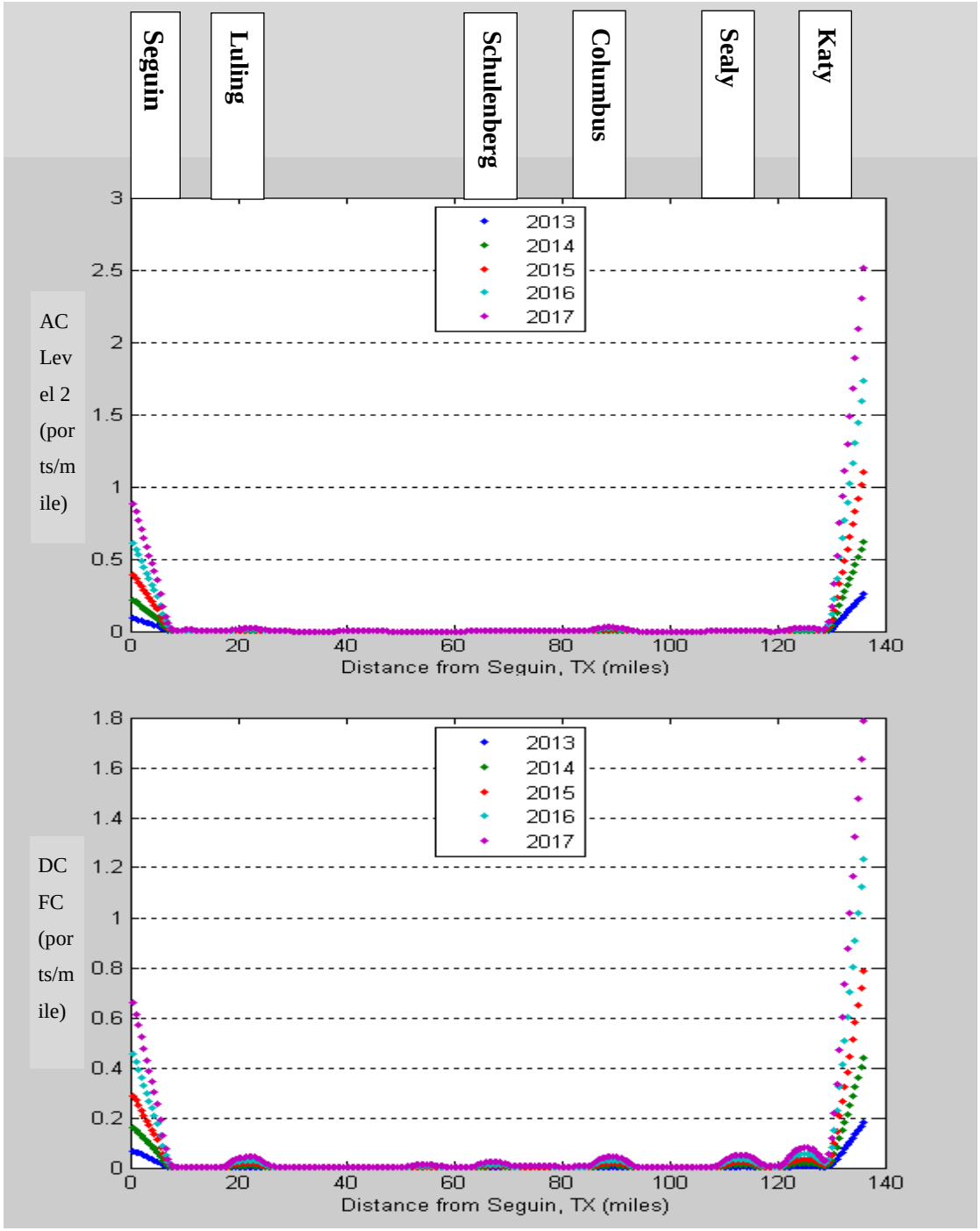


Figure 5C-8 Interstate 10, Seguin to Katy:

Station Density Due to Private Industry $s_{pjk}(x)$

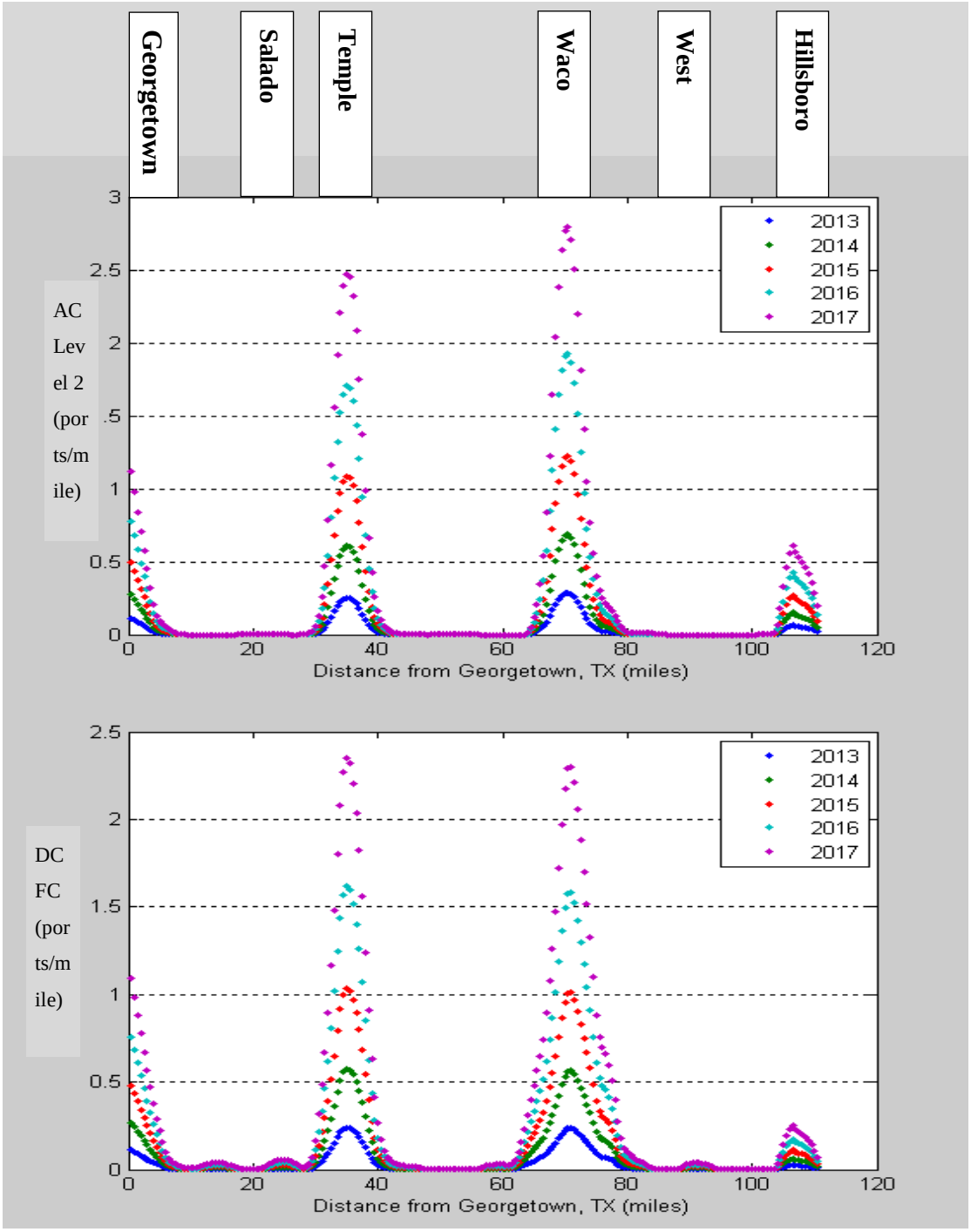


Figure 5C-9 Interstate 35, Georgetown to Hillsboro:

Station Density Due to Private Industry $s_{pjk}(x)$

Figure 5C-10 Interstate 35, Georgetown to Hillsboro:

AC Level 2 Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

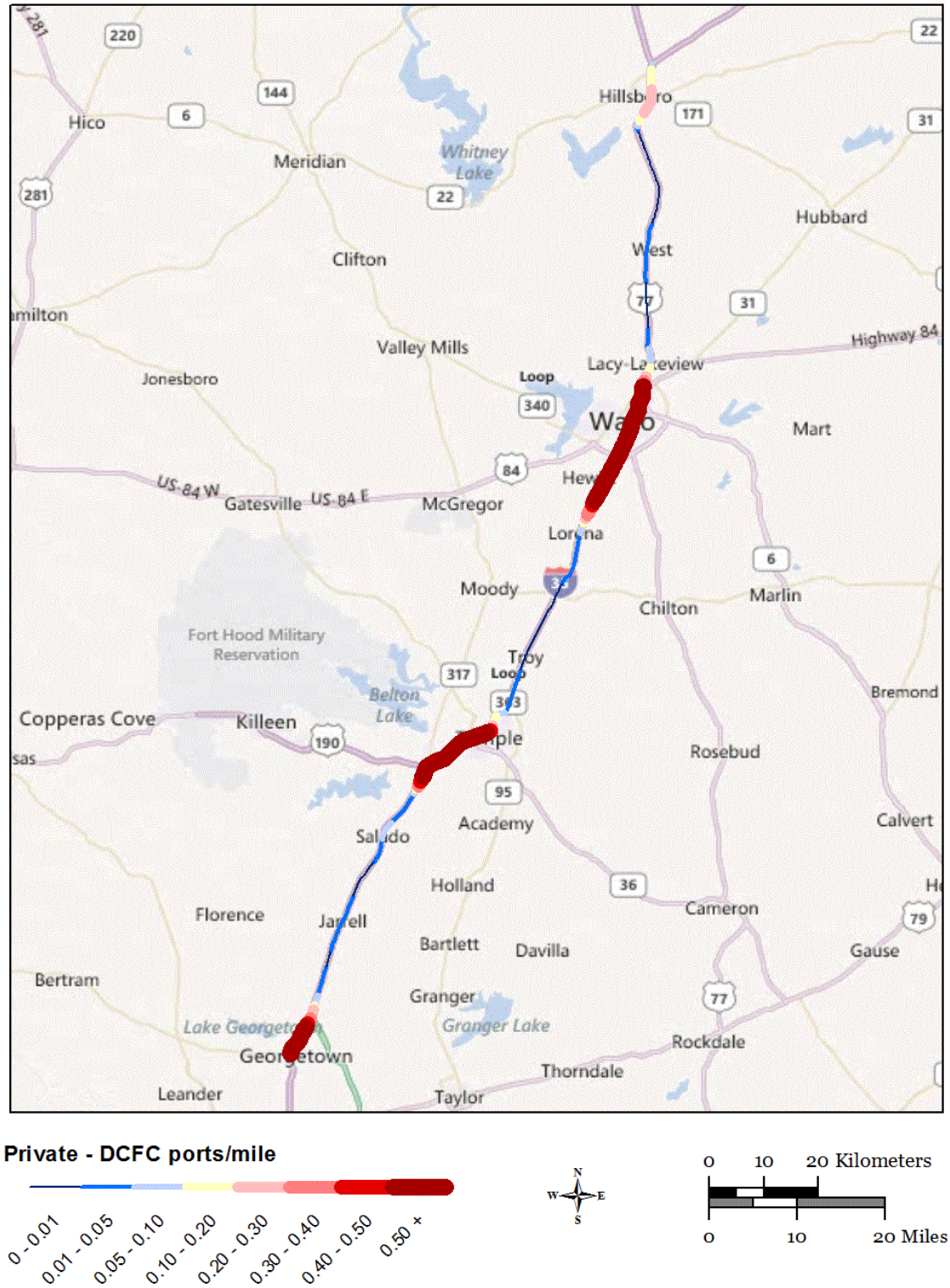


Figure 5C-11 Interstate 35, Georgetown to Hillsboro:
DCFC Station Density Due to Private Industry $s_{pjk}(x)$ in 2017

Appendix 5D Allocation of EVSE under a Publicly Funded PEV Charging Scenarios

Figure 5D-1 through Figure 5D-5 present results along all five corridors, for the scenarios described in section 5.7. As can be seen, the highest results are for I-35, whereas the lowest are for SR-30, which is in accordance with the levels of PEV traffic expected on each corridor. Each line corresponds to a different assumed value of η, as shown in the legends.

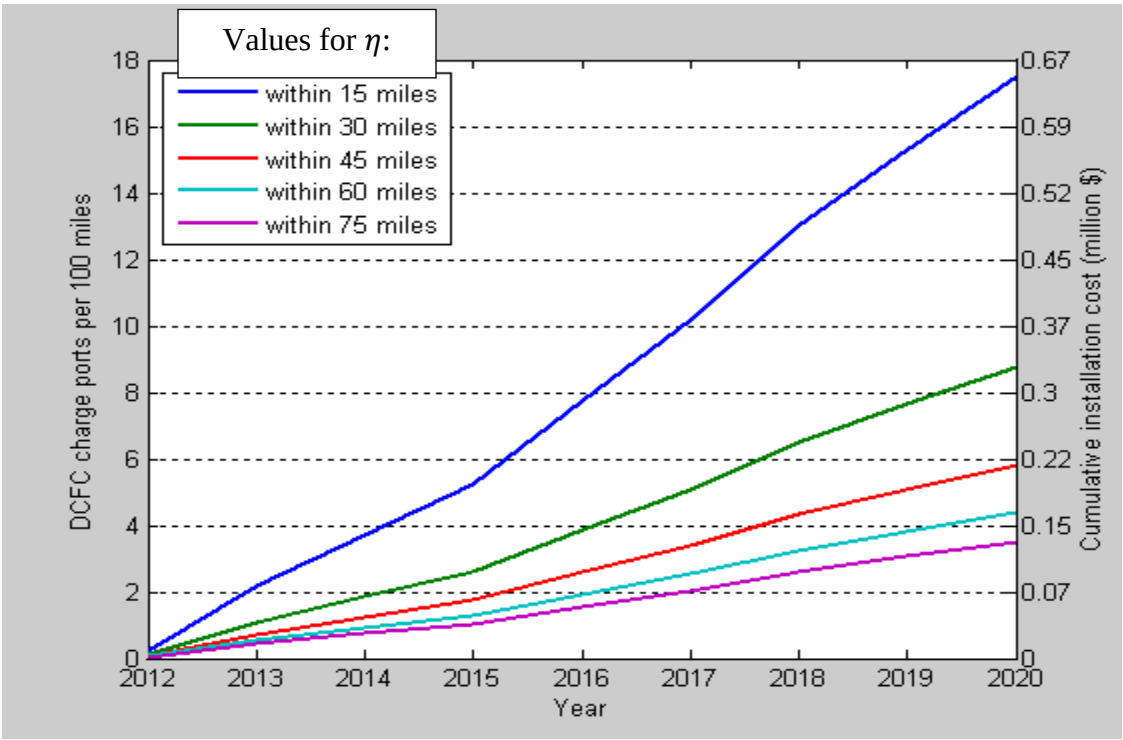


Figure 5D-1 Interstate 45, Conroe to Corsicana: Minimum Required DCFC Station Density S_{jk} and Associated Costs

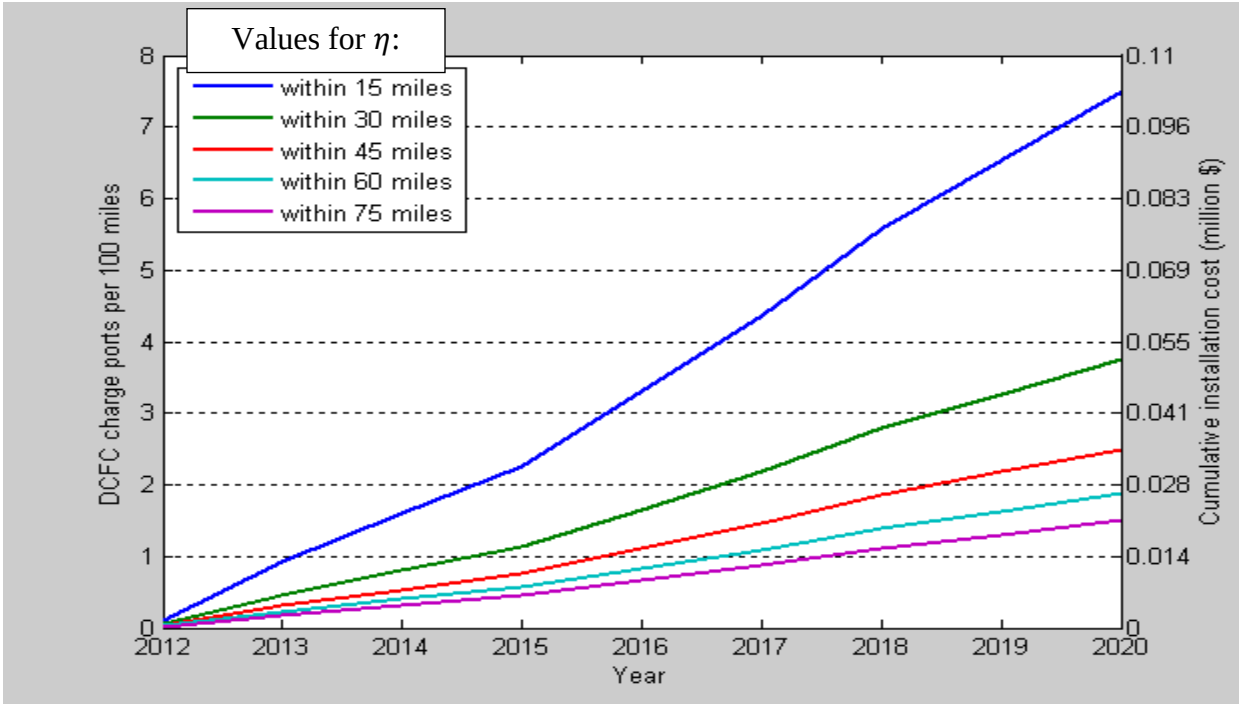


Figure 5D-2 State Route 71, Bastrop to Columbus: Minimum Required DCFC Station Density S_{jk} and Associated Costs

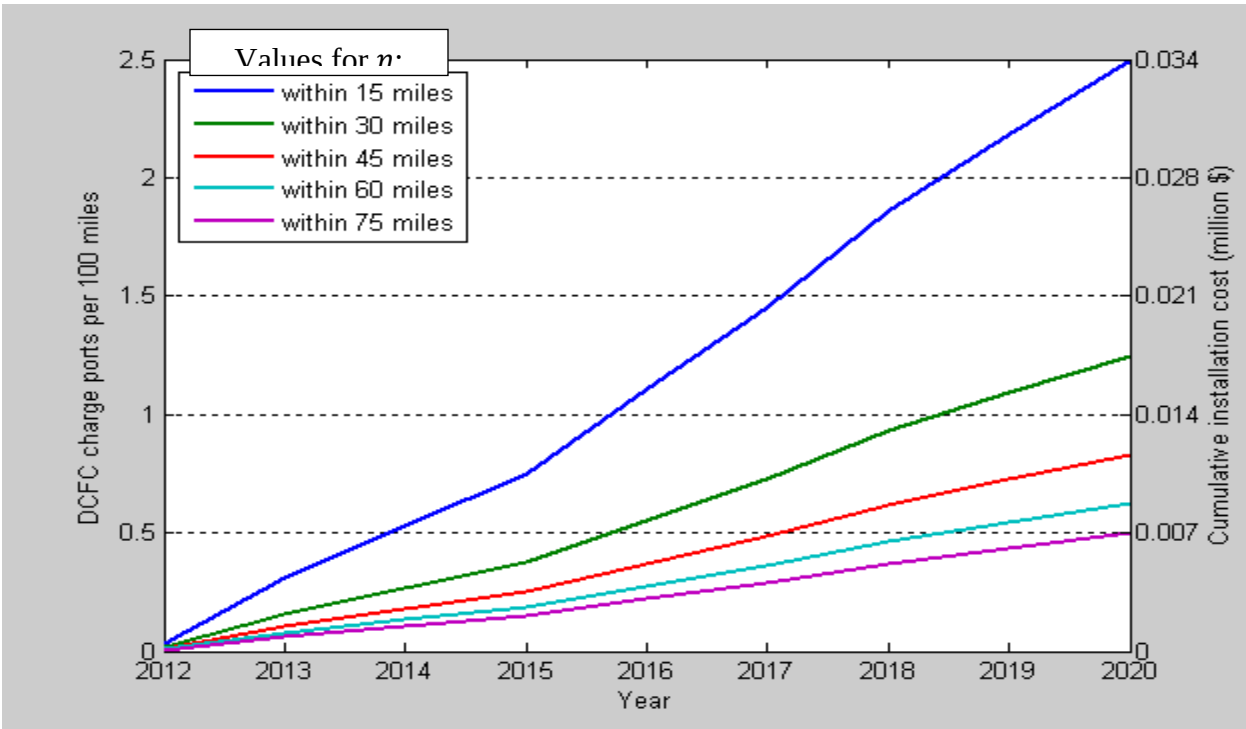


Figure 5D-3 State Route 30, College Station to Huntsville: Minimum Required DCFC Station Density S_{jk} and Associated Costs

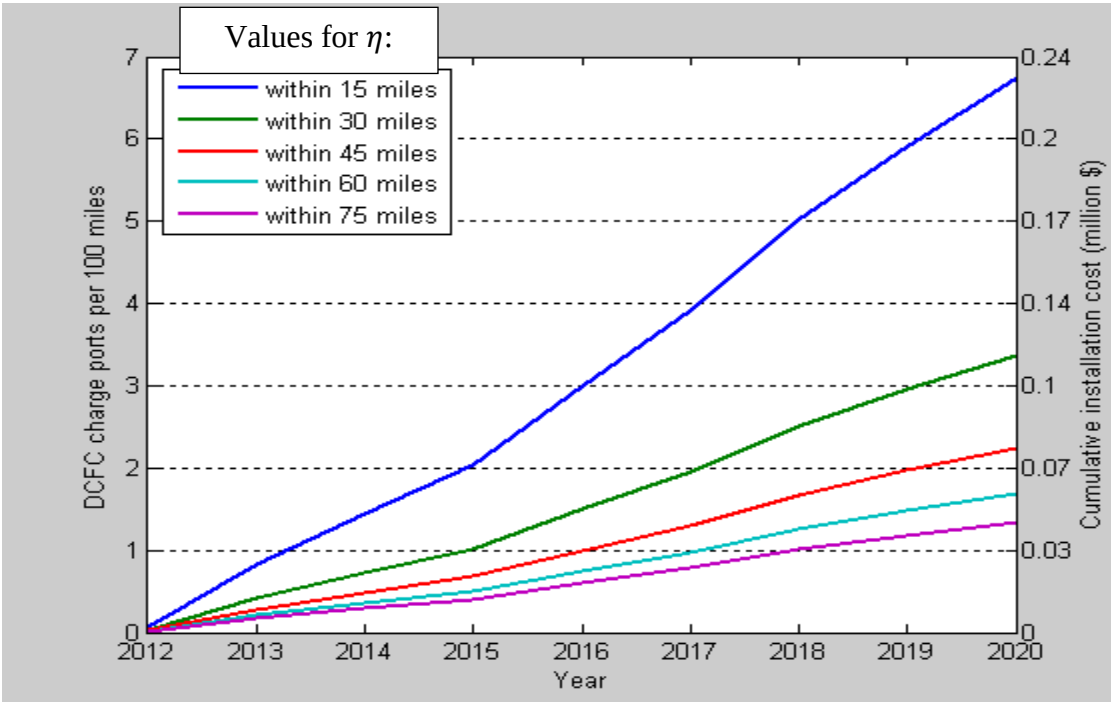


Figure 5D-4 Interstate 10, Seguin to Katy: Minimum Required DCFC Station Density S_{jk} and Associated Costs

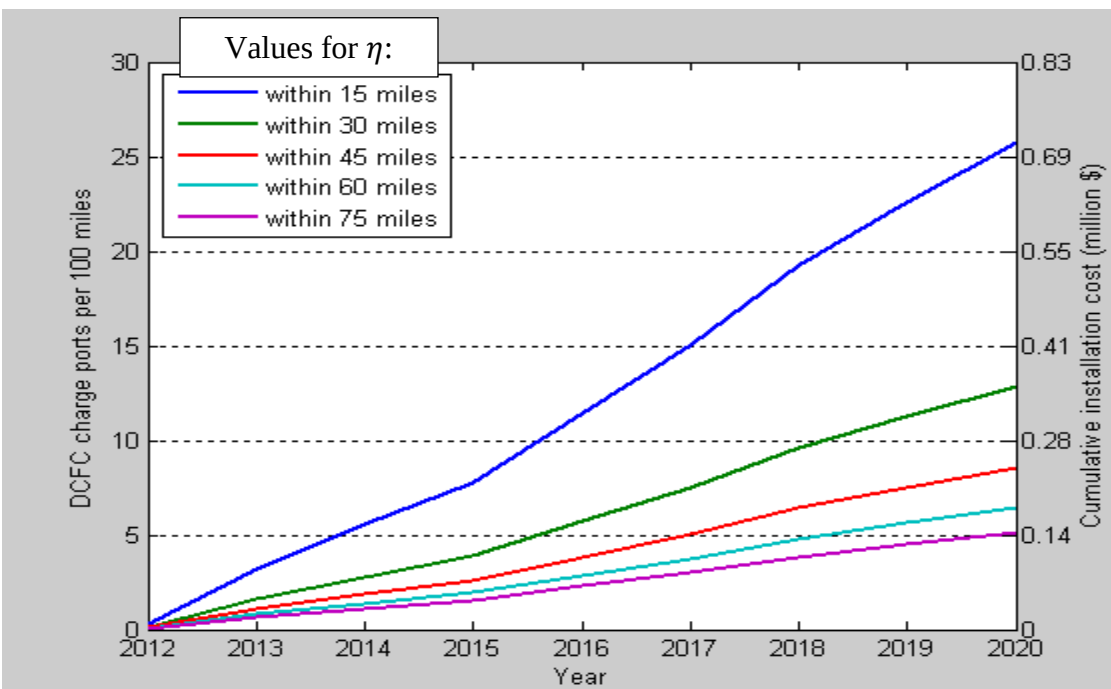


Figure 5D-5 Interstate 35, Georgetown to Hillsboro: Minimum Required DCFC Station Density S_{jk} and Associated Costs

Figure 5D-6 through Figure 5D-10 present the total number of ports that are required and associated costs, for all five corridors combined. The latter four figures also have requirements of one port per specified distance to ensure that minimum density is achieved throughout the corridors, even before demand grows to significant levels.

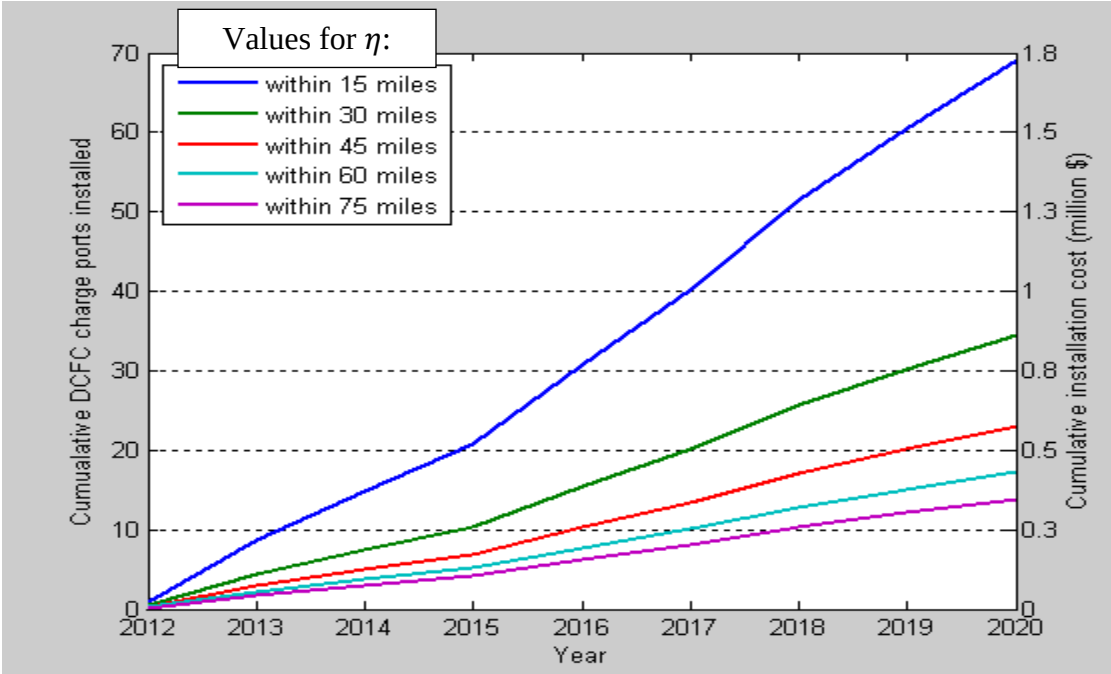


Figure 5D-6 Total installations and Costs for All Five Corridors

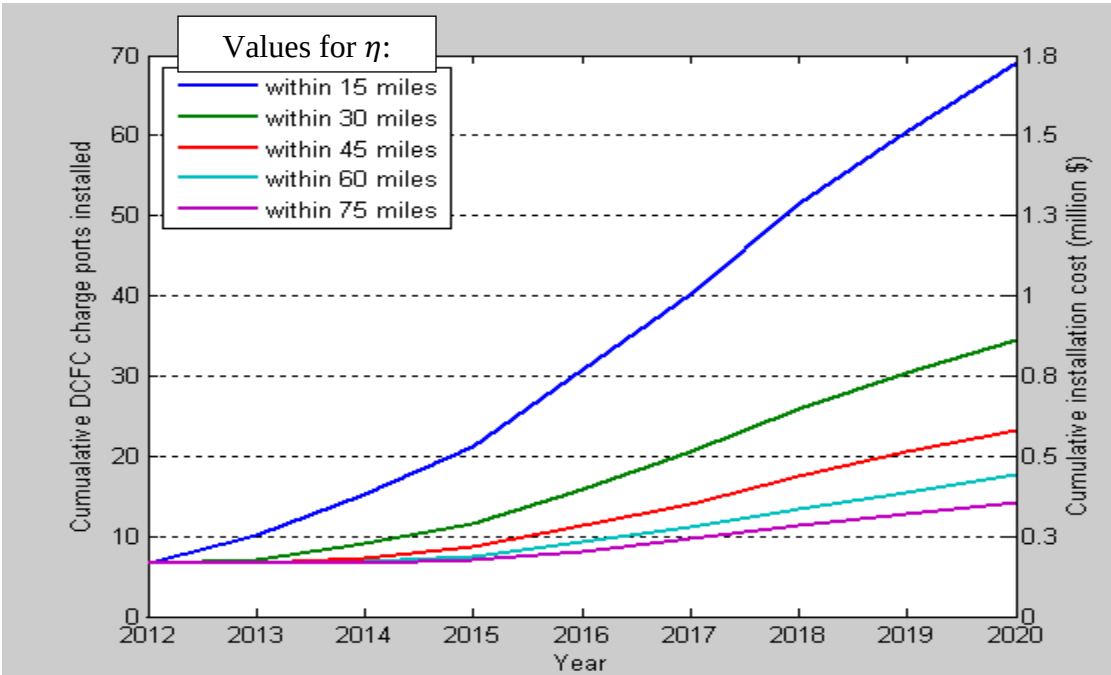


Figure 5D-7 Total Stations and Costs for All Five Corridors, with the Requirement $S_{jk} > 1\ port\ per\ 75\ miles$ at All Locations

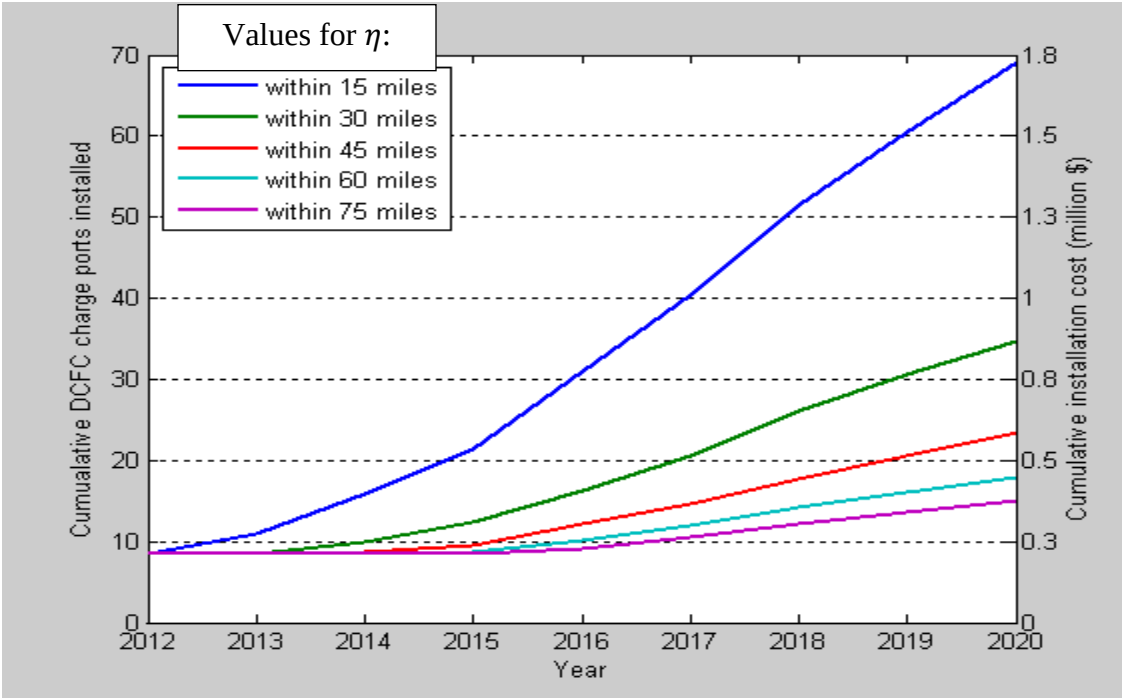


Figure 5D-8 Total Stations and Costs for All Five Corridors, with the Requirement $S_{jk} > 1\ port\ per\ 60\ miles$ at All Locations

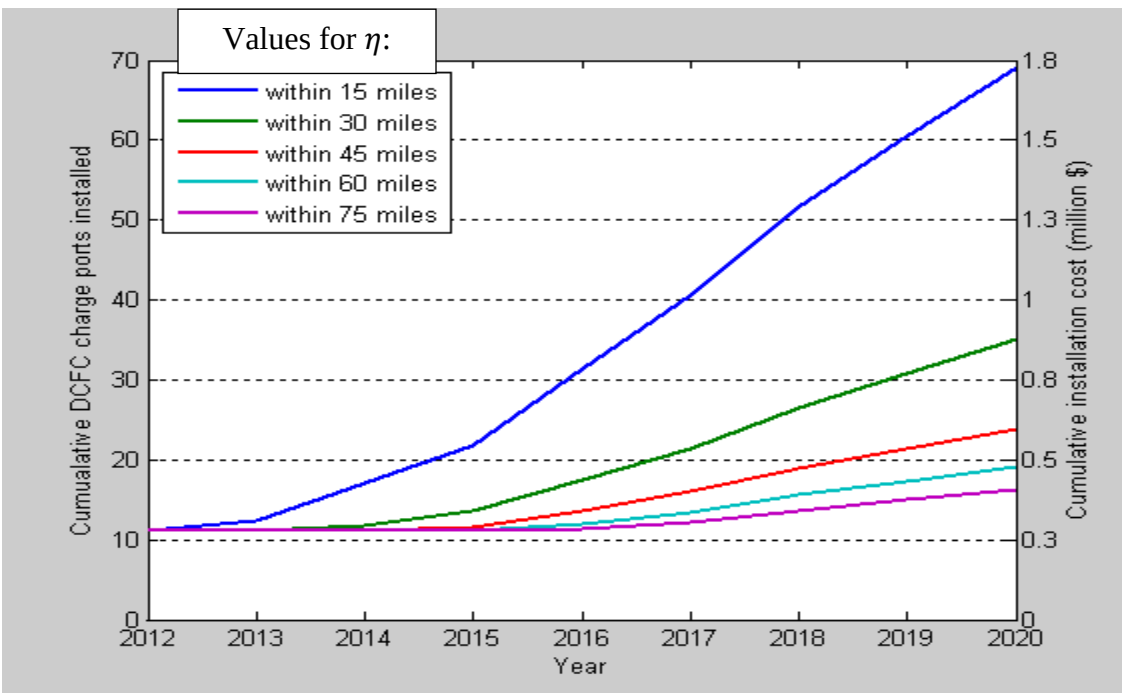


Figure 5D-9 Total Stations and Costs for All Five Corridors, with the Requirement $S_{jk} > 1\ port\ per\ 45\ miles$ at All Locations

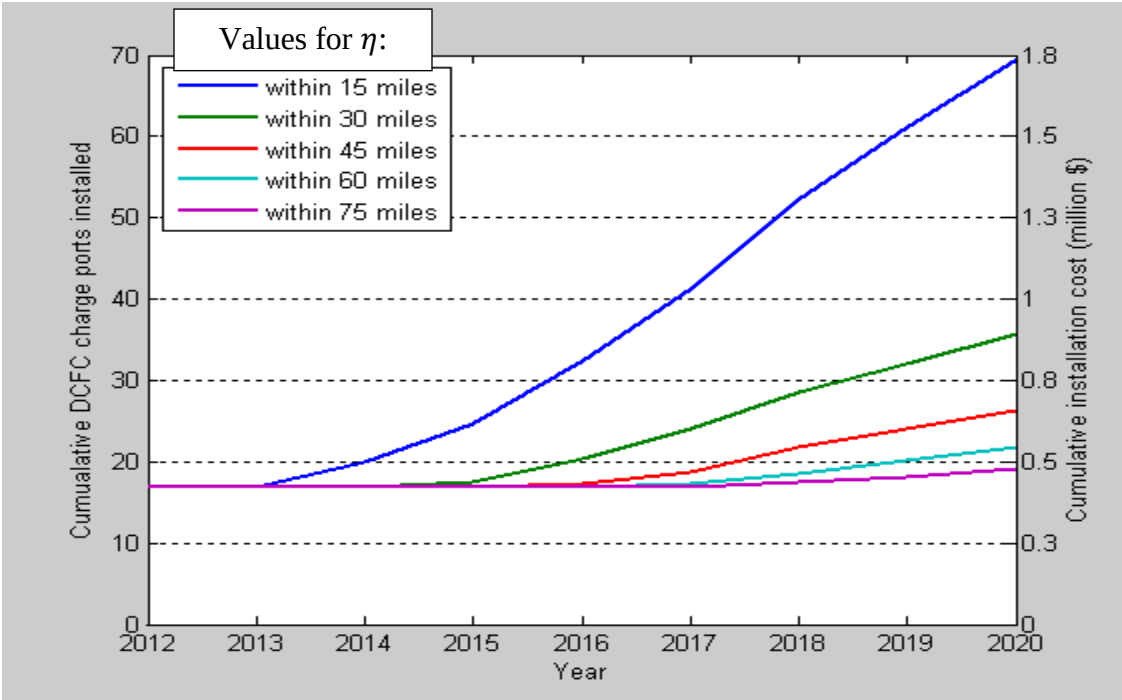


Figure 5D-10 Total Stations and Costs for All Five Corridors, with the Requirement $S_{jk} > 1\ port\ per\ 30\ miles$ at All Locations

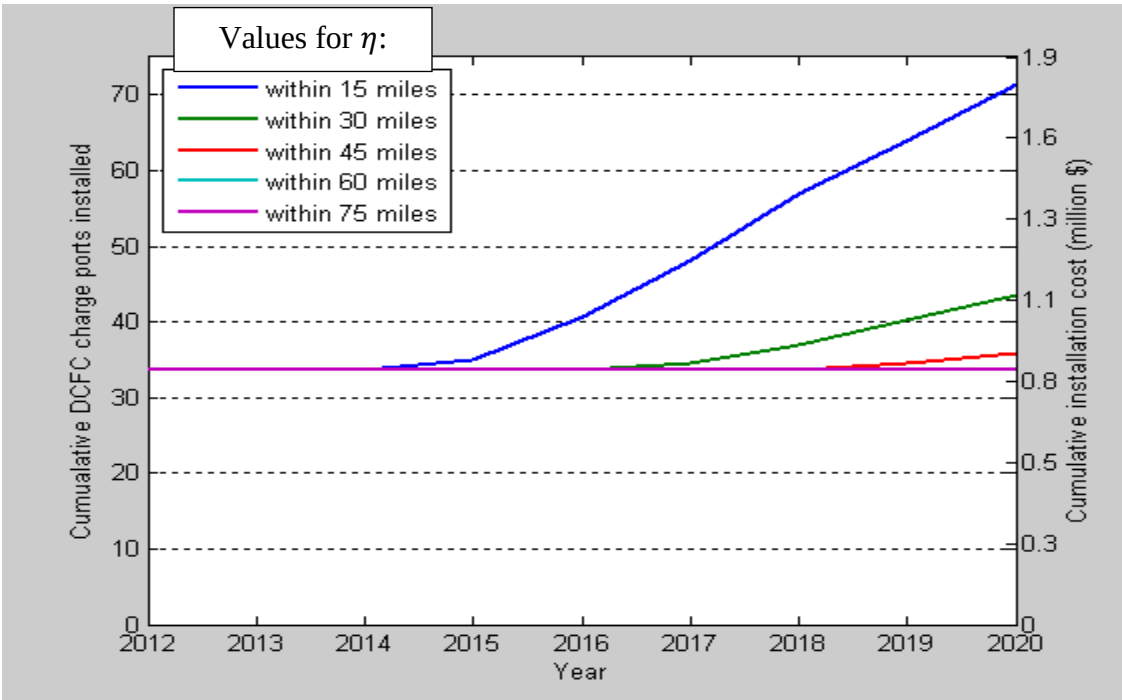


Figure 5D-11 Total Stations and Costs for All Five Corridors, with the Requirement $S_{jk} > 1\ port\ per\ 15\ miles$ at All Locations

Figure 5D-12 through 5D-20 give a more detailed view of the results for section 5.7.2.

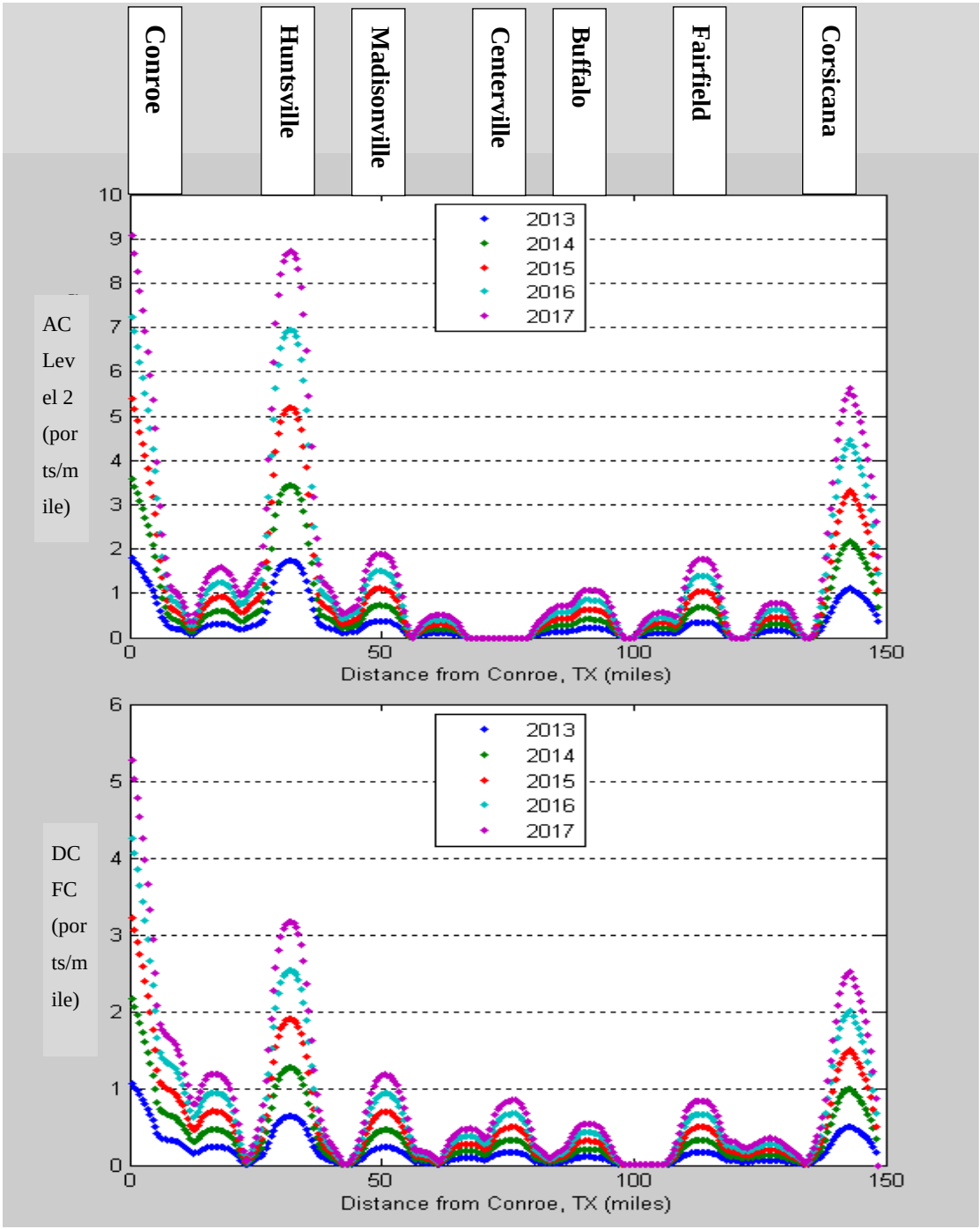


Figure 5D-12 Interstate 45, Conroe to Corsicana:

Optimal Publicly Funded Charging Station Density $s_{1jk}(x) + s_{2jk}(x)$

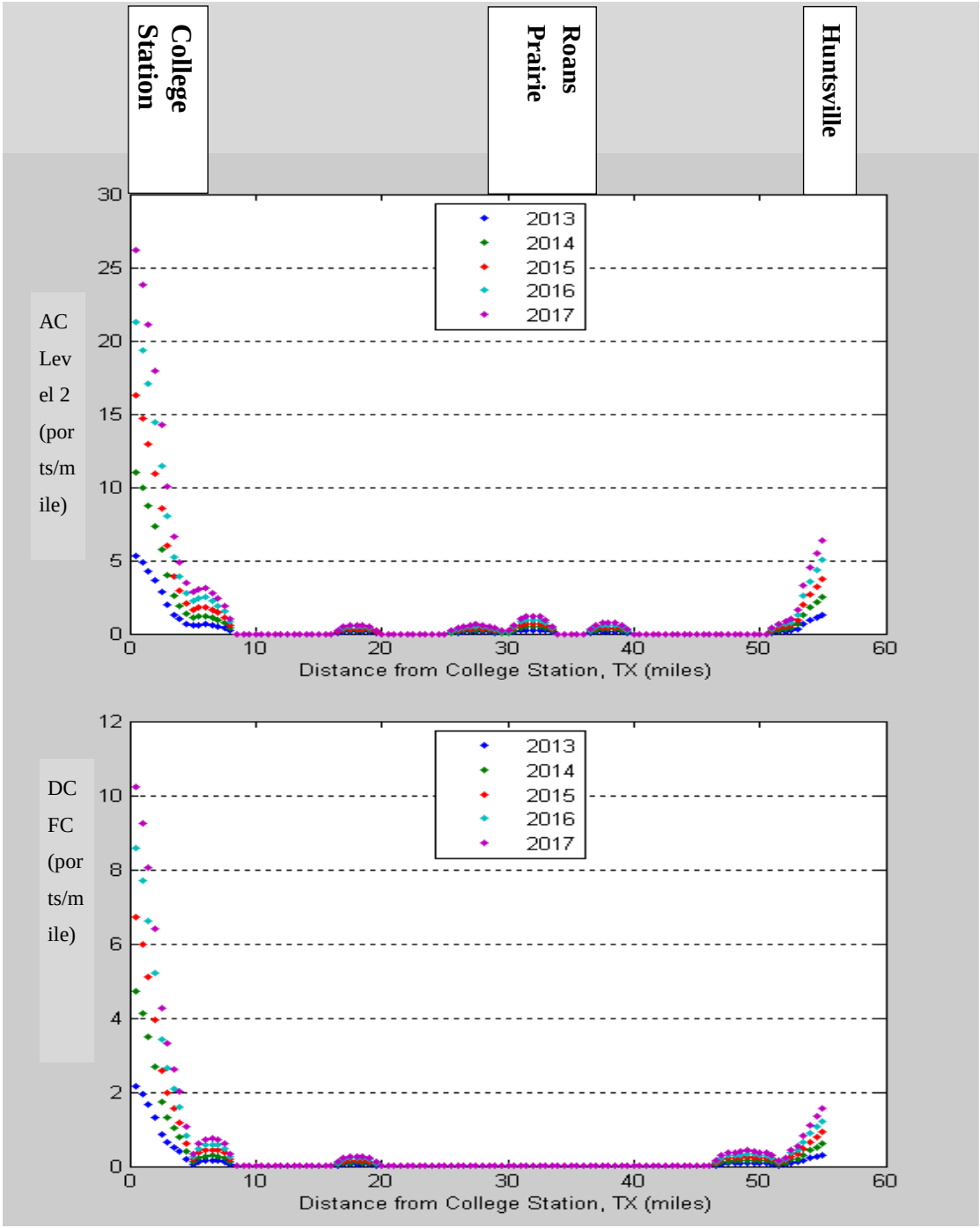


Figure 5D-13 State Route 30, College Station to Huntsville:

Optimal Publicly Funded Charging Station Density $s_{1jk}(x) + s_{2jk}(x)$

Appendix 5E Methodology and Results of an Estimation of Demand for EVSE on Texas Triangle Corridors

The estimation of the demand for PEV charging demand is addressed in this appendix. This is typically the aspect of infrastructure planning which is most difficult to predict accurately. This is especially true for a new industry such as EVSE, for which there is limited historic data available, and cause and effect relationships between explanatory and dependent behavioral variables have not yet been comprehensively analyzed. In addition, significant question marks have been raised regarding the application of standard demand modeling techniques to new infrastructure problems.[XL] Therefore, in this report, rather than utilizing models as a starting point, the available data is first examined to determine the most useful procedure for demand estimation. There are four types of data available for predicting demand at locations along the highway corridors in the Texas Triangle. These are 1) traffic, 2) vehicle registrations, 3) population, and 4) trip attraction sites. The remainder of this appendix provides a discussion on how these data are combined to estimate demand for this report.

First, traffic and registration data are considered. The traffic data, made available by the Texas Department of Transportation, are total annual average daily traffic (AADT), and the fraction of total AADT made up by light duty vehicles (LDVs).[XLI,XLII] Registration data has been used to project the number of PEVs that will be in each metropolitan area in the Texas Triangle during the time leading to the completion of the Obama administration's Target of one million electric vehicles in the U.S.[XLIII] For the analysis of sections 5.5 and 5.7 the Target is assumed to be reached in 2017 in accordance with the middle projection in in a previous study.[XLIV] The growth of PEV market penetration in the U.S. in this analysis is assumed to follow a piecewise linear curve, which gives values for the rate of increase $\partial q(\tau_l)/\partial t$ in the fraction of the Target that is met during each period indexed by l .The projection information is combined with aggregate vehicle ownership data[XLV] and projected population growth data to estimate the fraction of LDVs that are PEVs in each metropolitan area over time. This provides values for $q_{Gk}(x,t)$, the fraction of LDVs that are PEVs when the Target is met, and for $q(t)$, the fraction of the Target that is met by time t. In turn, these four pieces of information provide projections for PEV traffic along the Texas Triangle highway corridors. This can be represented analytically through Eq. 5E.1 and Eq. 5E.2.

$$q(\tau_m) = \sum_{l=1}^{m} \left[\frac{\partial q(\tau_l)}{\partial t} [\tau_l - \tau_{l-1}] \right] + q(x,0) \qquad \text{Eq. 5E.1}$$

$$Q_{Ek}(x,t) = q(t) q_{Gk}(x,t) Q_{EGk}(x,t) \qquad \text{Eq. 5E.2}$$

$q(t)$ is the fraction of the Target that is met by time t

$q_{Gk}(x,t)$ is the fraction of LDVs that are PEVs when the Target is met

$Q_{Ek}(x,t)$ is the PEV traffic volume on the corridor (vehicles/(day × mile))
$Q_{EGk}(x,t)$ is the LDV volume when the Target is met (vehicles/(day × mile))

The third data type available is the population surrounding the highway corridors. In particular, the population within 10 miles (16 kilometers (km)) of each relevant highway is accounted for, based on census data.[XLVI] The population data for a given census tract is assumed to be uniformly distributed within the tract, for purposes of matching the data with a relevant highway segment, to obtain the population along a corridor $Q_{Lk}(x,t)$. Note that total population is used, instead of population disaggregated by socioeconomic factors which generally affect demand, such as education and income level. This is because population with these characteristics is highly correlated with total population density along the corridors.

The fourth type of data available is trip attraction sites, at which drivers have some activity or reason to visit while their vehicle is charging. Attraction points include stores, restaurants, highway rest areas, and other points of interest such as museums. The number of trip attraction points within 3 miles (4.8 km) of the highway corridor is represented by $Q_{Sjk}(x)$. Each attraction site is weighted the same regardless of the size or customer throughput. This is due to the lack of exact data with this information. Below is a list of all attraction sites types accounted for.

AC Level 2 Site Types:

Malls
Outlet Centers
Tourists Sites
Museums
Stadiums
Libraries
Universities
Rest Areas

DCFC Site Types:

Restaurants
Gas Stations
Truck Stops
Stores
Rest Areas

Next, PEV traffic projections, population and traffic are combined to develop formulas for the estimation of charging demand due to local population and due to intercity travel along the corridors. The formula for demand due to intercity travel $v_{Tjk}(x,t)$ is shown in Eq. 5E.3, and the formula for demand due to local population $v_{Ljk}(x,t)$ is shown in Eq. 5E.4. As can be seen, there are two terms in each formula. One is a function of PEV traffic or population, and the other which is a function of either PEV traffic or population, along with the number of attraction sites. This approach is taken since charging demand is expected to be a function of the amount of passing traffic and local population (drivers willing to charge regardless of available activities), and also a function of how many attraction points are available (drivers wanting to charge

specifically where activities are available). $v_{Tjk}(x,t)$ and $v_{Ljk}(x,t)$ are then applied to estimate total demand in Eq. 5E.5. However, as previously mentioned, due to the lack of previous analyses of charging demand, and data limitations, there are obvious uncertainties in demand estimation. Nevertheless, parameters are included, for which values can be shifted to assess the optimal solution under assumptions about the influence of the various explanatory variables.

$$v_{Tjk}(x,t) = Q_{Ek}(x,t)\left[g_{Tj} + h_{Tjk}Q_{Sjk}(x)\right] \quad \text{Eq. 5E.3}$$

$$v_{Ljk}(x,t) = Q_{Lk}(x,t)\left[g_{Lj}(t) + h_{Lj}(t)Q_{Sjk}(x)\right] \quad \text{Eq. 5E.4}$$

$$v_{jk}(x,t) = \left[v_{Tjk}(x,t) + v_{Ljk}(x,t)\right] \quad \text{Eq. 5E.5}$$

$v_{Tjk}(x)$ is the demand for charging due to traffic (charge-hr/mile)

$v_{Ljk}(x)$ is the demand for charging due to local population (charge-hr/mile)

$Q_{Lk}(x,t)$ is the local population (persons/mile)

$Q_{Sjk}(x)$ is the attraction density (sites/mile)

$g_{Tj} > 0$ is a demand parameter (charge-hr/(vehicle × mile))

$g_{Lj}(t) > 0$ is a demand parameter (charge-hr/population)

$h_{Tjk} > 0$ are parameters (charge-hr/(attraction site × vehicles × mile))

$h_{Lj}(t) > 0$ are parameters (charge-hr/(attraction site × population))

The parameters are estimated by using Eq. 5E.6 through Eq. 5E.9. Example parameter values used in this report are shown in Table 5E-1. g_{Lj} is shown for Interstate 45, Conroe to Corsicana in 2017.

$$g_{Tj} = T_{Cj}\sigma_{aTj}\sigma_{bj}\sigma_{cj}/\rho_T \quad \text{Eq. 5E.6}$$

$$h_{Tjk} = T_{Cj}[1-\sigma_{aTj}]\sigma_{bj}\sigma_{cj}/\left[\alpha_{jk}[\rho_T]^2\right] \quad \text{Eq. 5E.7}$$

$$g_{Lj}(t) = T_{Cj}\sigma_{aLj}\sigma_{bj}\sigma_{cj}\sigma_{dj}\sigma_{pj} \quad \text{Eq. 5E.8}$$

$$h_{Lj}(t) = T_{Cj}[1-\sigma_{aLj}]\sigma_{bj}\sigma_{cj}\sigma_{sj}\sigma_{pj}[2\rho_L] \quad \text{Eq. 5E.9}$$

T_{Cj} is the duration of a charge event (hours)

σ_{aTj} is the fraction of corridor PEV drivers that do not require an attraction site when using a charge station

σ_{aLj} is the fraction of local PEV drivers that do not require an attraction site when using a charge station

σ_{bj} is the fraction of PEV drivers that use public chargers (versus those who do not due to having a PHEV for example)

σ_{cj} is the fraction of PEV drivers that use station type j versus other types

σ_{dj} is the fraction of days that a local PEV driver charges

σ_{sj} is the fraction of days that a local PEV driver charges per site

σ_{pj} is the fraction of the local population that drives a PEV

ρ_T is the typical driving range of a PEV

α_{jk} is the average number of attraction points per mile along the relevant corridor

ρ_L distance traveled by local population without using the highway corridor

Table 5E-1 – Example Values for Demand Parameters

	g_{Tj} (charge-hr/ [vehicles×miles])	h_{Tj} (charge-hr/ [sites×vehicles×miles])	$g_{Ljk}(2017)$ (charge-hr/ [population])	$h_{Lj}(2017)$ (charge-hr/ [sites×population])	T_{Cj} (hours)
AC Level 2	0	2.7×10^{-5}	0	1.0×10^{-6}	4.0
DC Level 2	2.5×10^{-9}	1.6×10^{-5}	5.4×10^{-12}	9.5×10^{-7}	.42

	σ_{aTj}	σ_{aLj}	σ_{bj}	σ_{cj}	σ_{dj}	σ_{sj}	σ_{pj}	ρ_T (miles)	ρ_L (miles)
AC Level 2	0	0	.50	.10	0	.01	10^{-4}	75	2.5
DC Level 2	10^{-6}	10^{-6}	.50	.90	.29	.01	10^{-4}	75	2.5

Next, maps with data used in the estimation of demand are presented. These data are utilized to obtain results in both Sections 5.5 and 5.7. Since many different data sources are utilized, the focus is on the three types of data that are inputs to the demand formulas in this appendix, mainly traffic, candidate sites, and population.

Figure 5E-1 through 5E-3 present maps with average annual daily two-way PEV traffic in 2015 when the Obama administration's one million vehicle Target is assumed to be reached, in accordance with the projection methods previously described. In addition, these figures present population density data from the 2010 census, as previously mentioned. Similarly, Figure 5E-4 through 5E-6 present maps with AC Level 2 candidate sites, and Figure 5E-7 through 5E-9 present maps with DCFC candidate sites. Figure 5E-10 is a map focused specifically on Texas Safety Rest Areas. As can be seen, there are 5 Safety Rest Areas in the corridors considered in this report.

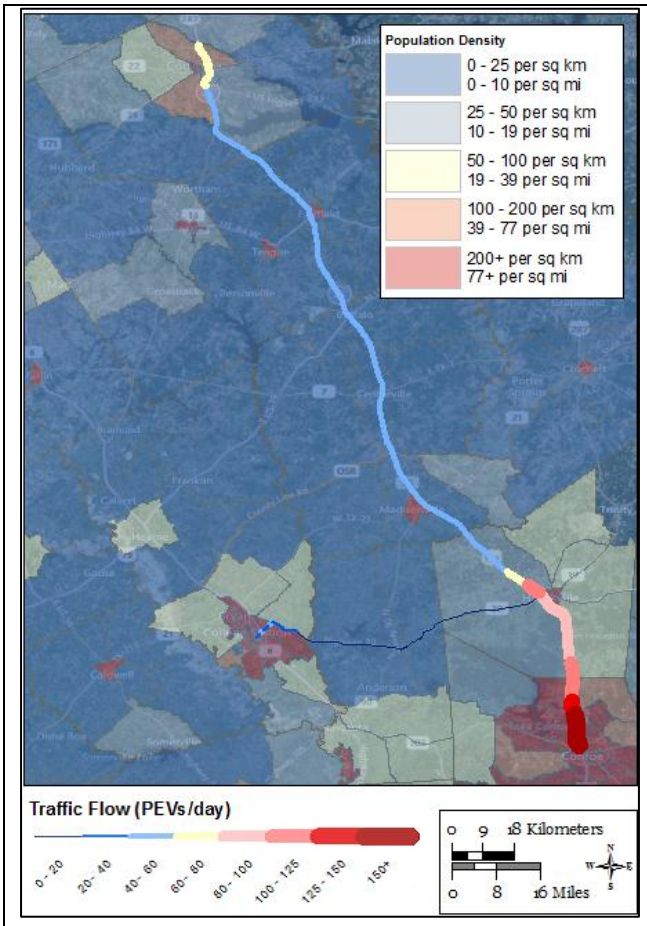


Figure 5E-1 Interstate 45, Conroe to Corsicana and State Route 30, College Station to Huntsville: Population Density in 2010 and Projected Average Annual Daily Two Way PEV Traffic in 2015, Assuming the One Million PEV Target for the U.S is Met in 2015

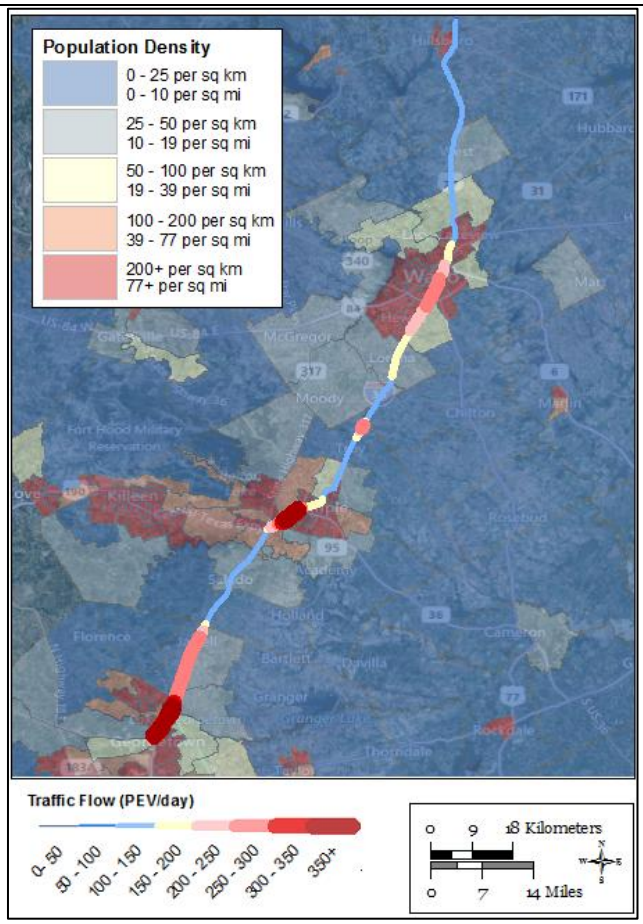


Figure 5E-2 Interstate 35, Georgetown to Hillsboro: Population Density in 2010 and Projected Average Annual Daily Two Way PEV Traffic in 2015, Assuming the 1 Million Target for the U.S is met in 2015

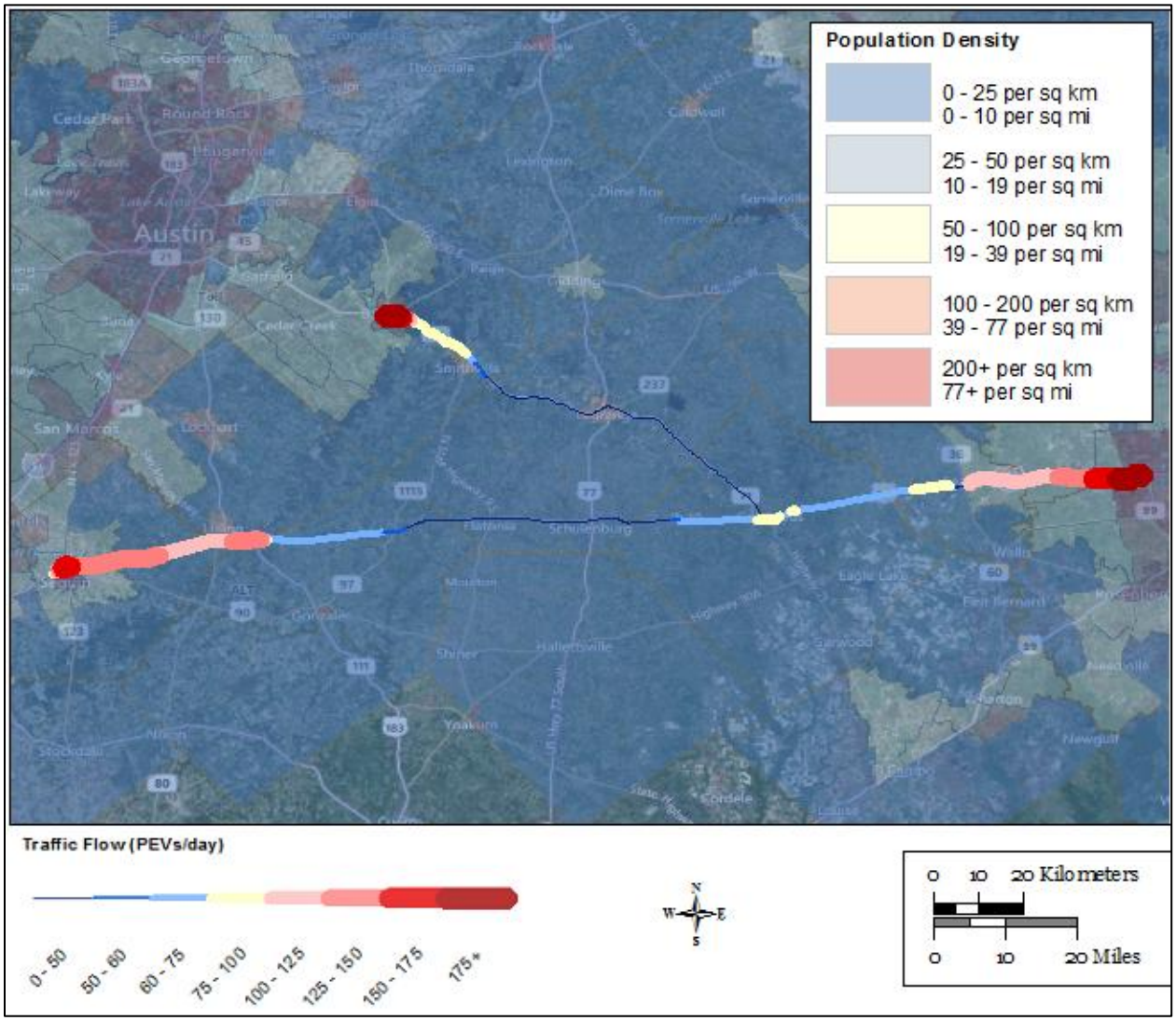


Figure 5E-3 Interstate 10, Seguin to Katy and State Route 71, Bastrop to Columbus: Population Density in 2010 and Projected Average Annual Daily Two Way PEV Traffic in 2015, Assuming the 1 Million PEV Target for the U.S is Met in 2015

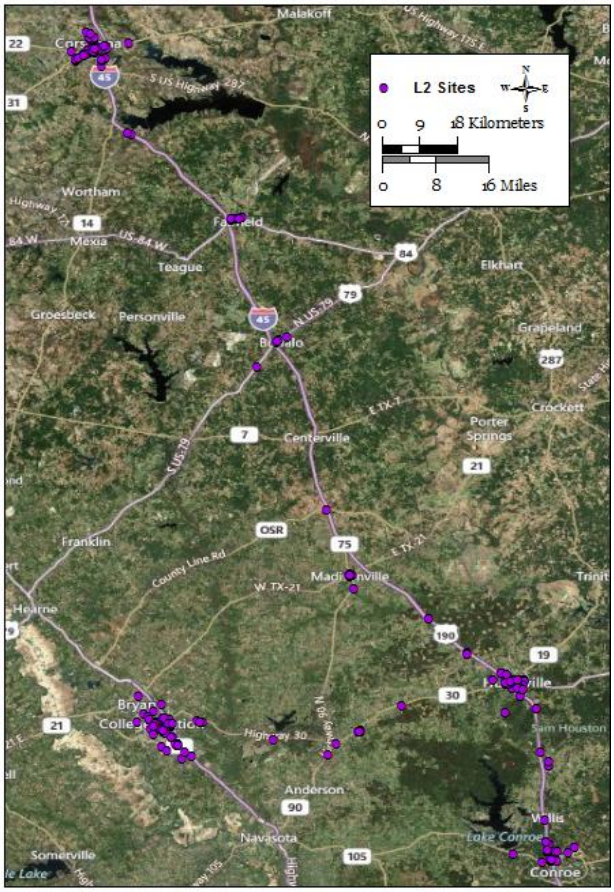


Figure 5E-4 Interstate 45, Conroe to Corsicana and State Route 30, College Station to Huntsville: AC Level 2 Candidate Sites

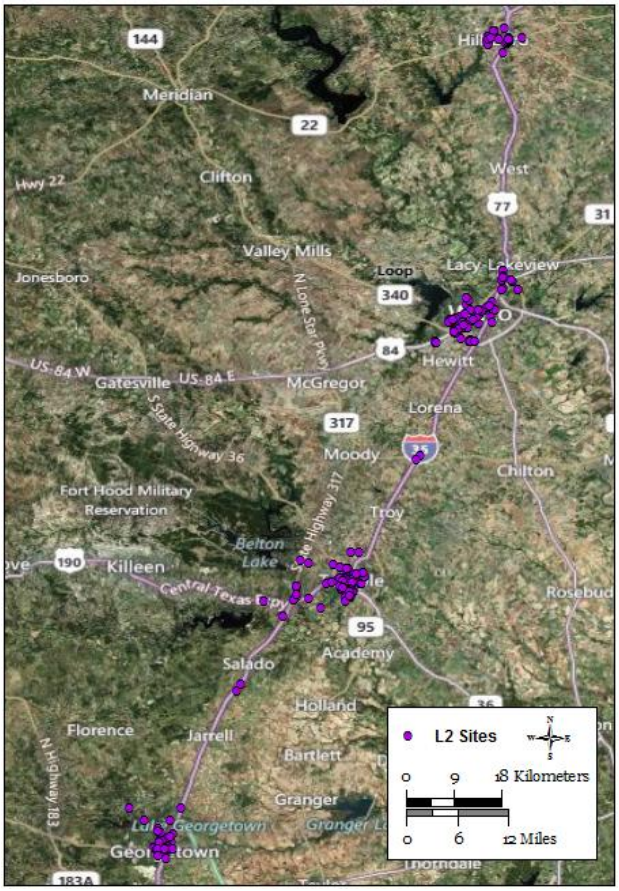


Figure 5E-5 Interstate 35, Georgetown to Hillsboro: AC Level 2 Candidate Sites

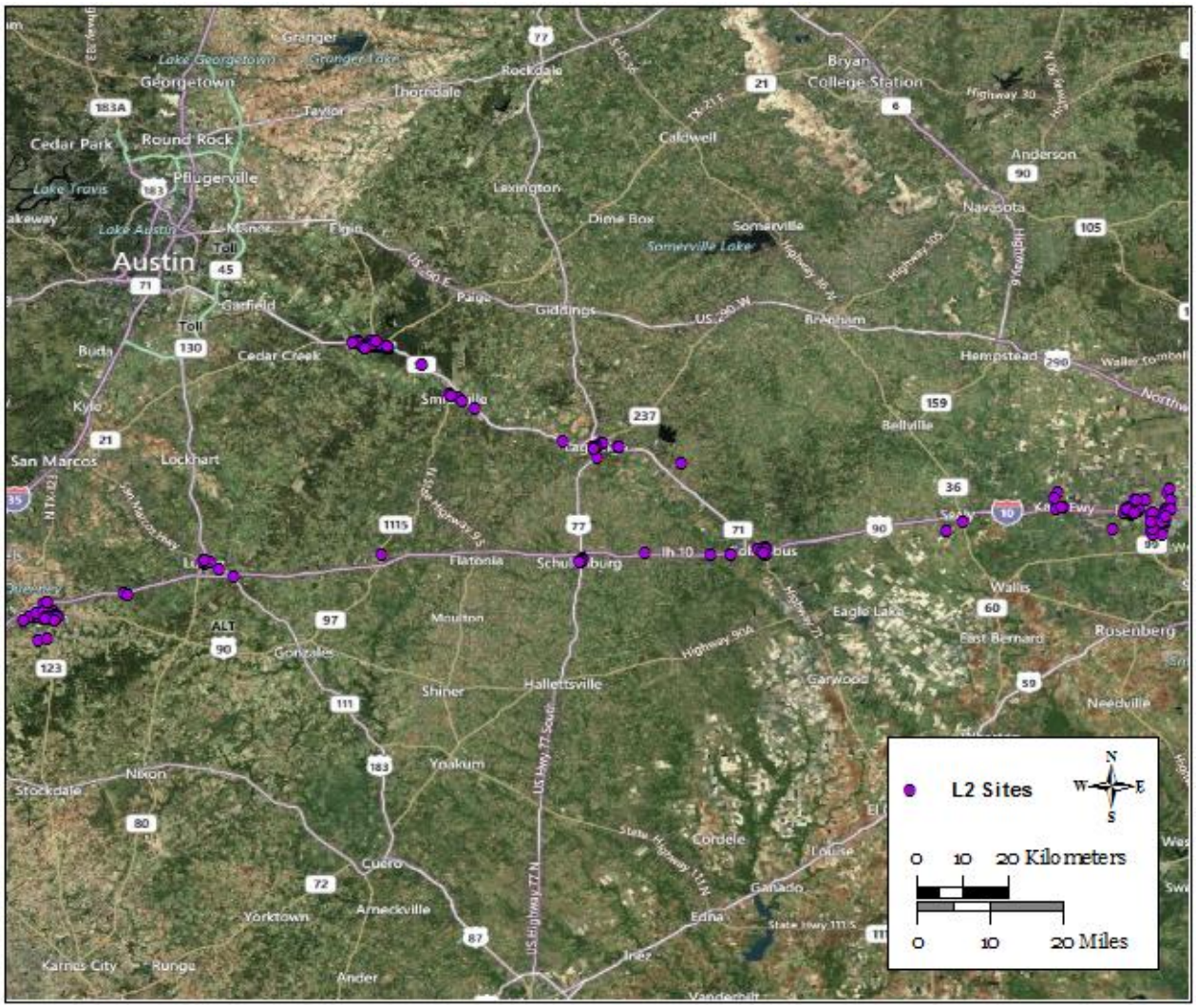


Figure 5E-6 Interstate 10, Seguin to Katy and State Route 71, Bastrop to Columbus: AC Level 2 Candidate Sites

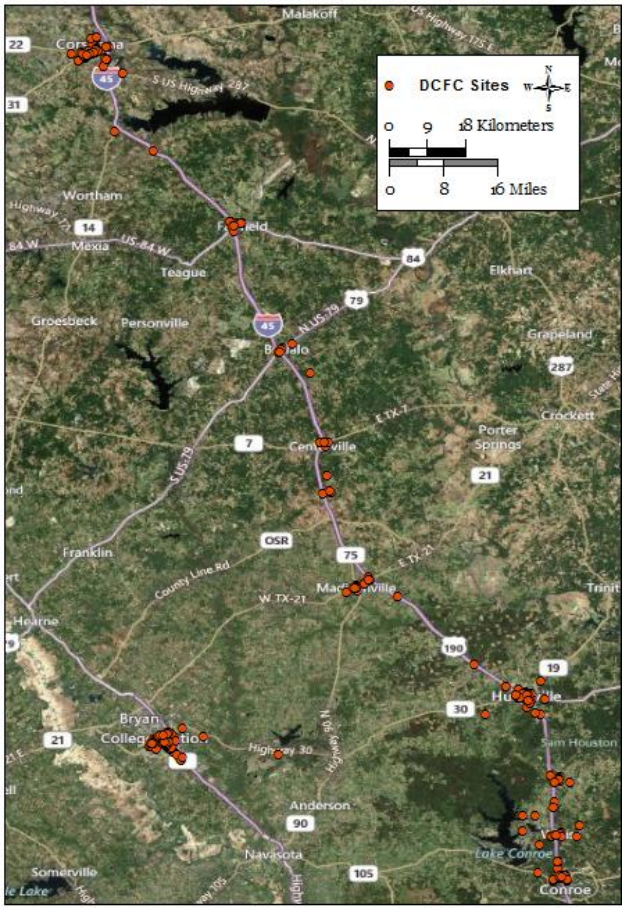


Figure 5E-7 Interstate 45, Conroe to Corsicana and State Route 30,College Station to Huntsville: DCFC Candidate Sites

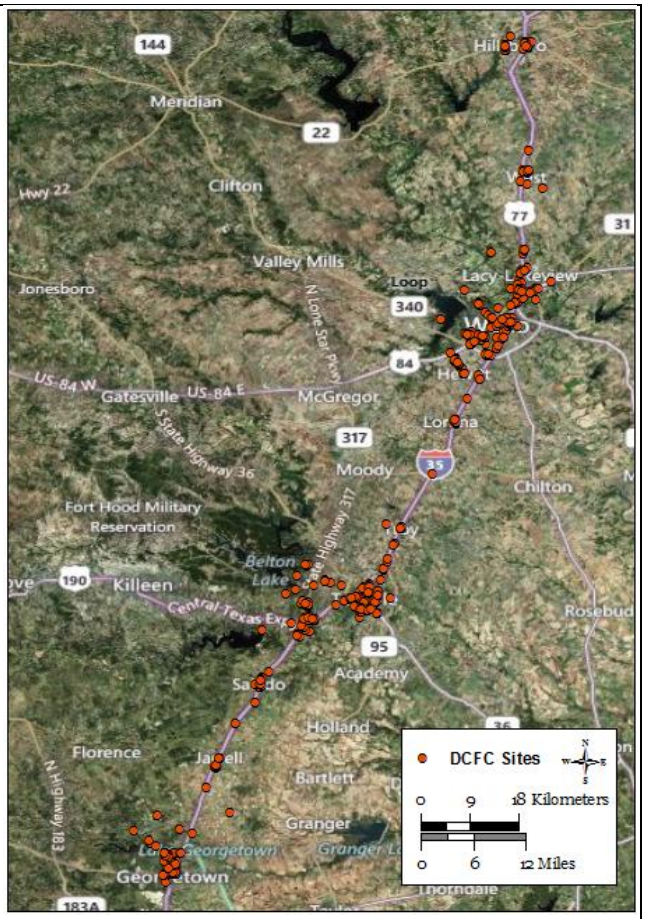


Figure 5E-8 Interstate 35, Georgetown to Hillsboro: DCFC Candidate Sites

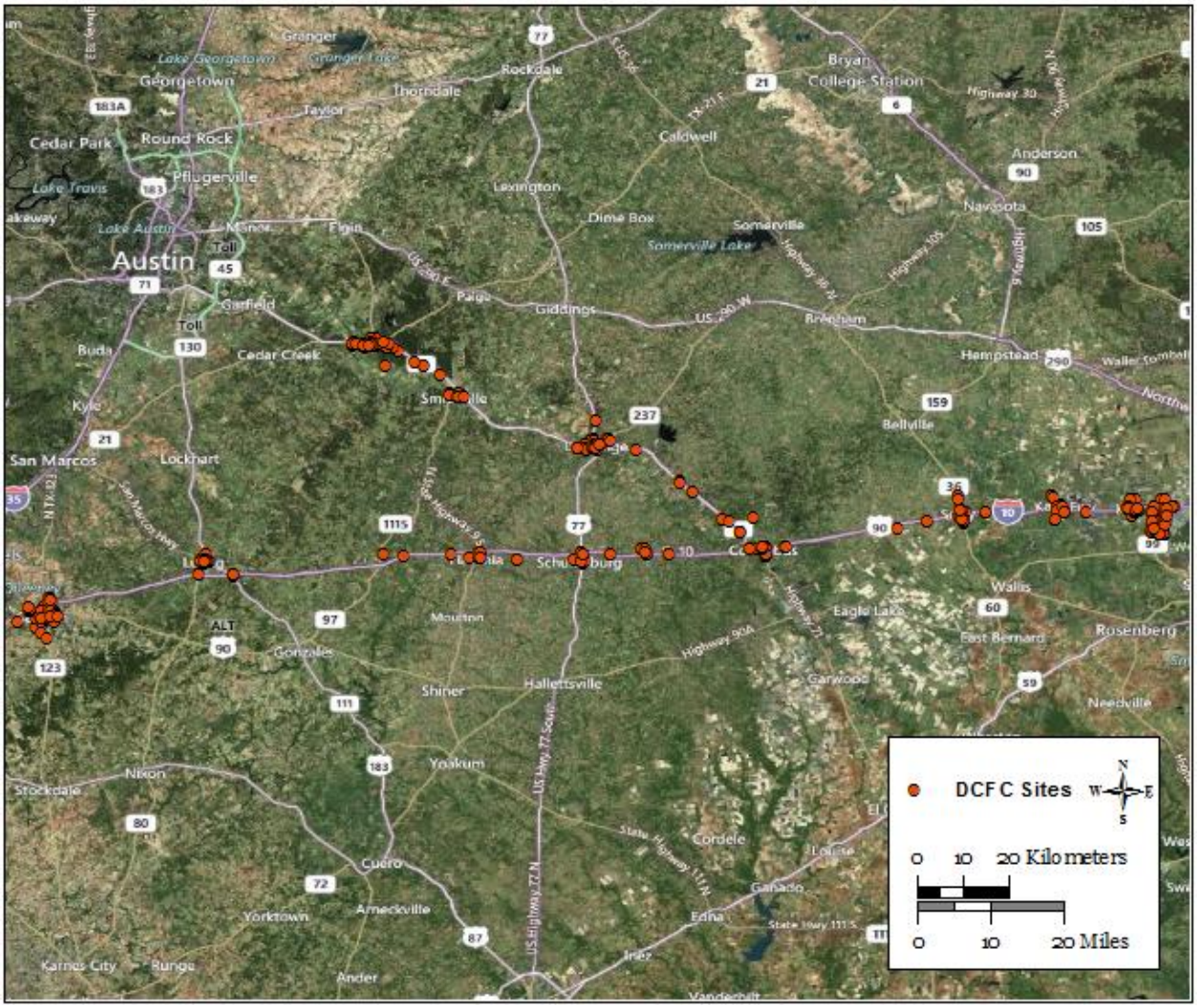


Figure 5E-9 Interstate 10, Seguin to Katy and State Route 71, Bastrop to Columbus: DCFC Candidate Sites

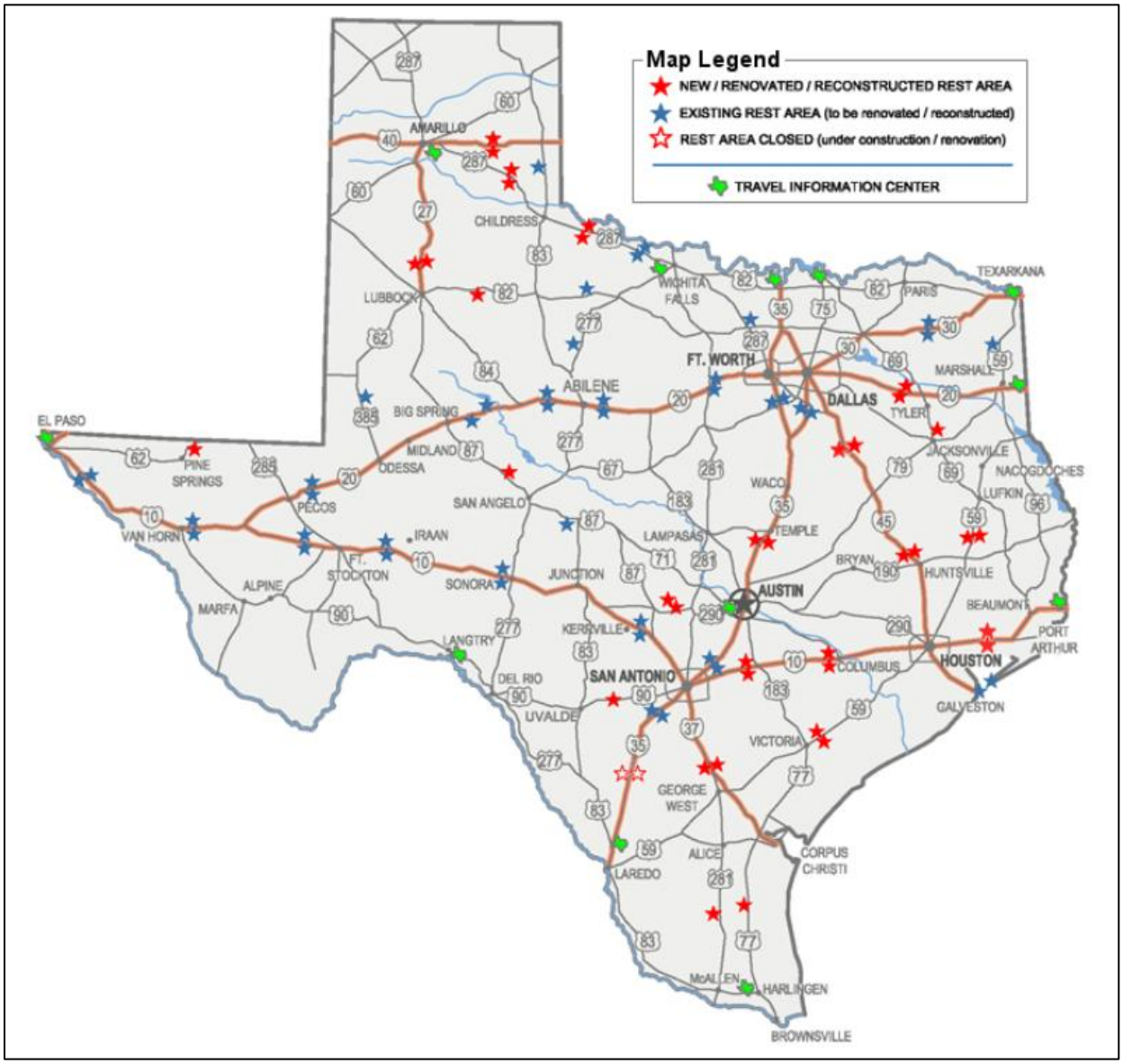


Figure 5E-10 Texas Safety Rest Areas[XLVII]

Appendix 6A Additional Information on Proposed PEV Website

A list of entities that were likely to be interested in PEVs was created over the course of the project. Outreach efforts were made to engage a considerable number of these PEV-interested entities. The strongest interest and greatest engagement were typically from the larger cities, utilities serving more urban areas, and firms with a commercial interest in selling of PEVs and related equipment. The Texas Triangle participants and Technical Advisory Group reflect this dynamic. The least interest shown was typically from rural areas. Through successive feedback and continued refinement, the online storyboard outline reflects the overall Texas Triangle PEV communication plan.

To create an easily accessible visual outline (or storyboard), a prototype website and links was created. **Note to reader**: to see this prototype of the recommended website, click here (https://sites.google.com/site/texastrianglev2/). While this prototype is not intended to be the final website with full hosting and maintenance support, webmaster, videos, and more aesthetically attractive design, we are making it available for viewing given it has many useful links and content. As time permits, suggestions submitted to TexasPEV@gmail.com and deemed appropriate and valuable will be incorporated. The basic structure was created to help visitors most easily navigate the website based upon their own perspectives, thought processes, or needs. For example, some viewers may be looking for information based upon who they are, who they represent, or who they are looking for. Examples of these parties included on the entry webpage are: Vehicle Buyers, Fleet Managers, PEV owners, Utilities, Cities/States/Regulators, Auto Dealers, Electricians, and First Responders (See Figure 6A-1). Tabs along the top of the webpage list these parties for those who may find that categorization of this type most intuitive and helpful. Selecting one of these tabs then navigates the user to web pages with specific information that is likely of interest to those parties.

Other viewers may find searching for a particular PEV related topic more helpful. Along the right column, specific categories of topics are listed. Examples of these topics on the right column of the entry webpage are:

- ✓ Types of PEVs,
- ✓ PEV Charging,
- ✓ PEV manufacturers,
- ✓ Cost Savings Calculators,
- ✓ PEVs and the electric grid,
- ✓ PEV Readiness,
- ✓ Educational Material,
- ✓ Texas Triangle information, and
- ✓ PEV information websites.

Selecting one of these topics then leads the viewer to webpages which contain information related to that particular topic.

Many of the most common PEV related questions or information areas of interest to viewers are included in the center of the entry webpage. Examples of these common questions or areas are:

- "What are Plug-In Electric Vehicles and why should I buy one?"
- "How Fleet managers may save money with PEVs"
- "Information for PEV owners"
- "Utilities: Information for (or by) electricity providers"
- "Cities, States, or Regulators: Helpful links"
- "Auto Dealers: Useful links for Sales, Vehicle Charging, etc"
- "Electrician Information for PEV charger installations"
- "First Responder education information"

Clicking on one of these questions or areas links the viewer to a webpage specific to that question or area. In the future, this entry page will likely be updated to include an opening narrative with these questions or areas woven into a paragraph (and made bold for contrast and to show a link available) which provides an introduction and some context for the viewer.

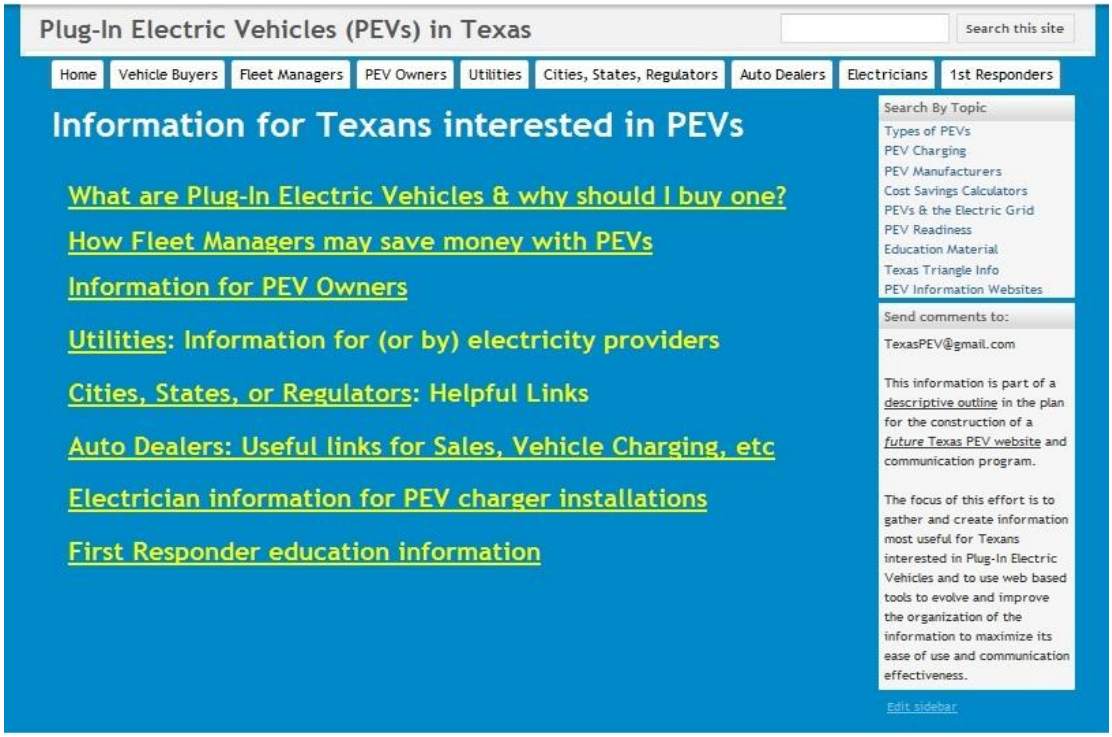


Figure 6-1

While there is a degree of overlap between these three methods to begin navigating the website, the number of options appears reasonable and the listing of the parties, topics and questions is also meant to subconsciously convey that information related to PEVs is finite in nature and not overwhelming.

Short, regionally tailored videos selectable for each of the parties, topics, or questions would be helpful to provide an associated introduction or summary. In addition, the richness of video can help make many of the related more easy to understand and less intimidating. Regionalized videos also improve the chance of maintaining the viewer's attention and more effectively explaining a complex topic in language that is most comfortable to them. Many of the questions related to PEVs will no longer seem so complex or intimidating once they are clearly explained and visualized. Some examples of videos that would be useful:

- Real examples of mass market viable PEVs. A quick walk around a Leaf BEV, a Chevy Volt eREV, and a Prius PHEV or a Ford CMAX-Energi PHEV (when they are available in Texas) to explain the key advantages of each type of PEV.

- A quick visual introduction to AC-Level-1, AC-Level-2, and DC fast charging (showing the actual plugging in of the charge cords) and the differences in charge times for the different types of PEVs and installation costs. The video would show how using a 120V AC-Level-1 charge cord can be as simple as plugging any other new electrical device into a standard wall outlet. Explaining when AC-Level-2 may be useful and how it is a permanent upgrade to the home that will be useable on future vehicles in addition to the one the owner has today.

- Explaining in layman's terms what the accustomed phrase "your mileage will vary" means for PEVs compared to conventional vehicles in the Texas climate and terrain. A quick explanation of how electric range can vary to a greater degree on PEVs based upon the
- "3 T's": ambient Temperature, Terrain, and driver Temperament.

- There are a number of calculators already online on the EDTA, DOE, and NCTCOG websites, for example. EDTA's is the simplest, DOE's is more sophisticated, and the NCTCOG is for very detailed financial analysis by fleet managers. A few short videos which walk the viewer through some of the calculator tools or online PEV cost analysis spreadsheets in a similar fashion to the many YouTube.com or www.khanacademy.org instructional videos would be helpful.

- There are Texas unique advantages and relationships between PEVs and the electric grid which can be effectively and compellingly conveyed through videos. For example, Texas

has its own electric grid which is separate from the rest of the U.S. This Texas grid also has considerably more wind power than any other state. West Texas wind typically blows strongest at night, precisely when most PEVs will be charged. In addition, these West Texas ranchers receive an estimated $600 to $800 per month per wind turbine royalty payments. An effective visualization for many Texans would be to show how they could conveniently charge their PEV at night while they are asleep with energy from West Texas wind turbines which keeps their money in Texas, benefitting Texans instead of sending their money to foreign oil providing countries that dislike Americans.

Appendix 6B Summary of CCET Grant Request

Texas PEV Friendly Community Program and Texas PEV Communications Plan and Website

In the June of 2012, the Center for the Commercialization of Electric Technologies (CCET), primary author of this Texas Triangle PEV Readiness Plan, submitted a grant request to the U.S. DOE to provide funding for two of the six elements of the Texas Triangle PEV Readiness Plan (Plan). Funding of one of the recommendations from the Electric Utilities PEV Readiness chapter (Chapter 4) was also requested. The proposal to DOE was in response to a solicitation for proposals to fund PEV readiness programs issued as Funding Opportunity Notice (FOA) 708. Because of the nature of the FOA, CCET had to make modifications to the Plan for purposes of the proposal. If funded, the project would use Clean Cities Coordinators in Texas along with Tuttle Consulting and Frontier Associates to execute the two tasks and help with a third. These three elements in the proposal are as follows:

1. **Implementing** a comprehensive PEV website (that will be expanded to include alternative fuels in general) including content for fleet managers, homeowners, interested buyers, first responders, decision makers, code officials, legislators and regulators. This task will include publicity campaigns to inform the public of its existence, as well as an effort to secure a permanent host organization so that the website and related efforts continue beyond this project.

2. **Implementing** a first-of-its-kind program to advise and assist municipalities in becoming designated, recognized PEV-friendly communities, and leveraging that experience to promote a national program. This task will include creation of a task force comprised of Texas Clean Cities Coalitions and other interested stakeholder, development of education and training materials, roadshows to educate the public and community leaders, guidance and assistance to communities interested in the PEV-Friendly Community certification, and promotion of the program details at the state and national level to ultimately secure an organization willing and capable of continuing this program beyond this project.

3. Testing the **implementation** of a new demand response capability to lower peak demand based on fleet-to-grid ancillary services. This effort will work with fleet managers to equip vehicles with reporting capabilities, introduce the ability to aggregate combined fleet vehicle storage as an energy resource through charging time management, test the ability to bid aggregated fleet load into the ancillary service market and deliver the resource, document all lessons learned, and conduct outreach to fleet managers on this new economic opportunity. Ultimately, this will result in a wealth of information available to fleet managers nationwide on the benefits of demand response at the fleet level.

END NOTES

[I] Includes counties of Dallas, Tarrant, Collin, Denton, Johnson, Rockwall, Kaufman, Hunt, Wise, Palo Pinto, Erath, Hood, Somervell, Ellis, Navarro, and Parker.

[II] A location is a site where the various charging equipment and electrical supplies are located and can be described by an address.

[III] A station is a place where a vehicle can park. A location may have several stations.

[IV] A port is the EVSE that connects to the on board charging equipment and may be Level 1, 2, or DCFC. A station may have one or two ports.

[V] The survey was conducted by Southwestern Economics Ltd of Rosenberg, Texas.

[VI]GM (Britta Gross) provided a set of PEV Policy Guidelines that was forwarded by Clean City City co-director Linda Bluestein on May 21, 2012 to DOE readiness grant recipients including CCET. This updated information was included in that PEV Policy Guidance document.

[VII] Ibid. Britta Gross.

[VIII] See the following website to see how this particular program works in Michigan: http://www.dteenergy.com/residentialCustomers/productsPrograms/electricVehicles/getReady.html

[IX] Ibid. Britta Gross. See also the following website for how an HOV program works. http://www.mva.maryland.gov/About-MVA/INFO/27300/27300-54T.htm.

[X] http://www.arb.ca.gov/msprog/carpool/carpool.htm

[XI] http://www.pluginamerica.org/why-plug-vehicles/state-federal-incentives.

[XII] Based on several presentations and discussion groups held at Plug-in 2012, EPRI conference, in San Antonio during July.

[XIII] Clean Cities Plug-in Electric Vehicle Community Readiness Partners Association Discussion Group, May 7, 2012.

[XIV] According to the California Plug In Electric Collaborative, most Level 1 EVSE operates at 1.44kW at 12 amps or up to 1.92 kW at 16A. This level should add 3 to 4 miles of range per house of charging. Ten hours of charging should replenish the battery such that the great majority of the commutes can be made without range anxiety.

[XV] This trend was commented upon in several sessions at EPRI's Plug-In 2012 annual conference in San Antonio.

[XVI] Clean Cities, May 7, 2012.

[XVII] A Community Toolkit for Plug-In Electric Vehicle Readiness: A Resource for Local Officials, May 2012, Plug In Electric Vehicle Collaborative.

[XVIII] Ray Cruz, City of Houston, (www.climatecommunities.us/dcouments).

[XIX] http://en.wikipedia.org/wiki/Low-speed_vehicle

[XX] SUBCHAPTER D. NEIGHBORHOOD ELECTRIC VEHICLES Sec. 551.301. DEFINITION. In this subchapter, "neighborhood electric vehicle" means a vehicle that can attain a maximum speed of 35 miles per hour on a paved level surface and otherwise complies with Federal Motor Vehicle Safety Standard 500 (49 C.F.R. Section 571.500)..

Texas Transportation Code citations:

Sec. 551.302. REGISTRATION. The Texas Department of Motor Vehicles may adopt rules relating to the registration and issuance of license plates to neighborhood electric vehicles.

Sec. 551.303. OPERATION ON ROADWAYS. (a) A neighborhood electric vehicle may be operated only on a street or highway for which the posted speed limit is 45 miles per hour or less. A neighborhood electric vehicle may cross a road or street at an intersection where the road or street has a posted speed limit of more than 45 miles per hour. A neighborhood electric vehicle may not be operated on a street or highway at a speed that exceeds the lesser of:(1) the posted speed limit; or(2) 35 miles per hour.(b) A county or municipality may prohibit the operation of a neighborhood electric vehicle on a street or highway if the governing body of the county or municipality determines that the prohibition is necessary in the interest of safety.(c) The Texas Department of Transportation may prohibit the operation of a neighborhood electric vehicle on a highway if that department determines that the prohibition is necessary in the interest of safety.

Added by Acts 2003, 78th Leg., ch. 1320, Sec. 7, eff. Sept. 1, 2003.Amended by: Acts 2009, 81st Leg., R.S., Ch. 722, Sec. 2, eff. September 1, 2009.

[XXI] Ibid. http://en.wikipedia.org/wiki/Low-speed_vehicle

[XXII] PikeResearch, 2011, Dave Hurst and Clint Wheelock.

[XXIII] Edmunds, Auto Observer. http://www.autoobserver.com/2011/06/neighborhood-electric-vehicle-sales-to-climb.html

[XXIV] http://naftc.wvu.edu/curricula_training/training/tjc

[XXV] Source: EcoTality North America, Electric Vehicle Charging Infrastructure Deployment Guidelines for the State of Texas, May 15, 2012.

[XXVI] From http://www.ercot.com/content/news/presentations/2012/ERCOT%20Quick%20Facts%20-%20Jan%202012.pdf accessed May 30, 3012.

[XXVII] From www.texasefficiency.com/index.php/about/industry-overview/ Accessed May 30, 2012.

[XXVIII] From www.ercot.com/about/ accessed May 30, 2012.

[XXIX] Presentation by Trip Doggett, President & CEO – ERCOT, to the Metropolitan Breakfast Club on November 9, 2011. From http://www.ercot.com/content/news/presentations/2012/DOGGETT%20-%20Austin%20Metropolitan%20Breakfast%20Club%2011-9-11.pdf accessed May 23, 2012.

[XXX] Presentation by Trip Doggett, President & CEO – ERCOT, to the Metropolitan Breakfast Club on November 9, 2011. From http://www.ercot.com/content/news/presentations/2012/DOGGETT%20-%20Austin%20Metropolitan%20Breakfast%20Club%2011-9-11.pdf accessed May 23, 2012.

[XXXI] From http://www.ercot.com/services/programs/load/laar/index accessed May 30, 2012.

[XXXII] From http://www.ercot.com/glossary/ accessed May 30, 2012.

[XXXIII] The J1772 is also the standard for North America and Japan. However, a standard is not yet available in other major markets, although a common connector is also the goal of designers in Asia and Europe.

[XXXIV] CHAdeMO (2010)

[XXXV] (ECOtality, Inc. 2012)

[XXXVI] (eVgo 2011)

[XXXVII] (Coulomb Technologies 2012a)

[XXXVIII] (Schroeder & Traber 2012)

[XXXIX] Ibid.

[XL] (Brownstone, Hansen, and Madanat 2010)

[XLI] (Texas Department of Transportation 2011)

[XLII] (Texas Department of Transportation 2010)

[XLIII] (Kema, Inc. 2010)

[XLIV] Ibid.

[XLV] (U.S. Census Bureau 2011)

[XLVI] Ibid.

[XLVII] (Texas Department of Transportation 2012)