

March 25, 2015

Plug-in Electric Vehicles and Charging Infrastructure: Alternative Financing to Develop a Mature Market

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Quarterly Webinar for the U.S. Department of Energy Clean Cities Program



CENTER FOR CLIMATE
AND ENERGY SOLUTIONS

C2ES.ORG

- **Independent, nonpartisan, nonprofit organization**
- **Working to advance strong policy and action to address the twin challenges of energy and climate change**
- **Founded in 1998 as the Pew Center on Global Climate Change**
- **Became C2ES in 2011**
- **On behalf of U.S. Department of Energy Clean Cities, working with Argonne National Laboratory to present a quarterly *State of Play on EVs***

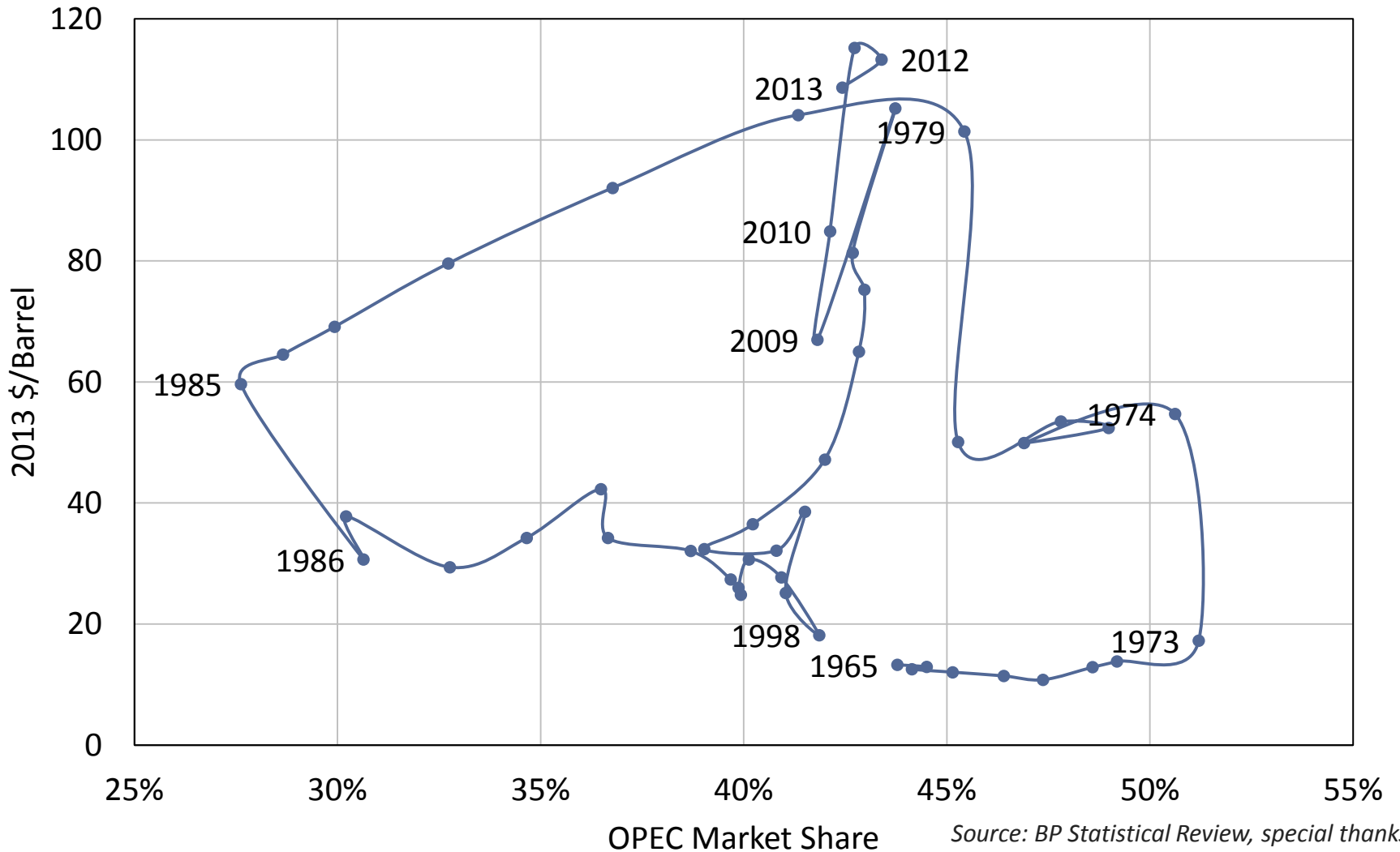


Theme for This Quarter: Alternative Financing for EVs and EV Infrastructure



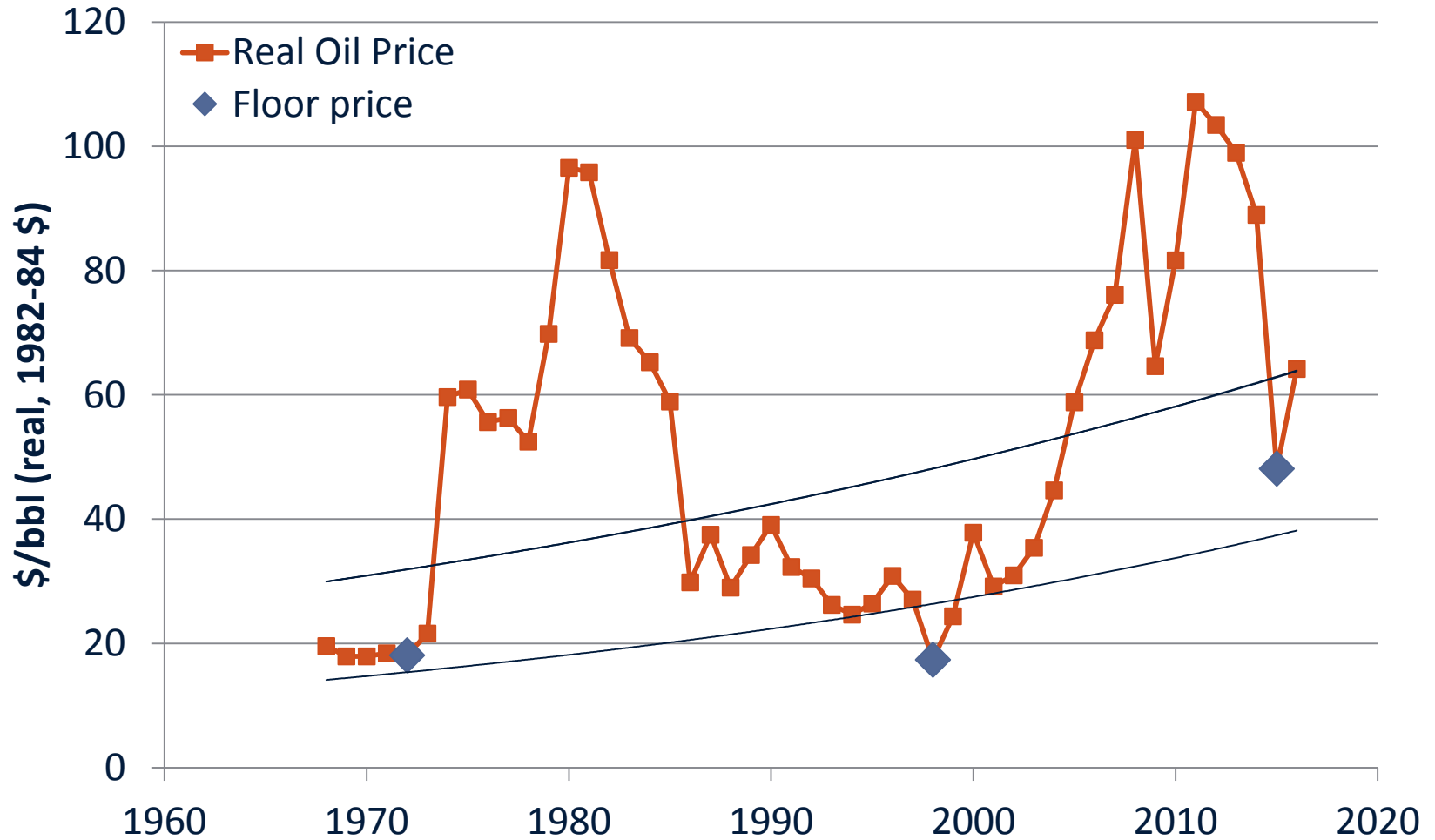
- **EV Market and Technology State of Play**
 - EV sales have leveled off recently, but the number of commercially produced EV models continues to grow
 - Low oil prices have made promoting EV fuel costs savings more challenging
 - Electric utilities and other businesses are expanding investments in charging networks across the United States
- **Spotlight on Community Readiness Grant Recipients**
 - Updating the lessons learned from the DOE's 2012 Clean Cities Community Readiness and Planning for Plug-In Electric Vehicles and Charging Infrastructure awardees
 - Exploring business models and alternative finance methods to ease deployment of EVs and EV charging infrastructure
- **Presentation of *Business Models that Capture the Indirect Value of EV Charging Services***
 - C2ES report on encouraging more private investment in EV charging infrastructure
 - Identifies methods to capture indirect revenue from charging services

OPEC Market Share and World Oil Prices: 1965-2013



Source: BP Statistical Review, special thanks to David Green of University of Tennessee

Long Term Trends in Oil Prices Are Upward

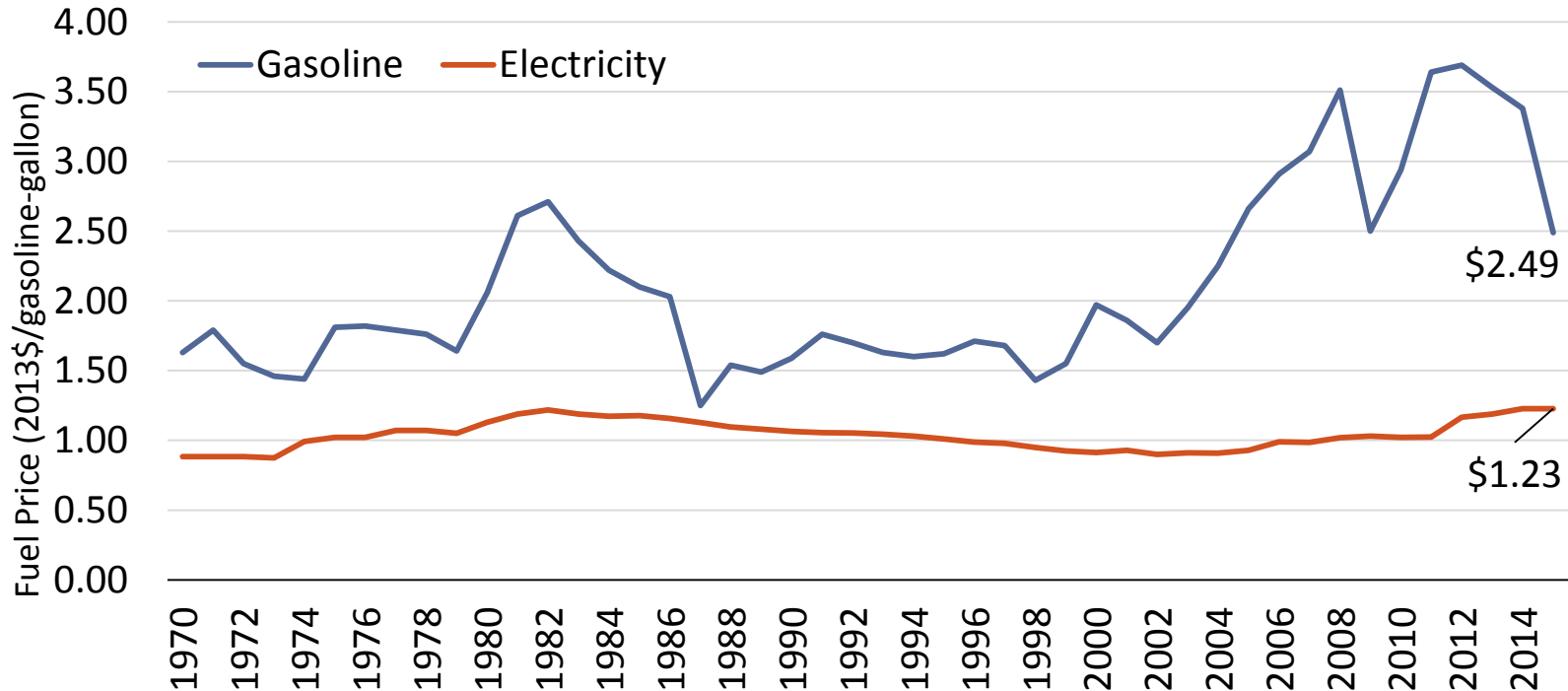


Source: EIA, special thanks to Dan Santini of Argonne National Lab

Oil Prices: Price Volatility

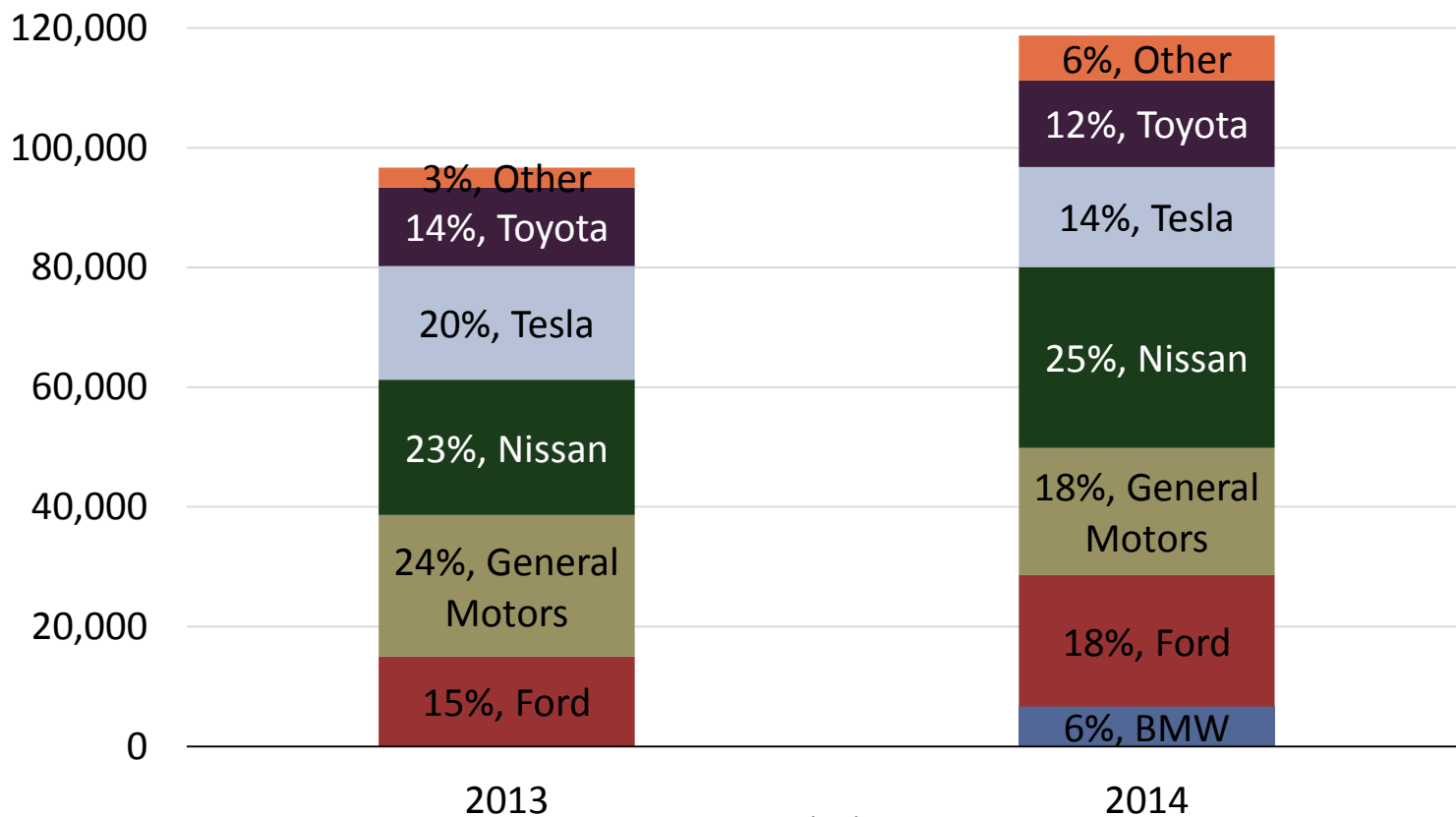


- Inelastic consumer demand for gasoline means that oil price shocks will feed through to U.S. drivers
- The diversity and reliability of electric fuel sources has helped keep electricity prices stable and inexpensive



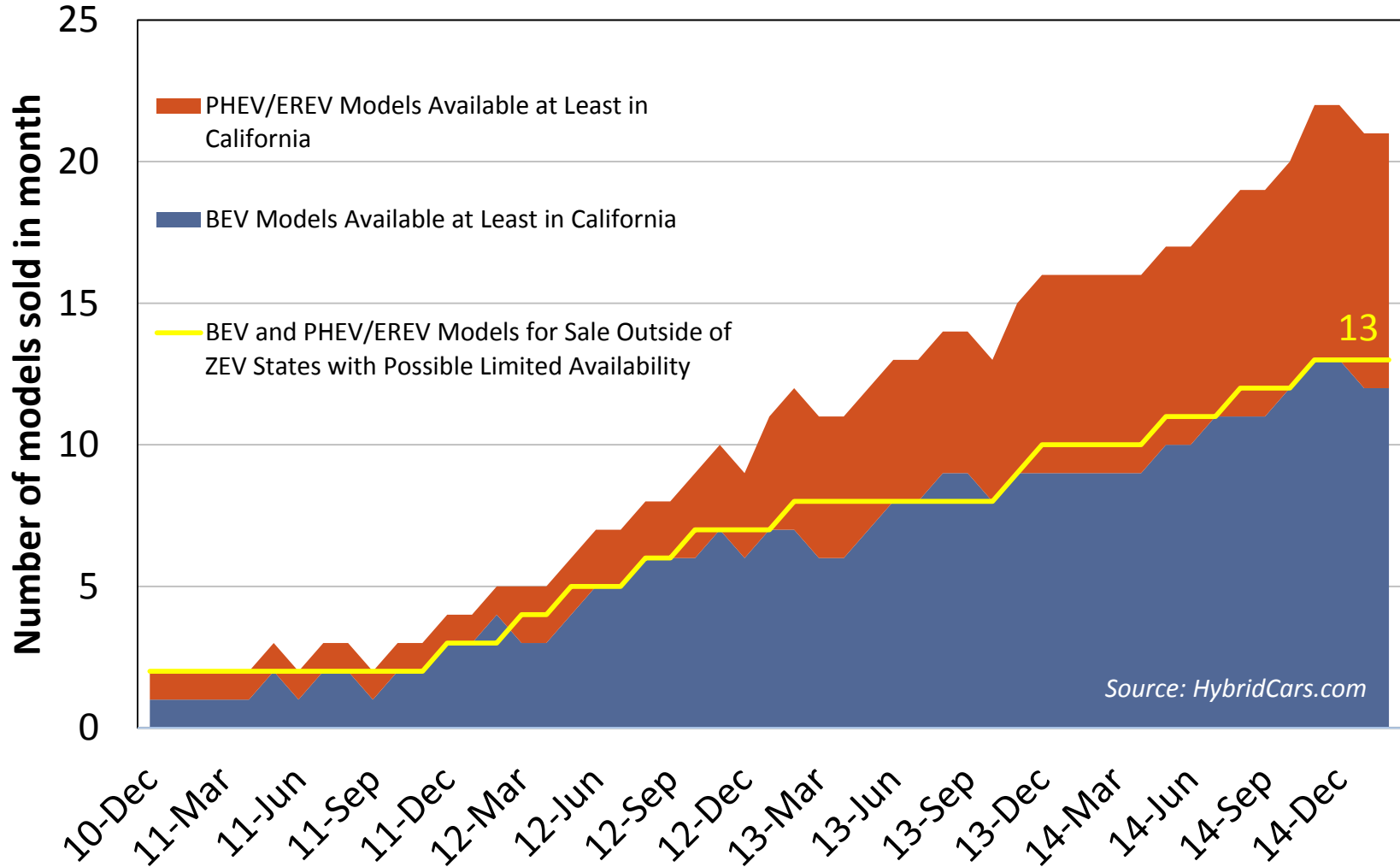
Sources: EIA Annual Energy Review, EIA Monthly Energy Review

- The number of commercially available EVs has been increasing in recent years

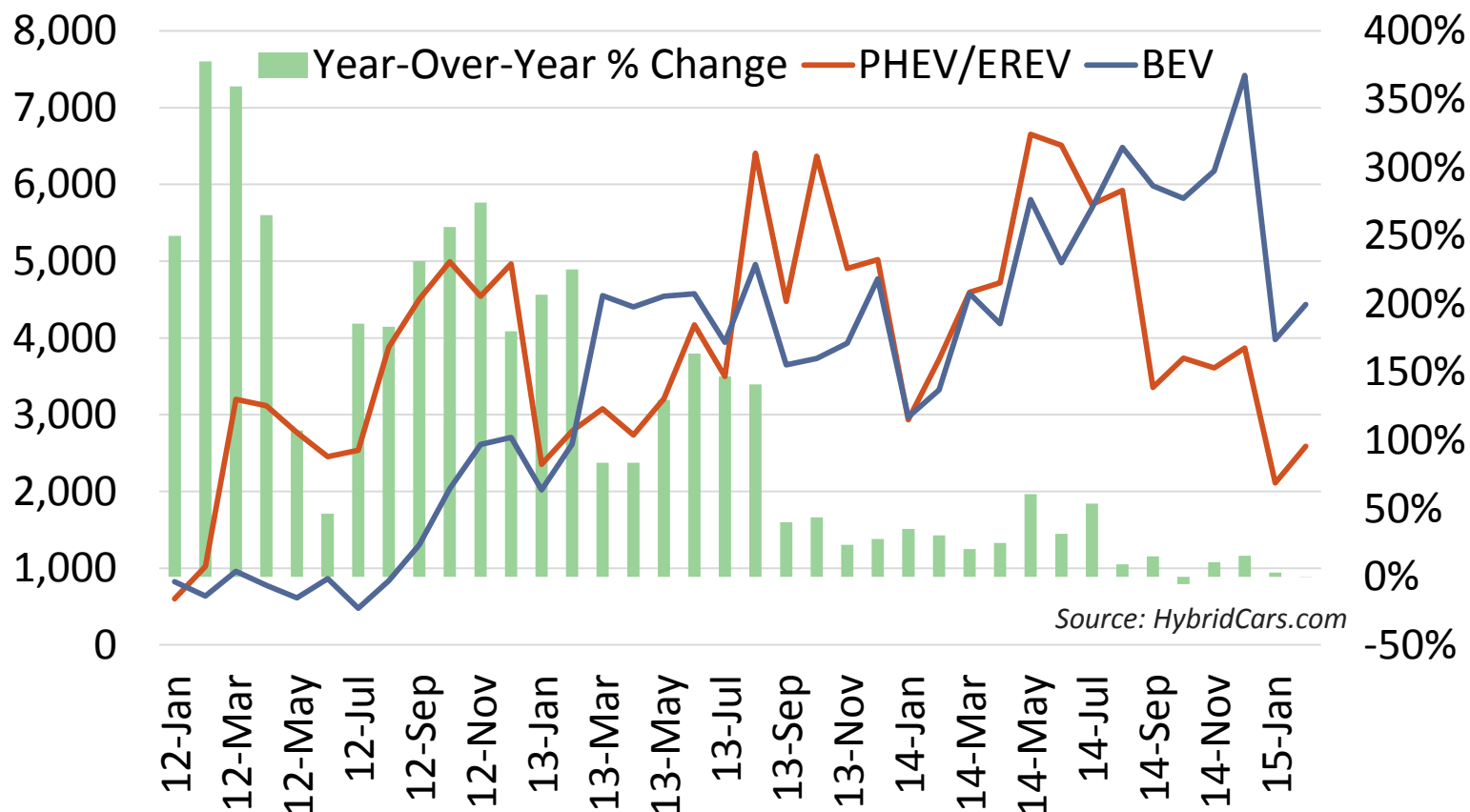


Source: HybridCars.com

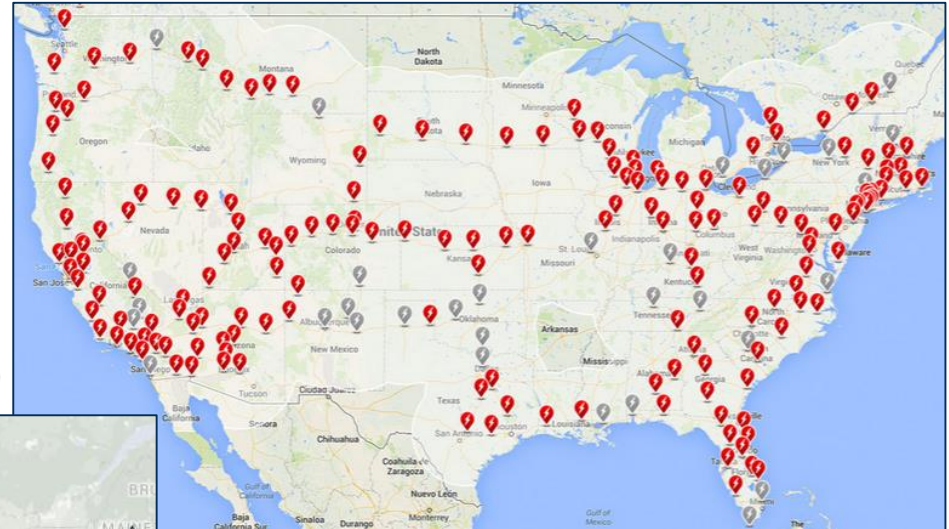
Regional Model Availability Varies



- Annual EV sales growth has flattened, but has not shrunk
- BEVs have gained a noticeable market advantage over PHEVs

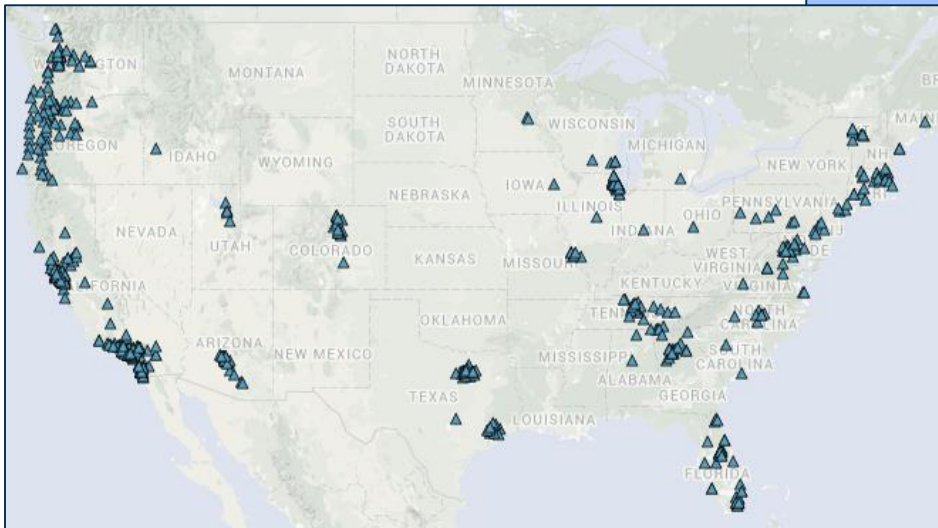


- Automakers have committed to expanding the nation's DC fast-charging network
 - Tesla's network spans the nation
 - BMW, VW, and Nissan will expand charging networks



Tesla DC Fast Charging Stations (Source: Tesla)

Non-Tesla DC Fast Charging Stations (Source: AFDC)



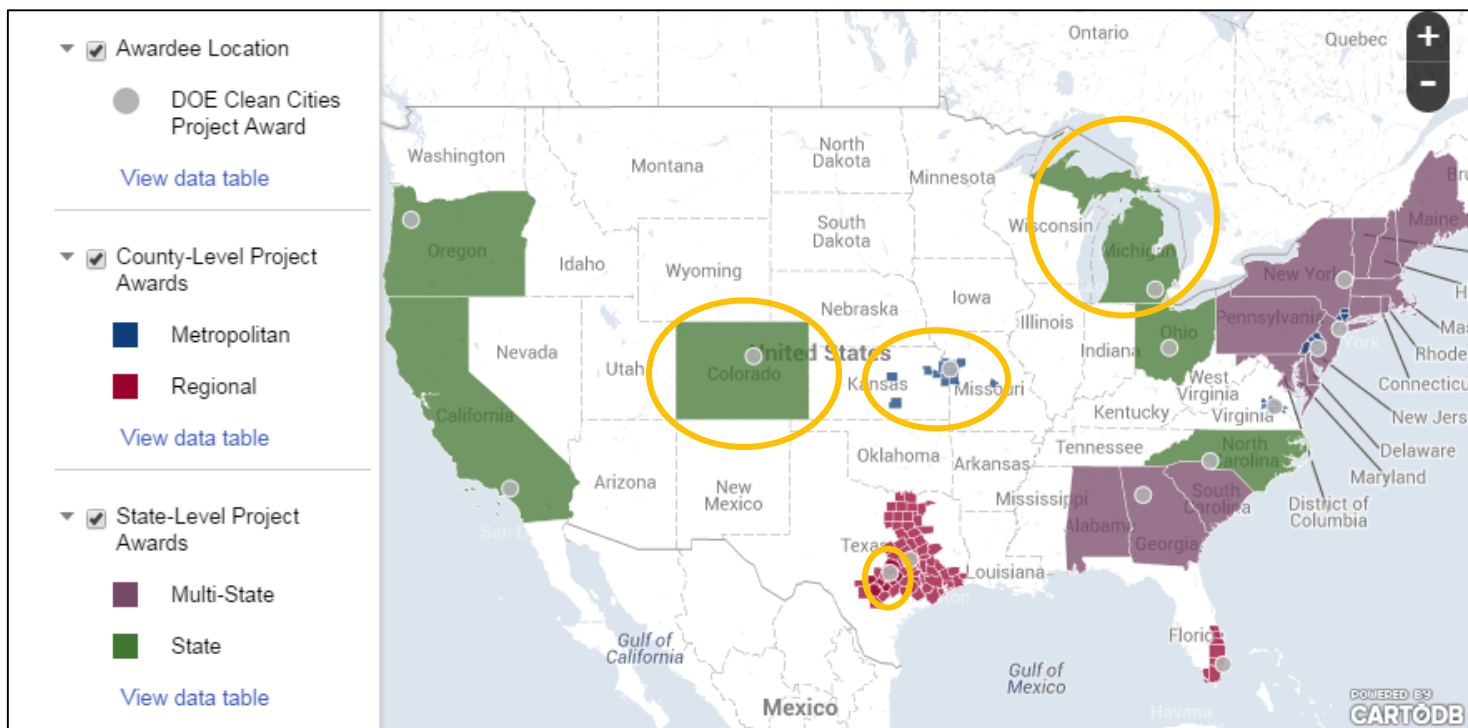
- Utilities are asking regulators for ratepayers to help fund EV infrastructure

Investor Owned Utility	Investment (\$)	EVSE Count	Role	Use Target	State(s)	PUC Status
Indiana Power & Light	\$16m	200	Transfer Ownership	Public	Indiana	Approved (\$3 million)
Kansas City Power & Light	\$20m	1,001	Owner-Operator	Public	Missouri, Kansas	Proposed
Pacific Gas & Electric	\$654m	25,000	Owner-operator	MUDs, Public, Workplaces,	California	Proposed
Puget Sound Energy	\$2.5m	5,000	\$500 Level 2 EVSE rebate	Residential	Washington	Approved
San Diego Gas & Electric	\$103m	5,500	Third Party Contract	MUDs, Workplaces,	California	Proposed
Southern California Edison	\$355m	30,000	Make Ready	Fleets, MUDs, Public, Workplaces,	California	Proposed

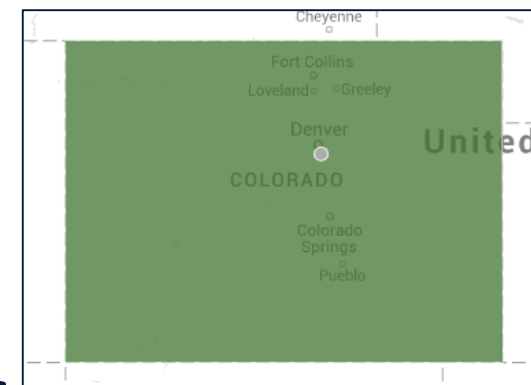
Lessons Learned from DOE PEV Community Readiness Grant Recipients



- Automakers, utilities, or government programs can drive expansion of EV charging infrastructure
- Consumers need continued and improved outreach and education programs



Source: [C2ES Map](#)



- 4,000 EVs
- 185 public Level 2 and 20 DC fast charging locations
- 404 total public charging ports
- **Project FEVER provides framework for Colorado to become a first-tier market for EVs, transportation technology, and EV charging infrastructure**
 - Colorado provides up to \$6,000 tax credit for alternative fuel vehicles – total credit for EVs is based on vehicle purchase price and battery capacity
 - Colorado's climate and lifestyle affect consumer EV choices
 - Outreach events spur EV growth by educating consumers on financial opportunities and creating comfort and familiarity with a new technology
 - Corporate partnerships increase EV visibility and enhance corporate prestige



- **Current Activities**

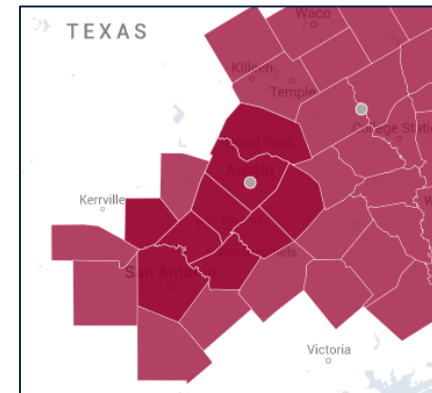
- Working with municipalities to apply for funding through the state-run Charge Ahead program, which covers EV charging infrastructure installation and permitting costs
- Reaching out to consumers through organizations, events, and conferences about the state EV tax credit
- Reaching out to companies through Department of Energy's Workplace Charging Challenge to deploy charging stations

- **Looking down the Road**

- The Charge Ahead Colorado program will expand EV charging locations to travel corridors outside of urban areas
- EV tax credit may be amended to a flat fee rebate to encourage greater EV adoption
- The State-run EV task force continues to convene stakeholders to implement policies laid out by the Colorado EV Market Implementation Study



Texas River Cities Plug-In Vehicle Initiative: Supporting Greater Austin EV Community



- **1,600 EVs**
- **218 public Level 2 charging stations and 2 DC fast charging stations**
- **Initiative vision is to develop a convenient, dependable charging infrastructure network for widespread regional EV deployment**
 - Electric utilities are valuable and effective partners for developing an EV charging network
 - Lack of diversity in body types among EVs may limit the EV market in a region with strong light-duty pick-up truck sales
 - Has experienced 300% year over year EV growth

Texas River Cities Plug-In Vehicle Initiative: Supporting Greater Austin EV Community



• **Current Activities**

- Austin Energy provides a 50% rebate on public charging installations, up to \$4,000, and provides an innovative monthly membership program for public charging station access through Plug-In Everywhere program
- Working with 50 regional stakeholders, including utilities, through the Central Texas Fuel Independence Project, a regional initiative to promote alternative fuel vehicles
- Engaging auto manufacturers and dealers to improve EV marketing and dealer training

• **Looking down the Road**

- Working with Nissan to install DC fast charging stations that will connect regional travel corridors and to expand public charging access
- Airline companies have purchased heavy-duty EV work vehicles through a pilot project at Austin-Bergstrom International Airport





- **4,000 EVs**
- **252 public Level 2 charging and 2 DC fast charging locations**
- **631 total public charging ports**
- **Helps prepare today's infrastructure for vehicles of tomorrow, securing state's future as automotive world capital**
 - Clustering EVs is an effective way to leverage EV infrastructure, though prevalence of multi-unit dwellings and regulations on resale of electricity can limit value of EV charging stations
 - Domestic auto manufacturers have an opportunity to invest in a clean, domestic energy future by building EV charging infrastructure

• Current Activities

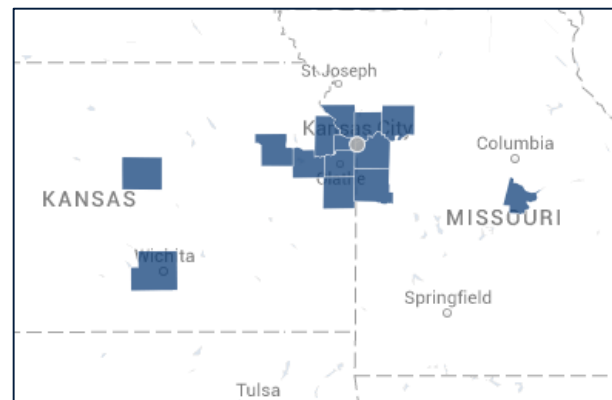
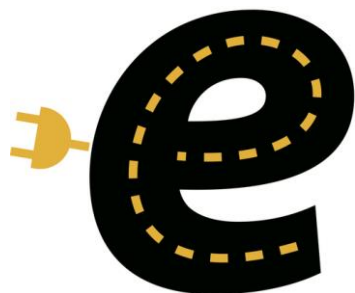
- Engaging with Redevelopment Ready Communities to promote energy efficiency measures such as EV zoning, planning, and policies
- Hosting a series of educational and promotional workshops in targeted high EV density areas
- Promoting municipal ordinance toolkits that reduce the costs of charging infrastructure installation
- Providing technical assistance for Michigan Energy Office's Level 2 charging grant program

• Looking down the Road

- Stakeholder group working to introduce a bill that would provide \$60 million to support alternative fuels, including the expansion of EV charging infrastructure



Metropolitan Energy Information Center: Supporting Greater Kansas City's EV Community



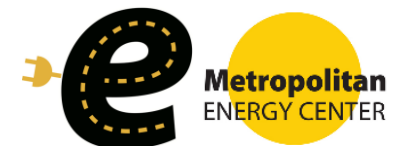
- **2,500 EVs**
- **91 public Level 2 and 12 DC fast charging locations**
- **161 total public charging ports**
- **Goal is to prepare public agencies and ensure economic and environmental benefits of EVs within several regional metropolitan areas**
 - Kansas City Power & Light (KCP&L) will install over 1,000 public Level 2 charging stations and 15 DC fast charging stations through a partnership with Nissan within the next year
 - Utility regulations and state programs cross state borders (Kansas and Missouri)
 - Metropolitan area's sprawling built environment limits fleet adoption and emphasizes engaging with consumers

• Current Activities

- Reaching out to companies through Department of Energy's Workplace Charging Challenge to deploy charging stations
- Engaging school districts, universities, and local government to install EV charging infrastructure
- Hosting EV events, most notably ride-and-drives, to engage customers directly and personally

• Looking down the Road

- Orange EV is closing on contracts to produce zero-emission electric terminal trucks
- Kansas and Missouri utility commissions will determine if KCP&L could receive rate recovery for installing EV charging stations



Lessons Learned from DOE PEV Community Readiness Grant Recipients



- **Regulation may effect EV charging infrastructure deployment**
 - Colorado has 10 times the number of DC fast chargers as in Michigan
 - Colorado permits charging service providers to set rates by kilowatt hour
- **Financing for EV infrastructure may come from a variety of sources**
 - Utility (Austin Energy, KCP&L)
 - Government (Charge Colorado)
 - Automakers (Nissan)
- **Improved marketing and outreach are consistently vital strategies for customer engagement**
- **Institutional knowledge within Clean Cities coalitions is a valuable asset for forging relationships and maintaining momentum**

Business Models that Capture the Indirect Value of EV Charging Services

Nick Nigro, C2ES

- **Describe business challenge facing electric vehicle (EV) charging infrastructure**
- **Explain how new business models can capture indirect value of charging services**
 - Establish value of charging services for private sector partners
 - Illustrate feasibility of business models by applying them to key charging infrastructure gaps
- **Identify short-term public sector interventions that enable private sector partners to implement business models**
 - Interventions by state and local government can improve business case in short term
 - In 5 years, private sector business model are viable without public sector support if the EV market continues to grow

Project: *Unlocking Private Sector Financing for Alternative Fuel Vehicles and Fueling Infrastructure*

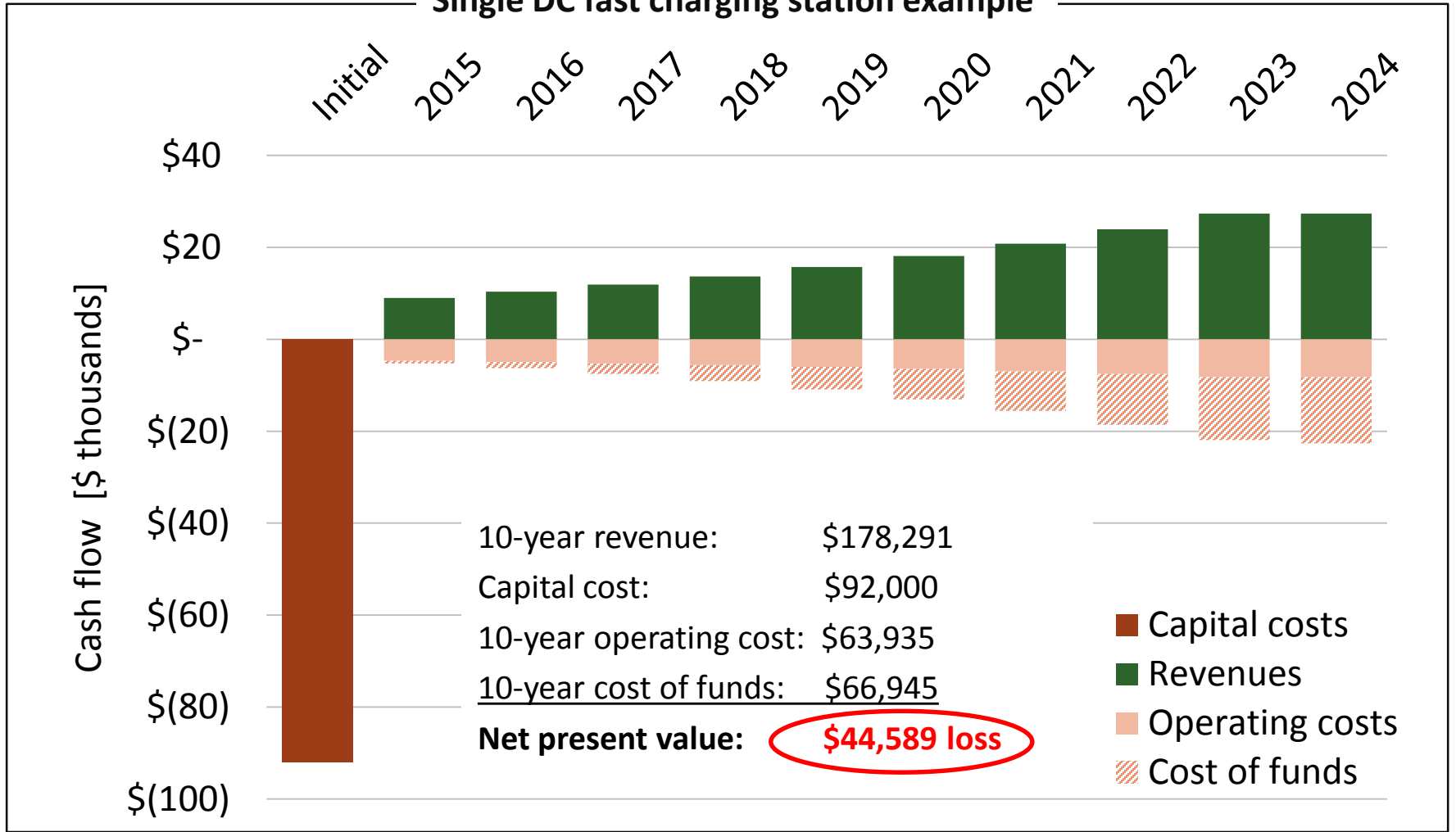


- **NASEO and C2ES, with funding from U.S. Department of Energy's Clean Cities Program, began this project in early 2013**
 - Transportation Energy Partners (TEP), New York State Energy Research and Development Authority (NYSERDA), and Colorado Energy Office are partners on this project
- **Goal: Develop strategies to demonstrate and advance new business models for AFVs and fueling infrastructure**
 - Apply lessons learned from use of financial mechanisms in other sectors to accelerate AFV deployment
- **Convening the AFV Finance Advisory Group, a diverse group of finance professionals, automakers, infrastructure providers, and public officials**
- **Producing original research and conducting stakeholder engagement and advising**

Why can't the private sector currently fund the DC fast charging network on its own?



Single DC fast charging station example



More Private Investment Requires Capturing Indirect Value of Charging Services



- **Business models based solely on direct revenues from EV charging services are currently financially infeasible**
- **Business models that capture the indirect value the private sector gains from EV charging services will increase private sector investment**
- **Some examples of EV charging indirect value**
 - Increased sales of other products and services at businesses located near EV chargers
 - Increased tourism business from EV travel to popular destinations
 - Increased sales of EVs
 - “Clean energy” marketing and brand-strengthening opportunities
- **Key private sector partners: automaker, electric utility, and retailer**
 - These partners could share some of the indirect value they derive from EV charging stations by contributing funds to the charging service provider to help stations get deployed

- **Private sector partners who stand to benefit from an EV charging network can improve the business case for charging service providers**
 - Subsidize upfront cost of charging equipment
 - Share portion of indirect revenue from EV charging use with owner operator
- **Demonstrate effect on charging station project financial performance of sharing value with owner operator of charging services**
 - Use Financial Analysis Tool developed by C2ES and Cadmus Group for financial analysis
 - Use three charging infrastructure gaps identified from charging network assessment



- **Value Proposition**

- A large business that benefits from expanded access to EV charging infrastructure contributes funding to subsidize deployment a DC fast charging network for interregional EV travel

- **Sources of indirect value**

- Increased sales of EVs
- “Clean energy” marketing and brand-strengthening opportunities

- **Candidate funding partners are larger businesses that can capture the indirect value, such as:**

- Automakers • Retail chains
- Electric utilities • Restaurant chains

- **Funding partner grants funds directly to charging station owner operator to subsidize network construction**

Charging Gap: Enable Interregional EV Travel on Interstate 90



- I-90 between Seattle to Spokane is a critical east-west corridor in the state
- DC fast charging station availability is insufficient to enable east-west travel of BEVs between Seattle and Spokane
- Filling the Charging Gap: 6 DC Fast Charging Stations



Business Model Example: Financial Analysis Shows Negative NPV for Owner Operator and Project



- Even with a \$42,000 subsidy from an automaker, the I-90 network still loses money

Financial Metric	Result
<i>Owner/operator</i>	
Funds spent on stations (equity)	\$224,640
Funds spent on stations (loans)	\$336,960
NPV	-\$118,207
Payback period	No payback
<i>Funding partner</i>	
Amount of funds transferred to owner/operator	\$42,000
NPV	+\$19,532
Payback period	5 years
<i>Total project level</i>	
Total capital investment (spent on charging station deployment)	\$561,600
NPV	-\$87,777
Payback period	No payback

Business Models are Unlikely to Succeed Without Public Sector Support in the Near Term



- **Identify role of public sector in implementing three charging station business models in short term**
- **Illustrate how public sector can help private sector to implement sustainable business models**
 - What combination of public subsidies/policies can achieve 5-year payback for owner operator and private sector partners?
 - What may the business models look like in the future, if public subsidies/policies are implemented in near term?
 - Identify possible revenue sources to implement public subsidies/policies

Business Model Example: I-90 Charging Gap, Near Term (2016-2025)



• Public Sector Interventions

- Low-Interest Loan: \$110,000 at 5.4%, 10 year term
- Grant: \$220,000
- Extension of BEV sales tax exemption

• Project Capitalization

- Total project cost = \$561,600
 - 20% owner-operator equity
 - 20% private loans
 - 20% public loans
 - 40% public grant
- Private sector partner (automaker) contributes \$42,000 up front

Financial Performance

<i>Owner/operator</i>	
NPV	+\$136,835
Payback	5 years
<i>Funding partner</i>	
NPV	+\$19,532
Payback	5 years
<i>Public sector</i>	
NPV	-\$222,394
Payback period	n/a
<i>Total project level</i>	
NPV	-\$61,033
Payback period	n/a

Business Model Example: I-90 Charging Gap, 5 Years from Now (2021-2030)



- *No public subsidies are needed*
- **Public Sector Interventions**
 - Sales tax exemption ends in 2020
 - No loans or grants are issued for this project
- **Project Capitalization**
 - Total project cost = \$508,170
 - 40% owner-operator equity
 - 60% private loans
 - Private sector partner (automaker) contributes \$42,000 up front

Financial Performance

<i>Owner/operator</i>	
NPV	+\$115,566
Payback	5 years
<i>Funding partner</i>	
NPV	+\$19,532
Payback	5 years
<i>Public sector</i>	
NPV	n/a
Payback period	n/a
<i>Total project level</i>	
NPV	+\$155,450
Payback period	5 years

- **Private sector entities that gain indirect value from EV charging station deployment play a critical role in improving financial performance of EV charging station investments**
- **Difficult to make EV charging investment attractive to business owner-operators (5-year payback) with private sector partners alone**
- **Public sector can enable new business models in near term**
 - In near term, public sector interventions are needed for owner-operator to reach payback within 5 years for each business model
 - If the EV market develops, the role for government can be scaled down to virtually nothing in 5 years

- **Community Readiness Projects**

- www1.eere.energy.gov/cleancities/electric_vehicle_projects.html

- **U.S. Department of Energy Clean Cities Program**

- cleancities.energy.gov

- **Alternative Fuels Data Center**

- www.afdc.energy.gov

- **C2ES Initiatives**

- www.c2es.org/initiatives/pev
- www.c2es.org/initiatives/afv-finance



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