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# 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***

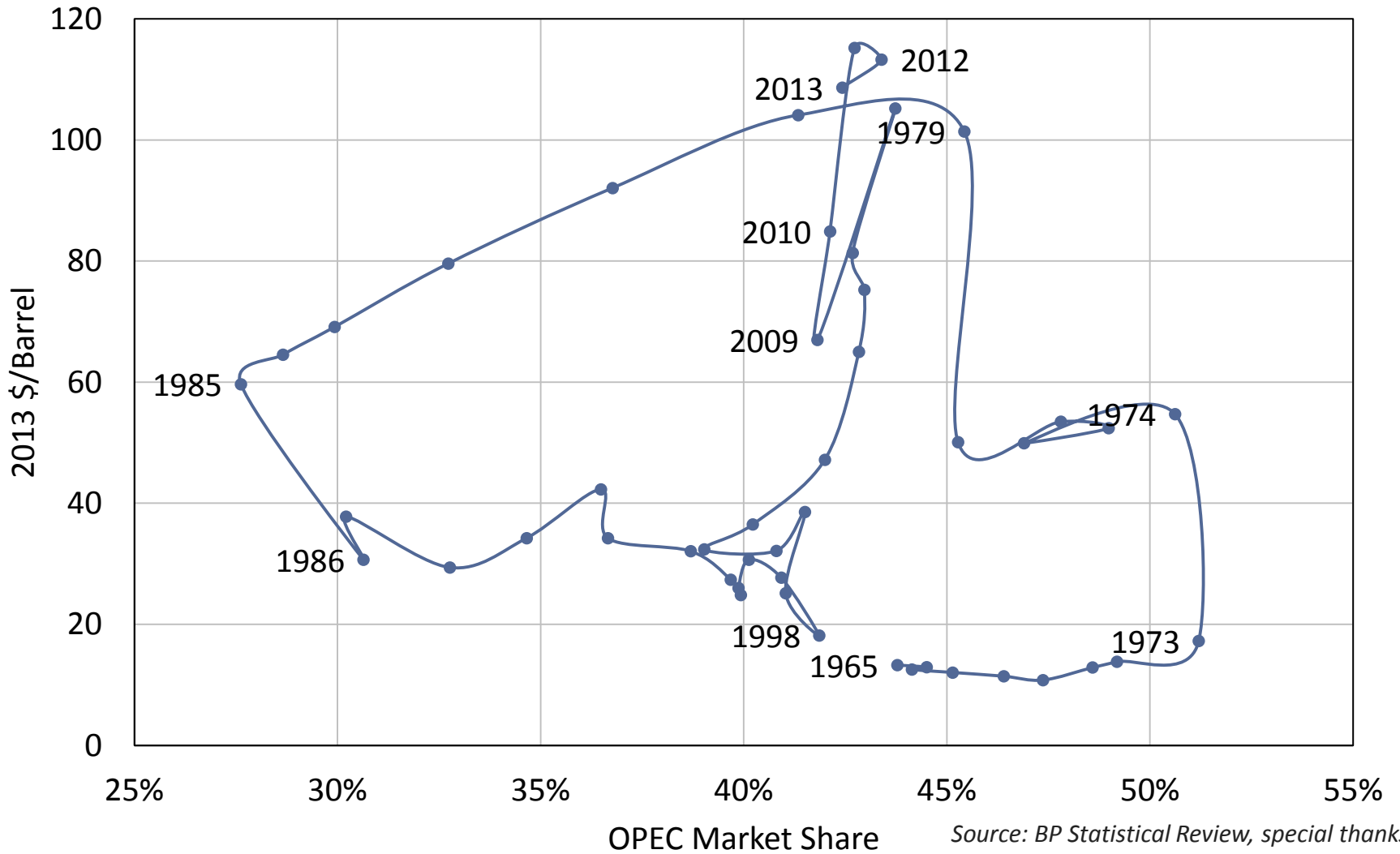


# Theme for This Quarter: Alternative Financing for EVs and EV Infrastructure



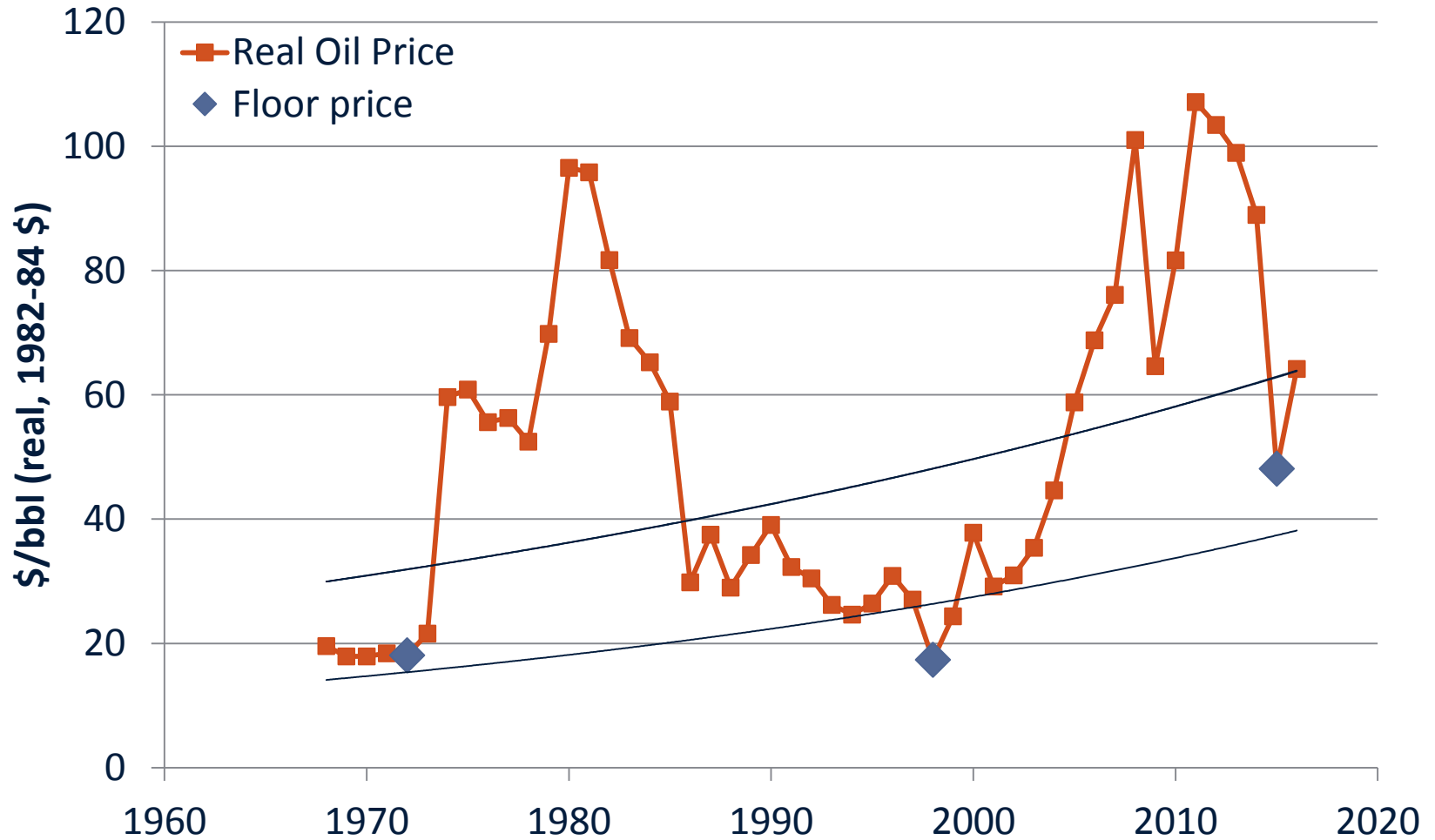
- **EV Market and Technology State of Play**
  - EV sales have leveled off recently, but the number of commercially produced EV models continues to grow
  - Low oil prices have made promoting EV fuel costs savings more challenging
  - Electric utilities and other businesses are expanding investments 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

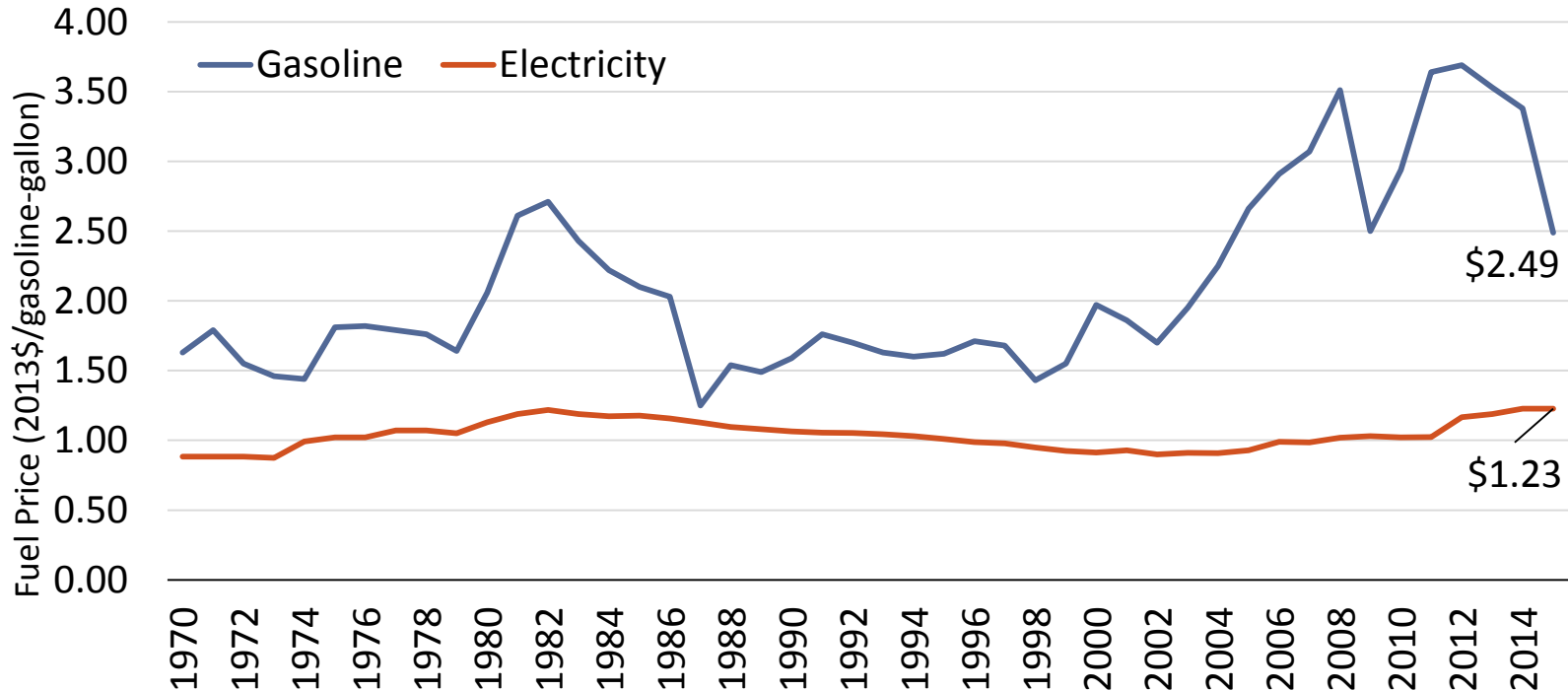


Source: EIA, special thanks to Dan Santini of Argonne National Lab

# Oil Prices: Price Volatility

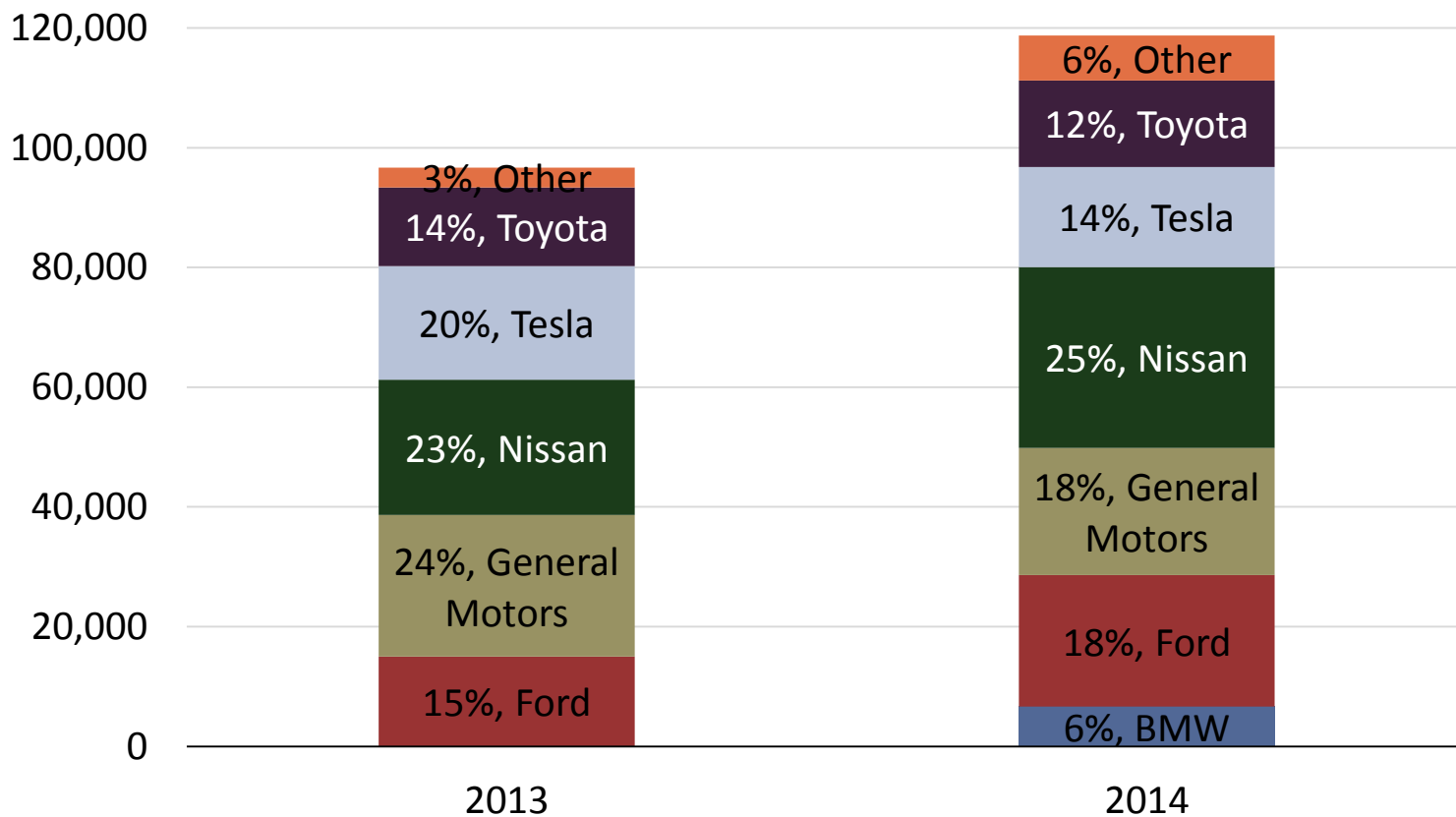


- Inelastic consumer demand for gasoline means that oil price shocks will feed through to U.S. drivers
- The diversity and reliability of electric fuel sources has helped keep electricity prices stable and inexpensive



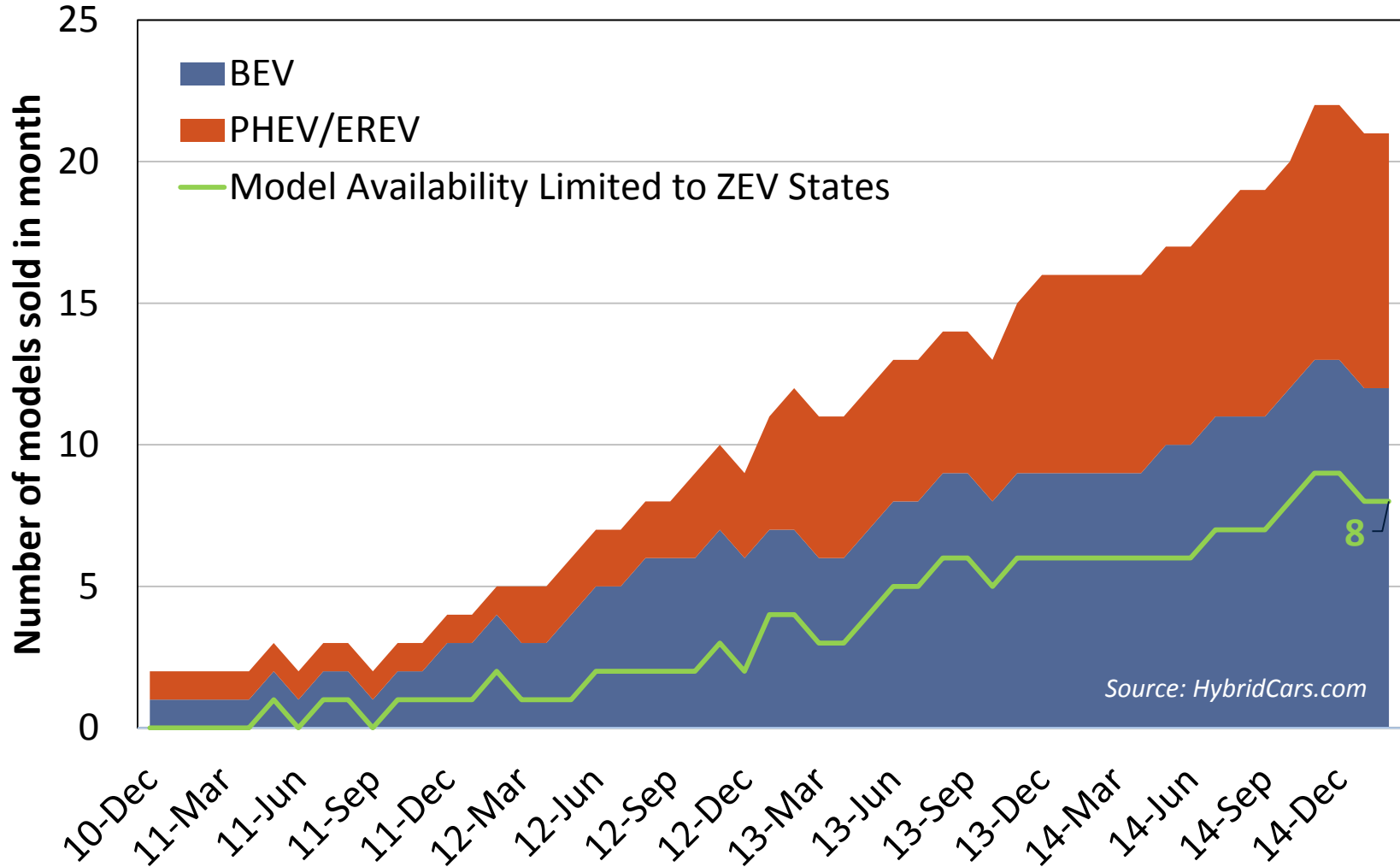
Sources: EIA Annual Energy Review, EIA Monthly Energy Review

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



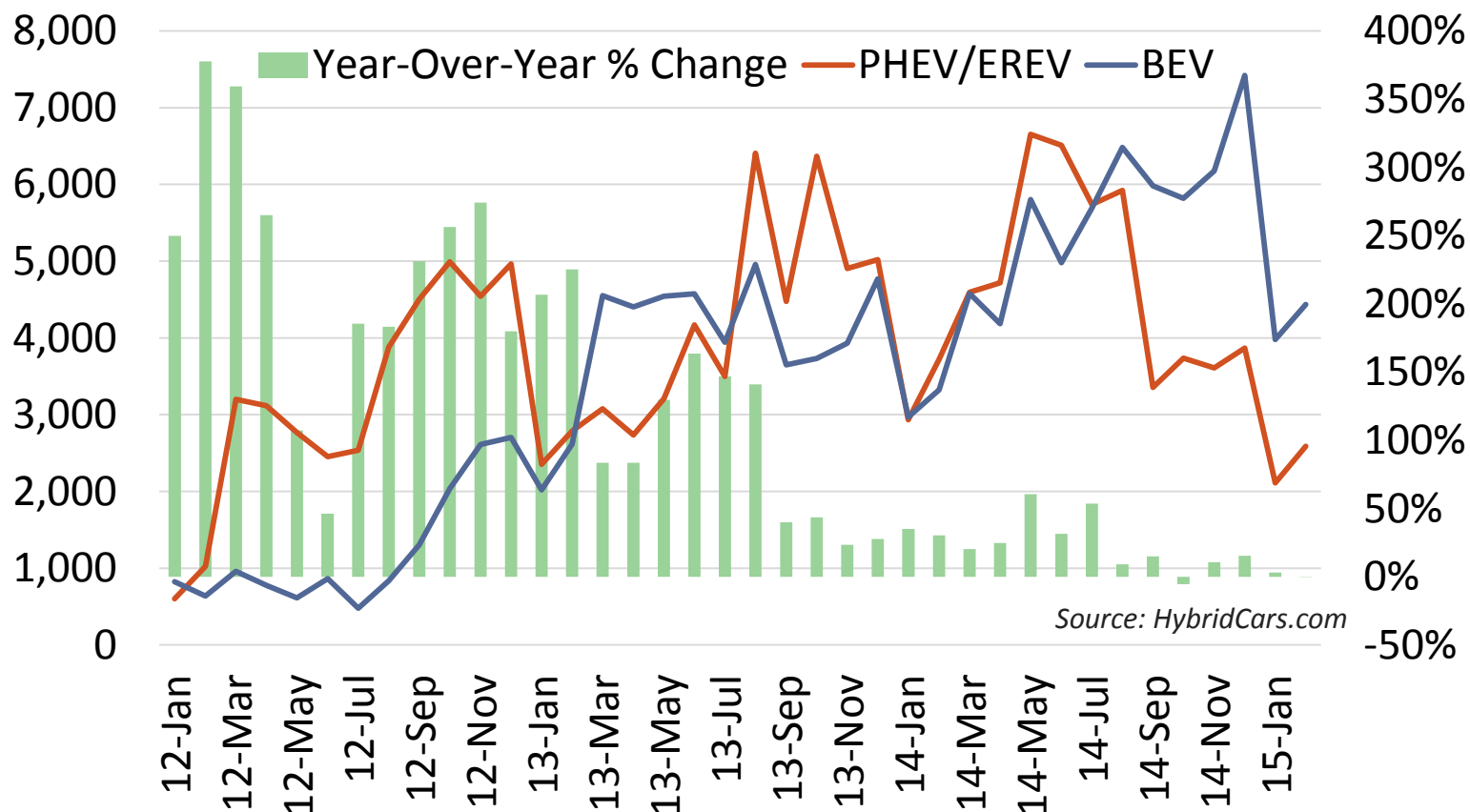
Source: HybridCars.com

# Model Availability from 2010-Present

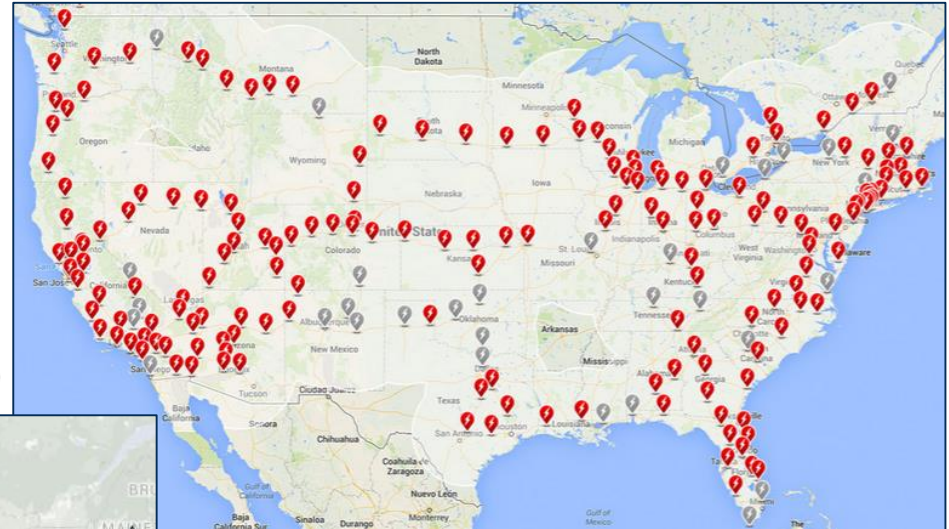




- Annual EV sales growth has flattened, but has not shrunk
- BEVs have gained a noticeable market advantage over PHEVs

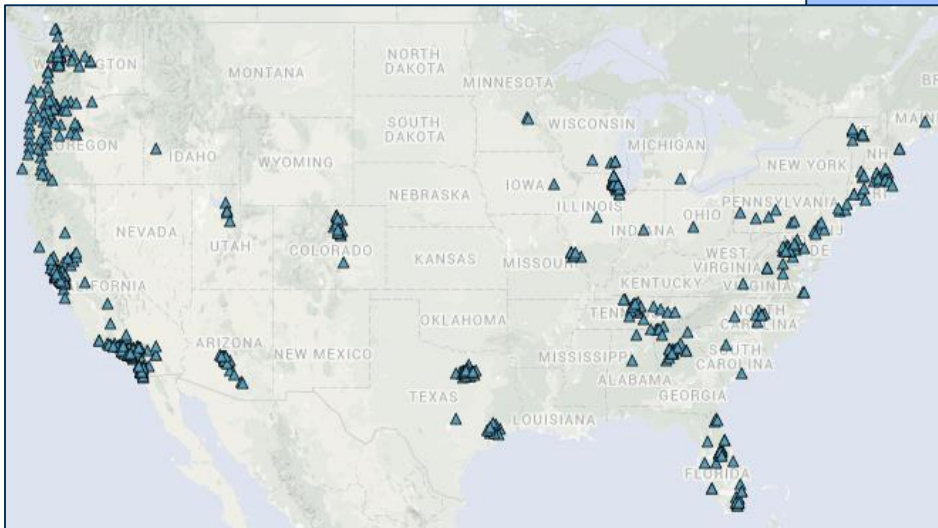


- Automakers have committed to expanding the nation's DC fast-charging network
  - Tesla's network spans the nation
  - BMW, VW, and Nissan will expand charging networks



*Tesla DC Fast Charging Stations (Source: Tesla)*

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



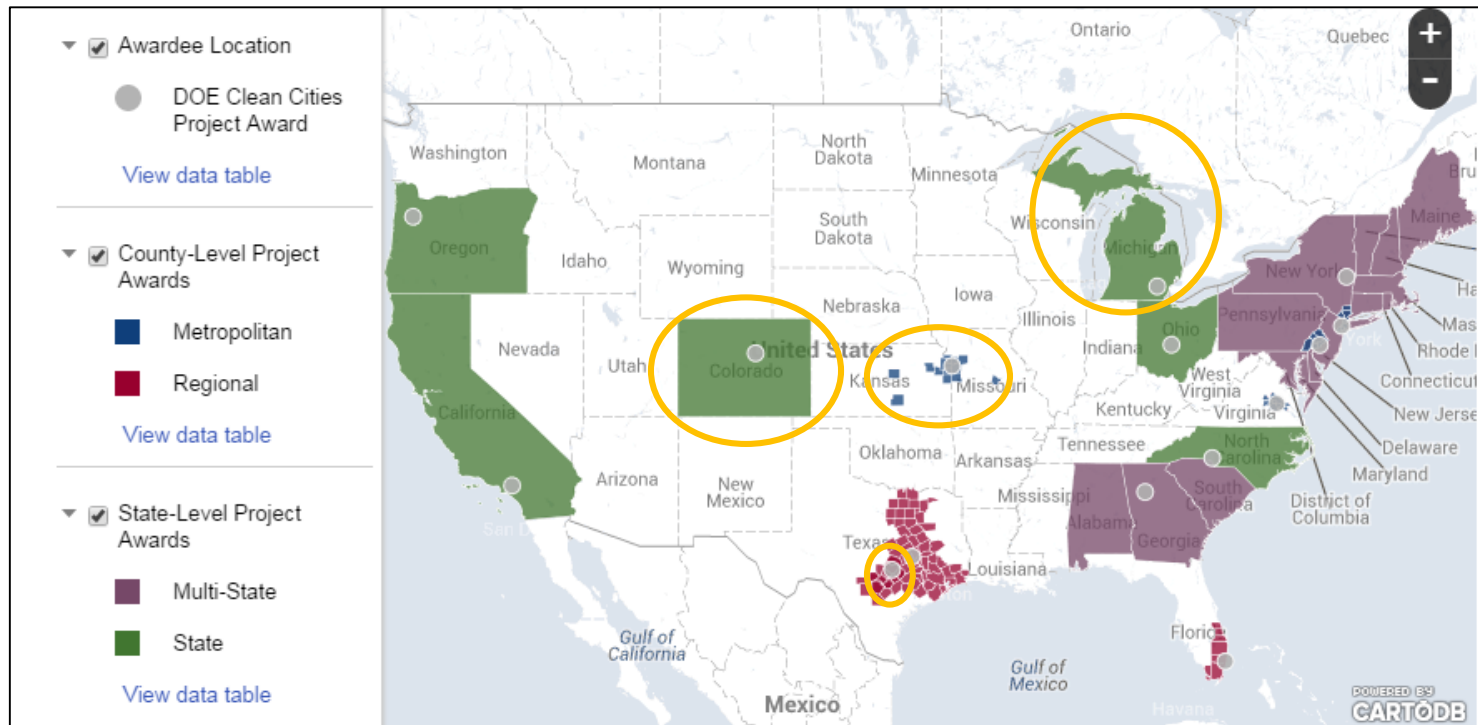
- Utilities are asking regulators for ratepayers to help fund EV infrastructure

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

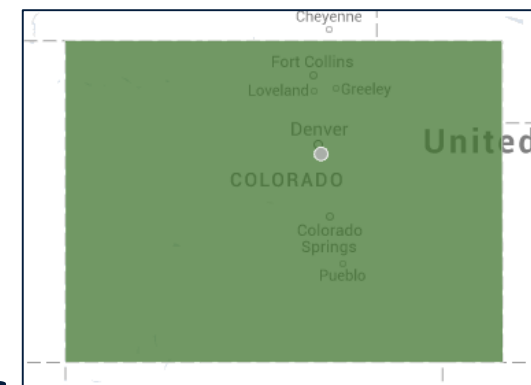
# Lessons Learned from DOE PEV Community Readiness Grant Recipients



- 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**

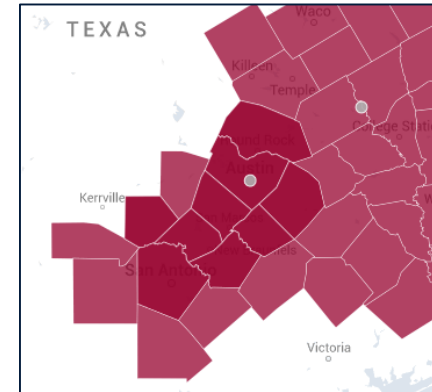
- Working with municipalities to apply for funding through the state-run Charge Ahead program, which covers EV charging infrastructure installation and permitting costs
- Reaching out to consumers through organizations, events, and conferences about the state EV tax credit
- Reaching out to companies 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

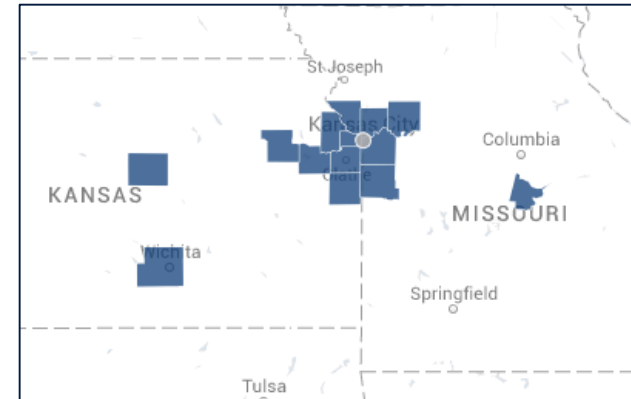
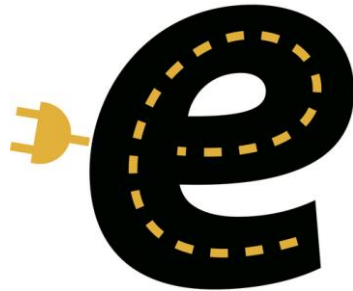
- Engaging with Redevelopment Ready Communities to promote energy efficiency measures such as EV zoning, planning, and policies
- Hosting a series of educational and promotional workshops in targeted high EV density areas
- Promoting municipal ordinance toolkits that reduce the costs of charging infrastructure 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*



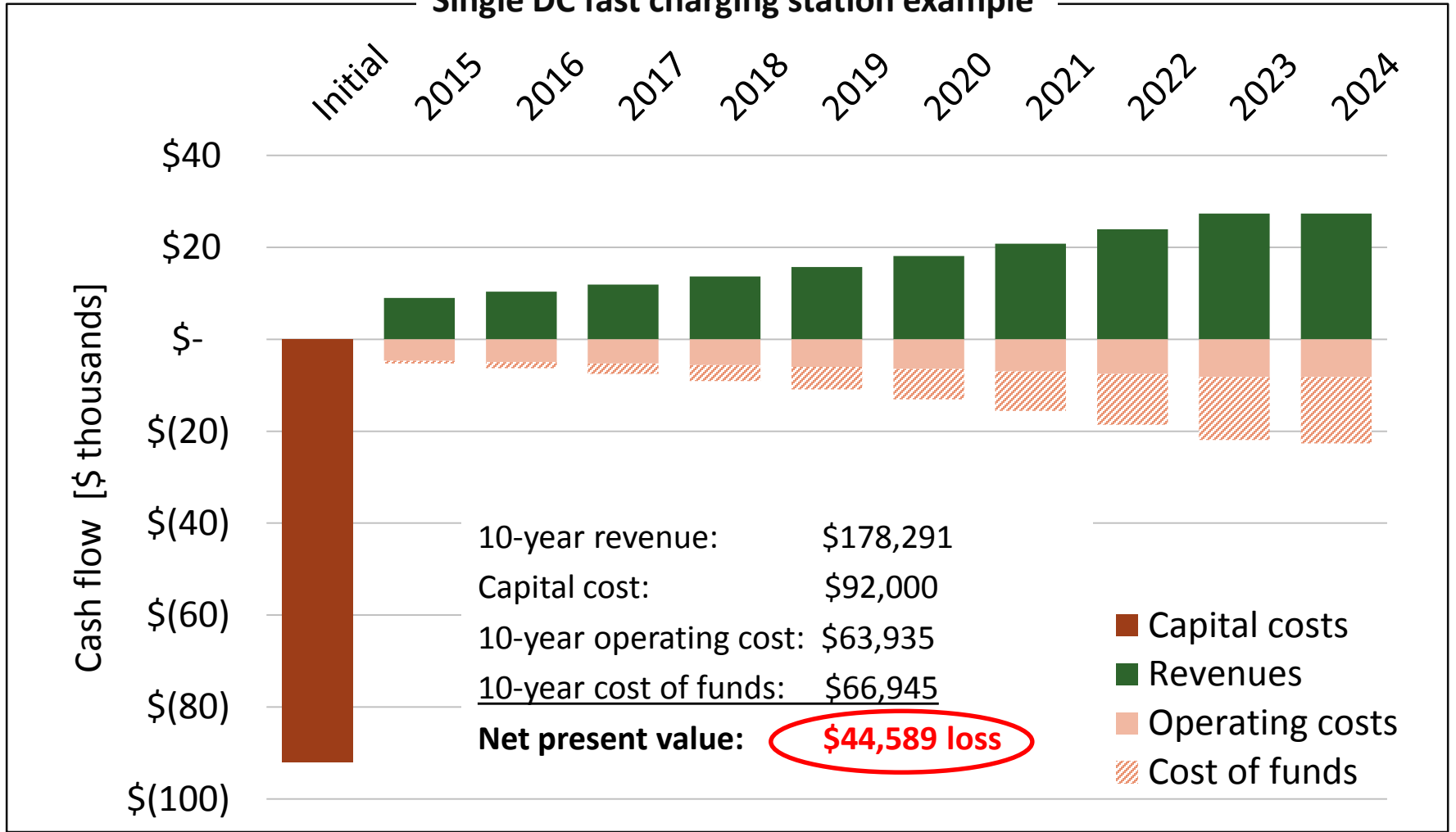
- **NASEO and C2ES, with funding from U.S. Department of Energy's Clean Cities Program, began this project in early 2013**
  - Transportation Energy Partners (TEP), New York State Energy Research and Development Authority (NYSERDA), and Colorado Energy Office are partners on this project
- **Goal: Develop 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](http://www1.eere.energy.gov/cleancities/electric_vehicle_projects.html)

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

- [cleancities.energy.gov](http://cleancities.energy.gov)

- **Alternative Fuels Data Center**

- [www.afdc.energy.gov](http://www.afdc.energy.gov)

- **C2ES Initiatives**

- [www.c2es.org/initiatives/pev](http://www.c2es.org/initiatives/pev)
- [www.c2es.org/initiatives/afv-finance](http://www.c2es.org/initiatives/afv-finance)



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