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New Approaches to Financing the Public EV Charging Network (DRAFT FINDINGS)

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JTC Meeting

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Project Summary and Presentation Overview

- **Goal of this study is to identify sustainable EV charging business models that the private sector can execute**

1. Evaluated existing publicly available charging network in Washington

- Drivers are dependent on public charging (more all-electric than plug-in hybrid vehicles)
- Network concentrated in Puget Sound region and Interstate 5 and many locations are inaccessible to all-electric vehicle drivers

2. Developed and evaluated business models that capture indirect value of charging services

- Established value of charging services for private sector partners
- Illustrated feasibility of business models by applying them to key charging infrastructure gaps
- Business models have potential but need assistance in the short term

3. Identified 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 Timeline

Task 1: Evaluate Current Status of EV Charging in Washington

- Establish a stakeholder network
- Construct Public Charging Network Database
- Create interactive maps for charging suitability assessment
- Provide insights into role of public charging networks in encouraging EVs
- Summarize findings

May – August

Task 2: Develop Business Models

- Leverage C2ES's AFV Finance Initiative
- Conduct Business Model Workshop
- Create 2-3 Business Model Summaries

July – November

Task 3: Identify Public & Private Roles

- Execute financial analysis on business model viability
- Identify public sector role in addressing barriers to private investment

October – December

EV Alphabet Soup

Plug-in Electric Vehicle (PEV)

A vehicle that can be powered by a rechargeable battery pack and connects to the electrical grid

Battery Electric Vehicle (BEV)

- Electric drive vehicle that can only be powered by a battery pack
- Example: Nissan LEAF, Tesla Model S

Extended Range Electric Vehicle (EREV)

- BEV with a backup internal combustion engine powered by gasoline, biofuel, etc. (a.k.a. range extender)
- Example: Chevy Volt

Plug-in Hybrid Vehicle (PHEV)

- Electric and conventional drivetrain in one
- Similar to a Prius with a larger battery pack that can be recharged
- Example: Toyota Prius Plug-in

Understanding Charging Needs

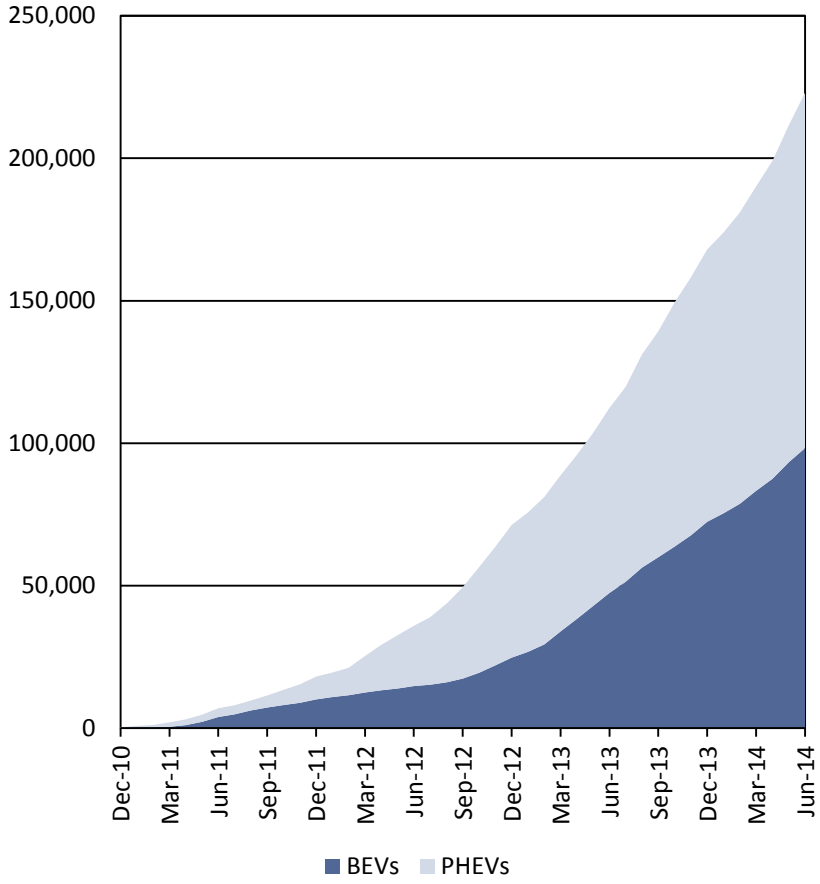
Low – AC 120V *"AC" LEVEL 1*	Medium – AC 240V *"AC" LEVEL 2*	High – DC Fast Charge *"DC" LEVEL 2*
• Uses standard outlet • Power requirements are like a toaster • Adapter comes with the car • Accommodates average daily driving needs • Very low cost installation, often free • *Fully charge a Nissan LEAF: 17 hours*	• Requires high-voltage circuit • Power requirements are like a clothes dryer • Charging stations can cost about $500 • Installation costs vary widely (~$1,500) • *Fully charge a Nissan LEAF in 3.5-7 hours*	• Requires very high voltage circuit & 3-phase power • Power requirements are up to max power for 15 homes • No common standard for electric vehicles (CHAdeMO, SAE, Tesla) • Very high installation cost (~$100k) • Equipment costs vary widely • *80% charge a Nissan LEAF in less than 30 minutes*

Existing Publicly Available Charging Network in Washington

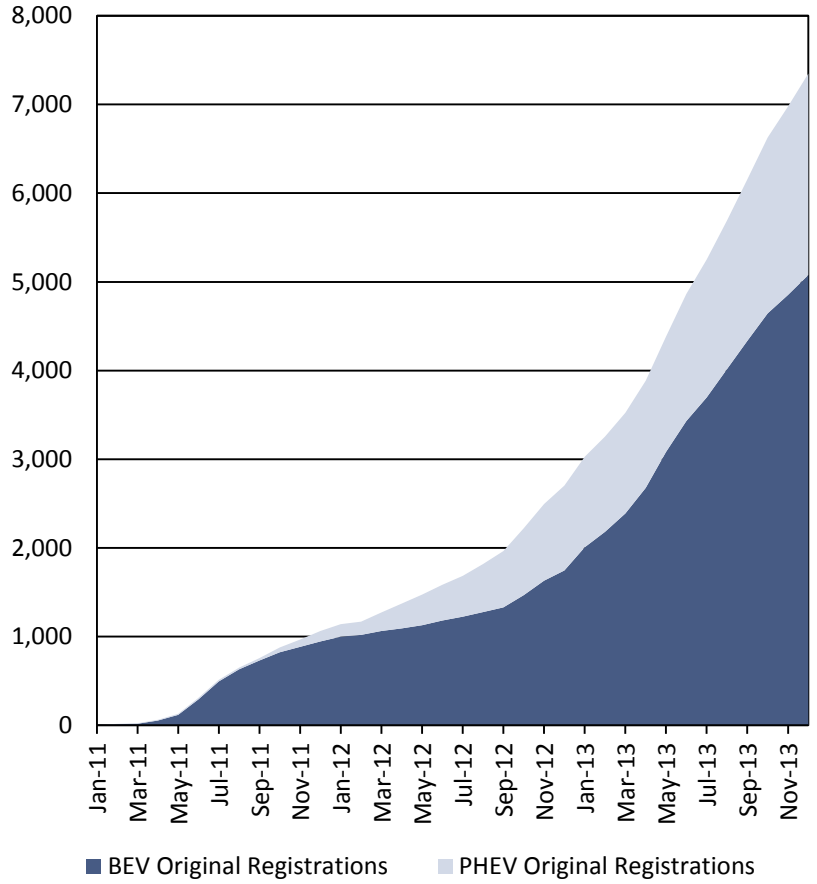
Strong BEV market compared to other states; Many locations are inaccessible to BEV drivers

BEVs are more popular in Washington than elsewhere

Cumulative U.S. Sales of BEVs and PHEVs



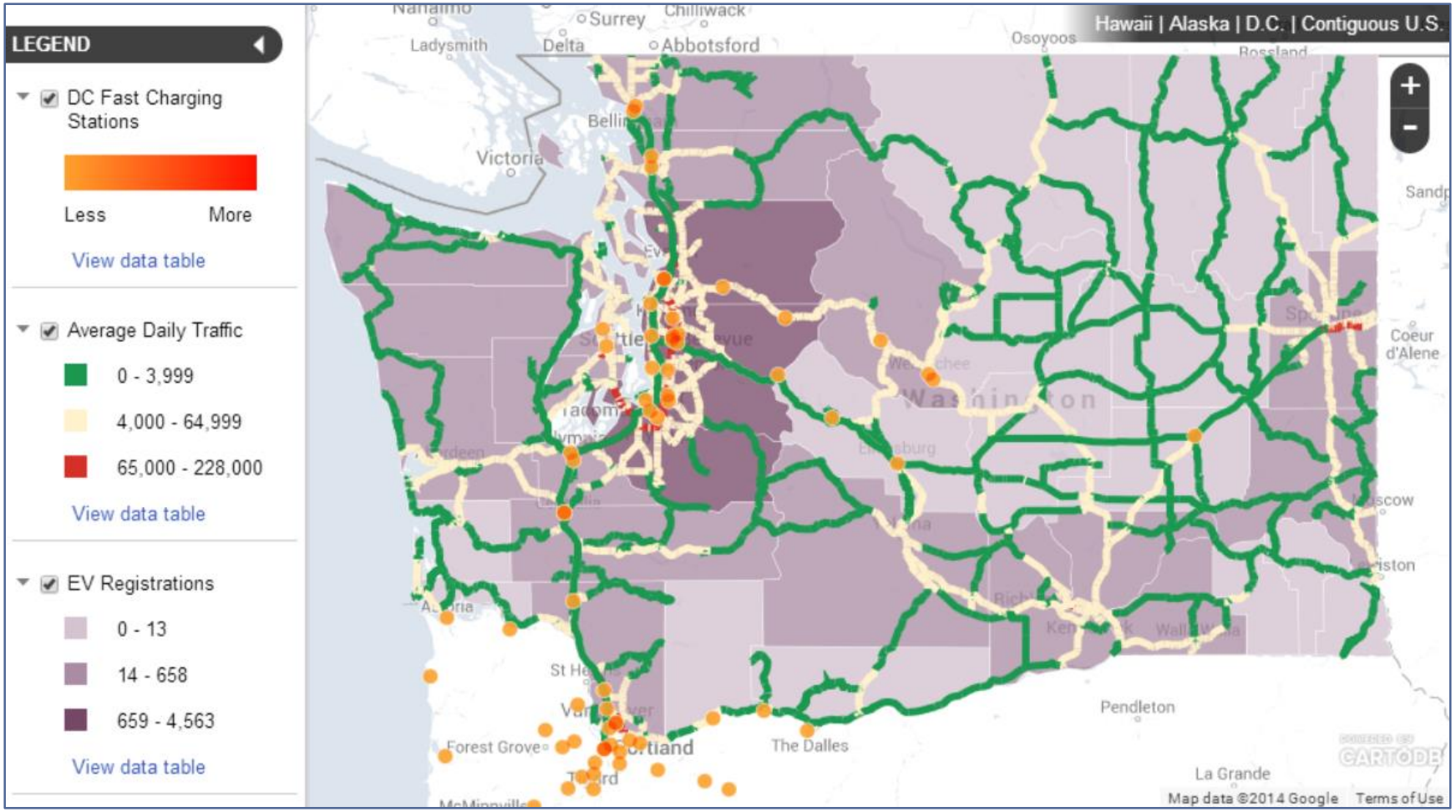
BEVs and PHEVs original registrations in Washington



Understanding EV sales in Washington

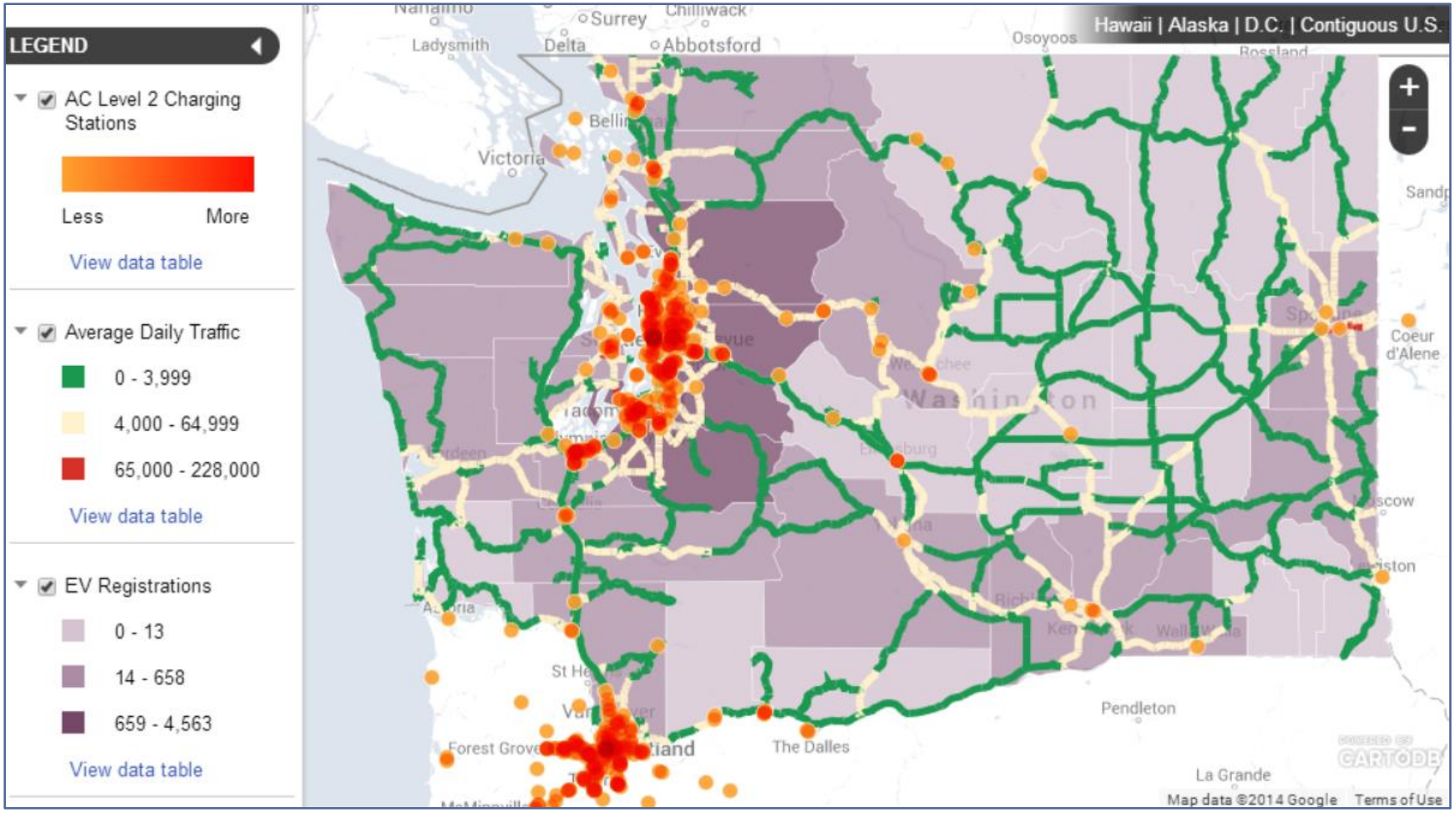
- **Popularity of BEVs over PHEVs could be from incentives**
  - Sales tax exemption provides a "discount" of $3,000 or more at the dealer
  - Automakers have said taking $1,000 off the sticker price increases sales
- **Georgia example**
  - $5,000 income tax credit
  - Atlanta has been Nissan LEAF's largest market for many months
- **Other possible explanations**
  - Consumer preference
  - Dealer incentives
  - Prevalence of public charging
- **Popularity of BEVs affects charging network needs**
  - Drivers more dependent on publicly available charging

DC Fast Charging Network Overview



As of June 2014

Level 2 Charging Network Overview



As of June 2014

Summary of Publicly Available Charging Network Assessment

- **430+ publicly available charging locations in Washington: 400+ Level 2 charging locations and 40 DC fast charging locations**
  - Located mostly in Puget Sound, along I-5, and around Vancouver
  - Also in Ritzville, Wenatchee, Leavenworth, and along SR 2
- **Some corridor travel possible**
  - Bellingham to Vancouver (north to south along Interstate 5)
  - Everett to Wenatchee (west to east along SR2)
  - Seattle to Ellensburg (west to east along Interstate 90)
- **Key charging infrastructure gaps**
  - West to east travel statewide using DC fast charging is not possible
  - No DC fast charging stations in or around Spokane
  - Access to the Pacific coast is limited
  - Segments of I-90, U.S. 395, I-82, and Route 12 have moderate daily traffic (6,000 to over 20,000 vehicles), but have little or no DC fast charging

Filling the Charging Gaps in Washington Requires More Private Investment

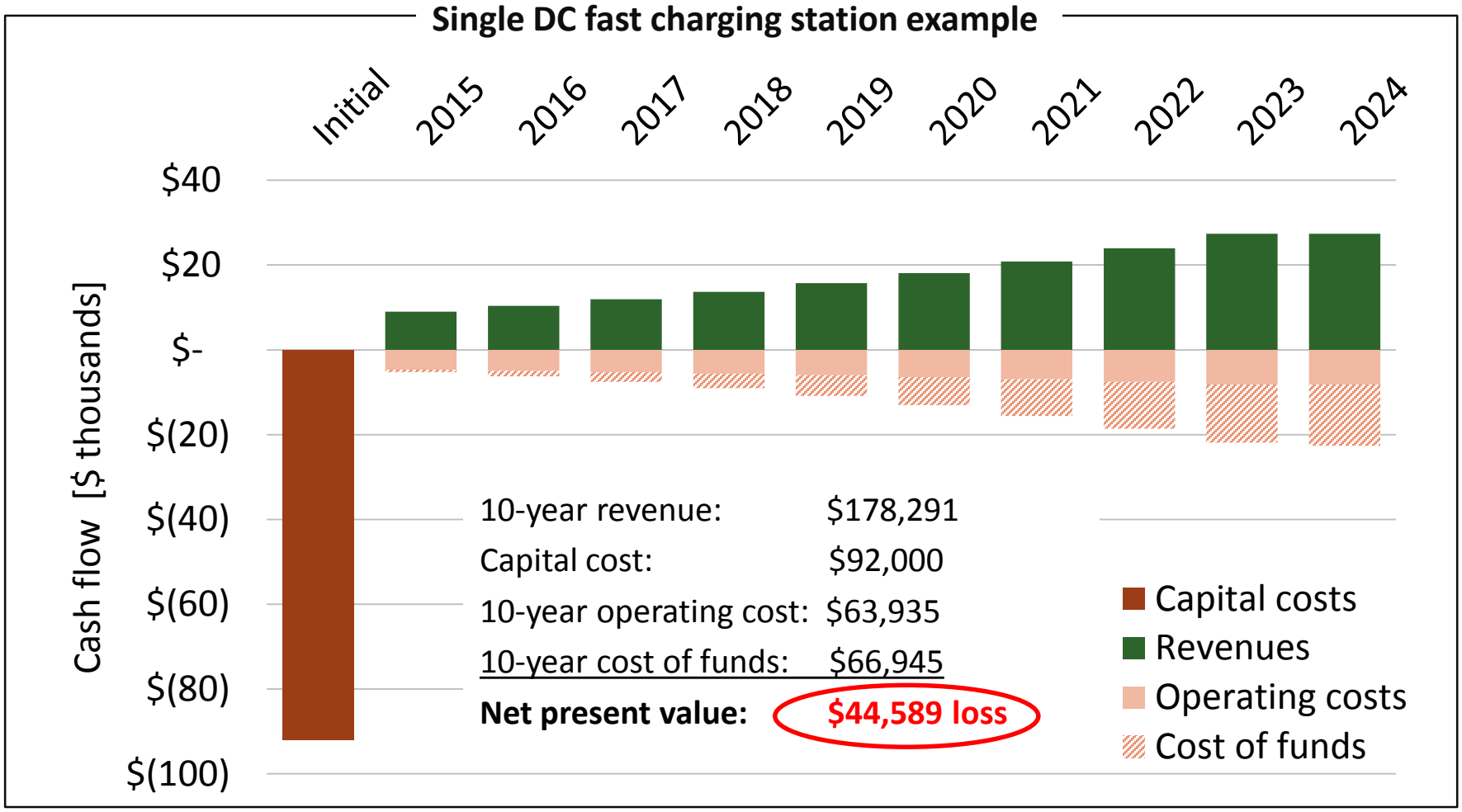
- **For DC fast charging, federal funds were a significant funding source in Washington and around the country**
  - 2009 ARRA programs funded installation of many DC fast charging stations
- **Large, new federal investments in charging infrastructure are very unlikely**
- **EV market needs a robust publicly available charging network to accommodate drivers**
- **Private sector must have a viable business opportunity for it to invest in charging infrastructure**

Business Models that Capture Indirect Value of Charging Services

Capturing indirect value of EV charging service is possible and necessary to increase private sector investment in charging network

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

- **Charging network operates at a loss if selling electricity is only source of revenue**



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**
- **To increase private sector investment, business models are needed that capture the indirect value the private sector gains from EV charging services**
- **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
  - Employee engagement and retention benefits of offering EV charging at the workplace
  - Increased sales of EVs
  - Sales of advertising at EV charging stations
  - "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

Quantifying Sources of Value for Private Sector Partners

- **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 team for financial analysis
  - Use three charging infrastructure gaps identified from charging network assessment

Summary of Private Sector Role

Partner Description	Examples	Upfront Capital Equipment Subsidy	Annual Indirect Revenue Sharing
Directly Benefit from EV Sales	Automakers, Battery Suppliers, etc.	$7,000 for DC fast charging station; $500 for Level 2 station	N/A
Directly Benefit from Charging Use	Investor-Owned Utilities or Private Power Generators	$2,000 for DC fast charging station; $450 for Level 2 station	N/A
Indirectly Benefit from Charging Use	Restaurants, Hotels, etc.	N/A	10% of attributable sales revenue

Analyzing Viability of Charging Station Projects with Financial Analysis Tool

- **A charging station project can involve multiple partners with different roles:**

Owner Operator	Private Sector Partner(s)	Public Sector Partner
• Organization that owns and operates charging station equipment • Receives direct revenue from charging	• Organization(s) that receive indirect revenue from charging stations • May share revenue or subsidize installation or operation	• Public sector may provide support for project in form of loans, grants, or other means

Business Model 1: Business Funding Partners for Charging Network Development along Major Roadways

- **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
  - Electric utilities
  - Retail chains
  - 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 1: 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
Owner/operator	
Funds spent on stations (equity)	$224,640
Funds spent on stations (loans)	$336,960
NPV	–$118,207
Payback period	No payback
Funding partner	
Amount of funds transferred to owner/operator	$42,000
NPV	+$19,532
Payback period	5 years
Total project level	
Total capital investment (spent on charging station deployment)	$561,600
NPV	-$87,777
Payback period	No payback

Business Model 2: Funding Pools for Charging Network that Enables EV Travel to Tourism & Employment Regions

- **Value Proposition**
  - Businesses that benefit from tourism destination or employment region establish a funding pool that subsidizes capital cost of deploying a charging network for EV travel to and within the region
- **Sources of indirect value**
  - Increased sales of other products and services at businesses located near EV chargers
  - Increased tourism business from EV travel to popular destinations
  - Employee engagement and retention benefits of offering EV charging at the workplace
- **Candidate funding partners likely smaller local businesses, such as:**
  - Hotels
  - Retailers
  - Restaurants
  - Tourist attractions
  - Commercial real estate owners
  - Employers
- **Local businesses contribute to an annual funding pool that is transferred to the charging station owner operator**

Charging Gap: Enable EV Travel to and within Ocean Shores

- **Ocean Shores is a popular destination due to its coastal tourism, convention centers, casino, and other attractions**
- **DC fast charging station availability is insufficient to enable BEV travel to Ocean Shores from inland, populated areas**
- **No publicly available DC fast charging or Level 2 charging stations available to enable BEV travel within the destination region**
- **Filling the Charging Gap:**
  - 3 DC Fast Charging Stations
  - 25 Level 2 Charging Stations

Business Model 2: Financial Analysis Shows Positive NPV but Return May Be Too Far Into the Future

- **With annual revenue transfers from local businesses, the Ocean Shores network makes money, but a 6 or 9 year payback may be too long for most private investors**

Financial Metric	Result
Owner/operator	
Funds spent on stations (equity)	$200,600
Funds spent on stations (loans)	$300,900
NPV	+$49,439
Payback period	9 years
Funding pool	
Amount of funds transferred to owner/operator annually	$28,000 - $84,125
NPV	+$206,566
Payback period	1 years
Total project level	
Total capital investment (spent on charging station deployment)	$501,500
NPV	+$292,320
Payback period	6 years

Business Model 3: Large Funding Partner & Funding Pools for Charging Network that Enables EV Travel to Tourism & Employment Regions

- **Value Proposition**
  - A large funding partner subsidizes deployment of a DC fast charging network for interregional EV travel
  - Businesses located in popular tourism destination or employment region contribute to funding pool that subsidizes cost of deploying a charging network for EV travel to and within the region
- **Candidate funding partners are a large business and small, local businesses**
- **Funding Summary**
  - Upfront transfer of funds from a large business to charging station owner operator
  - Local businesses contribute to an annual funding pool that is transferred to the charging station owner operator

Charging Gap: Enable EV Travel to and within Tri-Cities and Walla Walla

- **Demand for EV charging services may be relatively high to and within these tourism and energy employment destinations**
- **DC fast charging station availability is insufficient to enable BEV travel to Tri-Cities and Walla Walla from Seattle and Spokane and Level 2 charging is very limited in these cities**
- **Filling the Charging Gap: 10 DC Fast Charging Stations and 50 Level 2 Charging Stations**

Business Model 3: Financial Analysis Shows Positive NPV but Return May Be Too Far Into the Future

- **With subsidies from both automakers and local businesses, the Tri Cities/Walla Walla network makes money, but a 9 year payback period may be too long to attract private investors**

Financial Metric	Result
Owner/operator	
Funds spent on stations (equity)	$553,640
Funds spent on stations (loans)	$830,460
NPV	+$54,166
Payback period	9 years
Funding partner/pool	
Amount of funds transferred to owner/operator initially	$95,000
Amount of funds transferred to owner/operator annually	$56,000 - $168,250
NPV	+$457,312
Payback period	2 years
Total project level	
Total capital investment (spent on charging station deployment)	$1,384,100
NPV	+$513,518
Payback period	6 years

Business Model Analysis Summary and Findings

- **Analysis included no public sector interventions**
- **Under current market conditions, unlikely that business models will be implemented by private sector alone**
  - Only providing an upfront cost subsidy to owner operator (Business Model 1) does not yield a positive NPV
  - Retailers sharing revenue with owner operator achieves payback (Business Models 2 and 3), but is likely too long for private sector
- **Sensitivity analyses show that business models hold promise**
  - Business Model 1 can become NPV positive if initial utilization is 75% higher than expected, resulting in higher charging service revenue
  - Business Models 2 and 3 can approach 5-year payback if initial utilization is 65% higher than expected, resulting in higher charging service revenue

Short-term Public Sector Interventions Enable Private Sector Partners to Implement Business Models

- Private sector business models could be sustainable after 5 years if public sector intervenes in near term
- This public sector intervention is critical for two reasons:
  - To help private sector expand charging network in near term
  - To sustain EV market growth, so public subsidies are no longer required as station utilization grows and equipment costs decline

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

Summary of Public Sector Interventions

- **Interventions that directly affect financial performance**
  - Low-interest loan
  - Grant
- **Interventions that indirectly affect financial performance through higher utilization or lower upfront costs**
  - Extending BEV sales tax exemption
  - Consumer education
  - Zero Emission Vehicle (ZEV) program
  - Building codes
  - Shared-use EV charging stations

Public Sector Intervention Summary

Low-Interest Loan	• Finance 50% of project debt at 5.4% interest rate (equal to cost of funds) or 30% of total project capital costs
Grant	• Subsidize cost of charging station equipment by 50%
Extending BEV Sales Tax Exemption	• Increase charging station utilization growth rate from 15% to 22%
Consumer Education	• Increase charging station utilization growth rate from 15% to 18%
ZEV Program	• Increase charging station utilization growth rate to 15% to 30%
Building Codes	• Subsidize 50% of cost of grid interconnection for DC fast charging; subsidize 50% of installation cost
Shared Use EV Charging Stations	• Increase initial charging station utilization level by 30%; increase maximum utilization level by 10%

Combination of Public Sector Interventions

- **It will likely take a combination of public sector interventions in order to make the business models viable in the near term**
- **If near term interventions help EV market to develop, then the business models may be viable without additional public sector interventions for projects that begin 5 years in the future**
  - Station utilization growth due to more EVs on the road
  - Lower DC fast charging station equipment costs due to increased scale and competition

Business Model 1: I-90 Charging Gap, Near Term

- **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

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

Business Model 1: I-90 Charging Gap, 5 Years from Now

- ***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

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

Business Model 2: Ocean Shores Charging Gap, Near Term

- **Public Sector Interventions**
  - Low-Interest Loan: $150,000 at 5.4%, 10 year term
  - Grant: $85,000
  - Extension of BEV sales tax exemption
- **Project Capitalization**
  - Total project cost = $501,500
    - 23% owner-operator equity
    - 30% private loans
    - 30% public loans
    - 17% public grant
  - Local business funding pool contributes $28k - $84k annually

Financial Performance

Owner/operator	
NPV	+$213,107
Payback	5 years
Funding pool	
NPV	+$236,304
Payback	<1 year
Public sector	
NPV	–$83,750
Payback period	n/a
Total project level	
NPV	+$418,851
Payback period	6 years

Business Model 2: Ocean Shores Charging Gap, 5 Years from Now

- ***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 = $481,275
    - 40% owner-operator equity
    - 60% private loans
  - Local business funding pool contributes $62k - $84k annually

Financial Performance

Owner/operator	
NPV	+$347,310
Payback	3 years
Funding pool	
NPV	+$327,135
Payback	<1 year
Public sector	
NPV	n/a
Payback period	n/a
Total project level	
NPV	+$728,746
Payback period	2 years

Business Model 3: Tri-Cities/Walla Walla Charging Gap, Near Term

- **Public Sector Interventions**
  - Low-Interest Loan: $415,000 at 5.4%, 10 year term
  - Grant: $240,000
  - Extension of BEV sales tax exemption
- **Project Capitalization**
  - Total project cost = $1,384,100
    - 23% owner-operator equity
    - 30% private loans
    - 30% public loans
    - 17% public grant
  - Private sector partner (automaker) contributes $95,000 up front
  - Local business funding pool contributes $56k - $168k annually

Financial Performance

Owner/operator	
NPV	+$886,073
Payback	6 years
Funding partner/pool	
NPV	+$516,792
Payback	2 years
Public sector	
NPV	-$237,500
Payback period	n/a
Total project level	
NPV	+$886,073
Payback period	6 years

Business Model 3: Tri-Cities/Walla Walla Charging Gap, 5 Years from Now

- ***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 = $1,308,030
    - 40% owner-operator equity
    - 60% private loans
  - Private sector partner (automaker) contributes $95,000 up front
  - Local business funding pool contributes $124k - $168k annually

Financial Performance

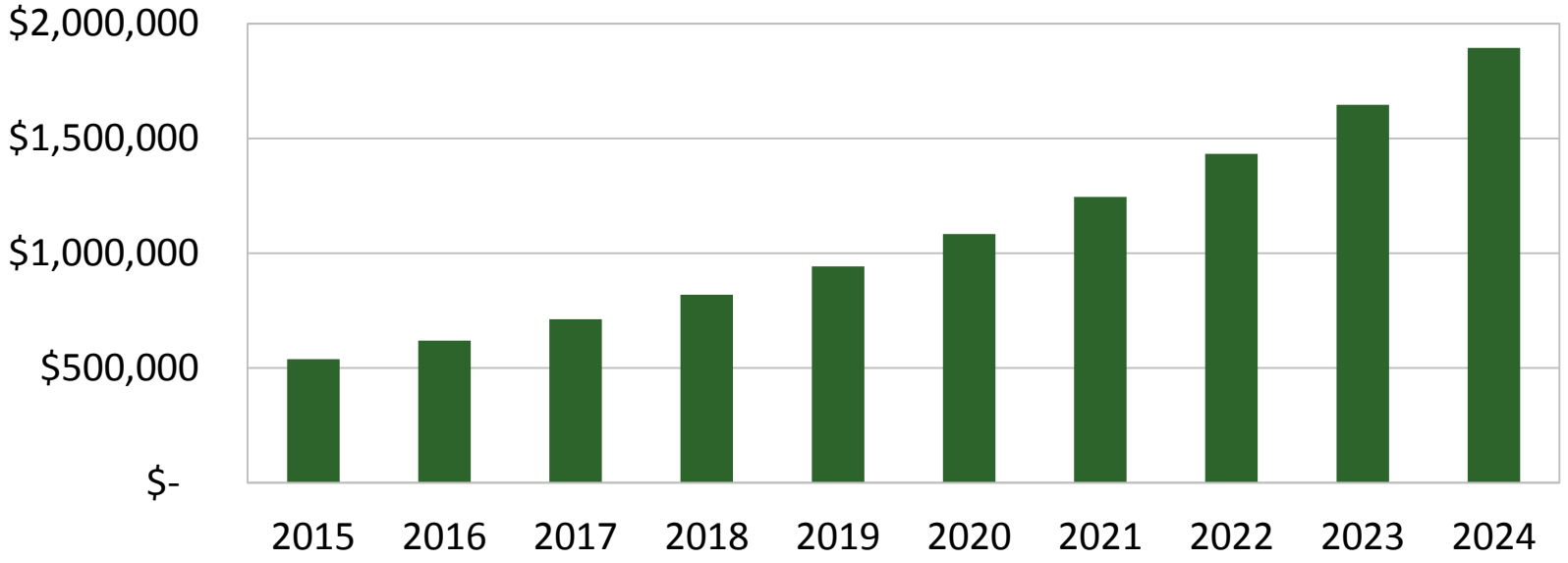
Owner/operator	
NPV	+$805,762
Payback	3 years
Funding partner/pool	
NPV	+$698,446
Payback	<1 year
Public sector	
NPV	n/a
Payback period	n/a
Total project level	
NPV	+$1,630,710
Payback period	2 years

Potential Revenue Sources for Near Term Public Sector Interventions

- **EV-driver based revenue sources**
  - Increase annual registration fee for EVs
  - Dedicate portion of sales tax exemption revenue
- **Federal transportation funding**
  - Congestion Mitigation and Air Quality Improvement Program ($2.2 billion annually)
  - Surface Transportation Program ($10 billion annually)
- **State transportation funding**

Revenue Example: EV Registration Fee Increase

- **Calculate additional public sector revenue from increasing annual EV registration fee from $100 to $150**
  - Assume annual EV growth of 15%
  - Generate additional $1.9 million annually by 2024 if fee increased $50 per year
  - Generate additional $400,000 annually by 2024 if fee increased only $10 per year



Key Findings

- **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
- **If government decides to play an active role in expanding private sector investment in EV charging infrastructure, funding sources must be considered**
  - EV registration fee increases, EV sales tax revenues, and state and federal transportation funding sources

Acknowledgments

- EV Advisory Panel
- EV Staff Workgroup
- Project partner Cadmus Group

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