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Unlocking Private Sector Financing for Alternative Fuel Vehicles and Fueling Infrastructure

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Findings Workshop

CENTER FOR CLIMATE AND ENERGY SOLUTIONS

C2ES.ORG

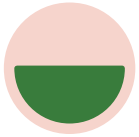
Project Overview

- **Partners: NASEO, C2ES, Transportation Energy Partners, and VEIC collaboration**
- **Funder: U.S. Department of Energy's Clean Cities Program**
- **Goal: develop innovative finance mechanisms to accelerate AFV deployment**

Alternative Fuel Vehicle & Fueling Infrastructure Deployment Barriers

Barriers to deployment of electric, natural gas, and hydrogen fuel cell vehicles and fueling infrastructure

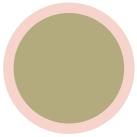
Potential role of private sector financial solutions



Case Studies on Natural Gas Vehicle Fleets and Electric Vehicle Charging

Applying the energy service company model to advance deployment of fleet natural gas vehicles and fueling infrastructure

The role of clean energy banks in increasing private investment in electric vehicle charging infrastructure



Strategic Planning Guides

Electric vehicle charging and natural gas vehicle fleets

Key factors that affect financial performance

Business model application to a particular market

Implementation guidance for policymakers and businesses

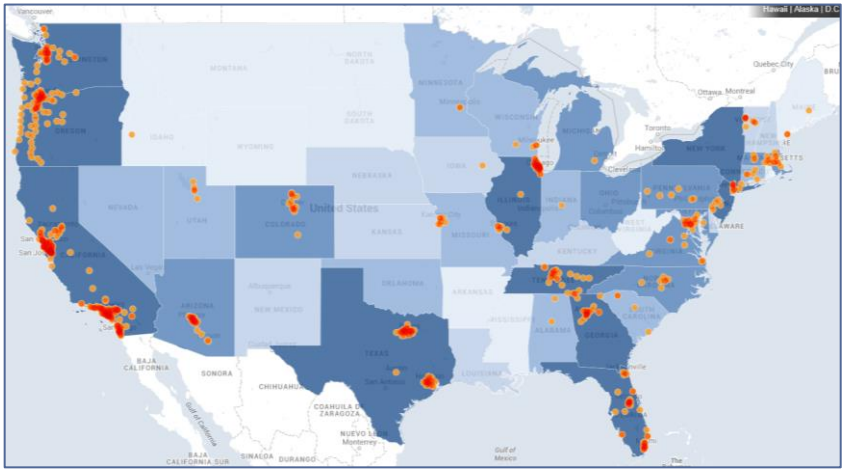
Complementary Project for Washington State Legislature: Business Models for Financially Sustainable EV Charging Networks. More info at www.c2es.org/initiatives/afv-finance

- **Findings indicate greater private investment is possible with near-term public support**
- **Key Strategic Questions to Assess the Financial Viability of EV Charging**

1. What are the key market factors that could affect an EV charging project's financial viability?
2. How do upfront costs and uncertainty about station utilization impact project viability and investor decisions?
3. Are there business models that can improve the financial viability of publicly available charging projects?
4. Can the federal, state, and local government sectors improve the financial viability of publicly available charging stations in the near term, resulting in more private investment in the medium term?

Charging locations Must Complement Existing Charging Networks

- Installing DC fast charging stations along travel corridors could enable all-electric vehicle drivers to expand travel ranges and access tourist destinations



- Market opportunity could exist for Level 2 charging stations to serve neighborhoods with higher EV populations

ZIP Codes around Seattle with More than 50 EVs and No Public Level 2 Charging Stations

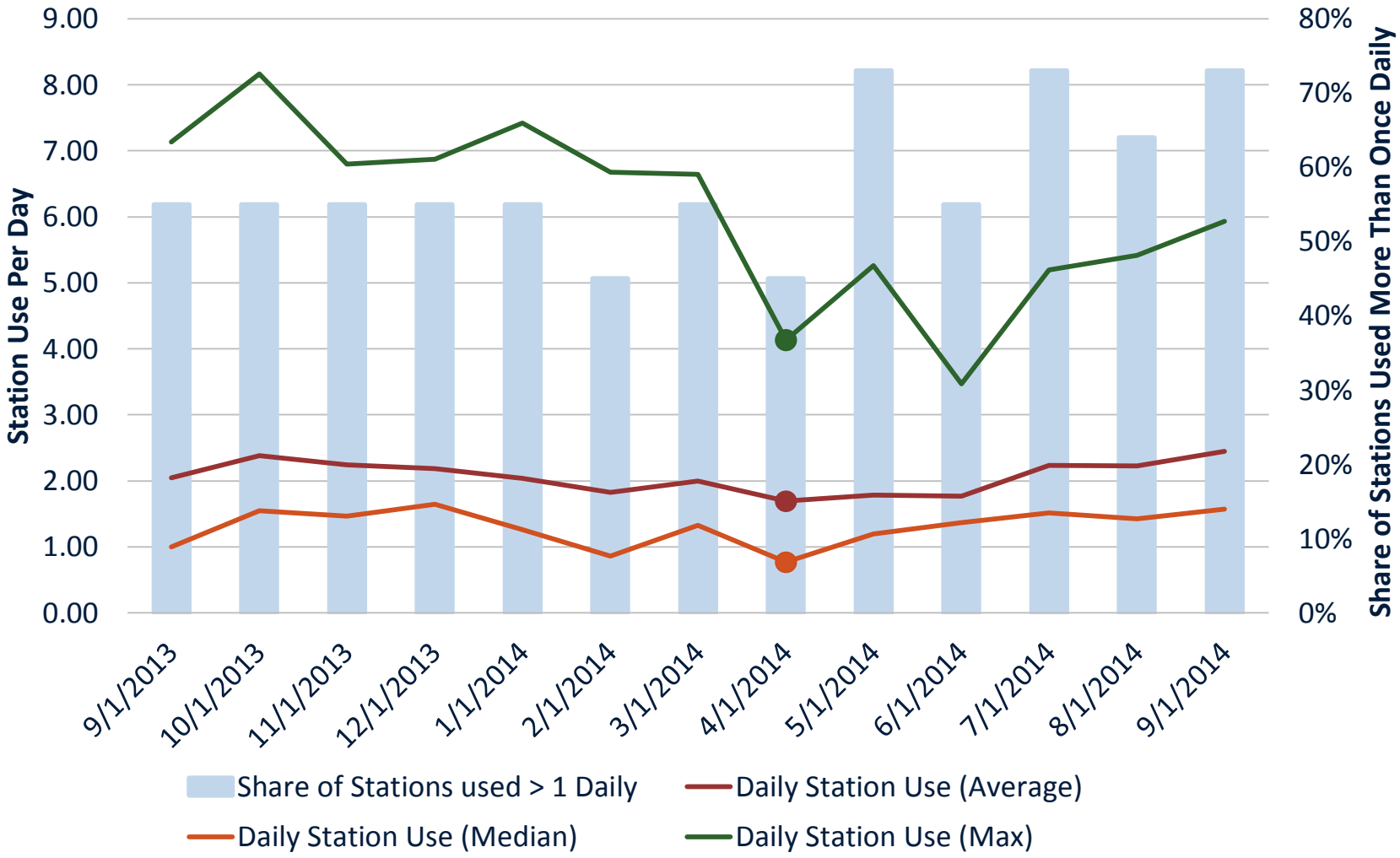
Public Charging Equipment Has High Upfront Costs

- **Public charging costs more than residential charging**
  - Can require trenching, extensive wiring, or pavement replacement
  - Must comply with regulations to serve public
  - Often provide access to a charging network
  - Must be designed and manufactured to withstand significant wear and tear
- **DC fast charging costs can include:**
  - Labor, electric-panel upgrades, host-site identification, analysis, and screening; negotiation, legal review, permitting, and execution of lease; and electric utility interconnection fee

Project Description	DC Fast Charging Installation Cost per Station
Washington West Coast Electric Highway	$49,000 to $61,500
EV Project (average)	$20,848
EV Project (median)	$20,188
EV Project (highest)	Over $45,000
Orlando Utilities Commission	$6,939 to $8,928

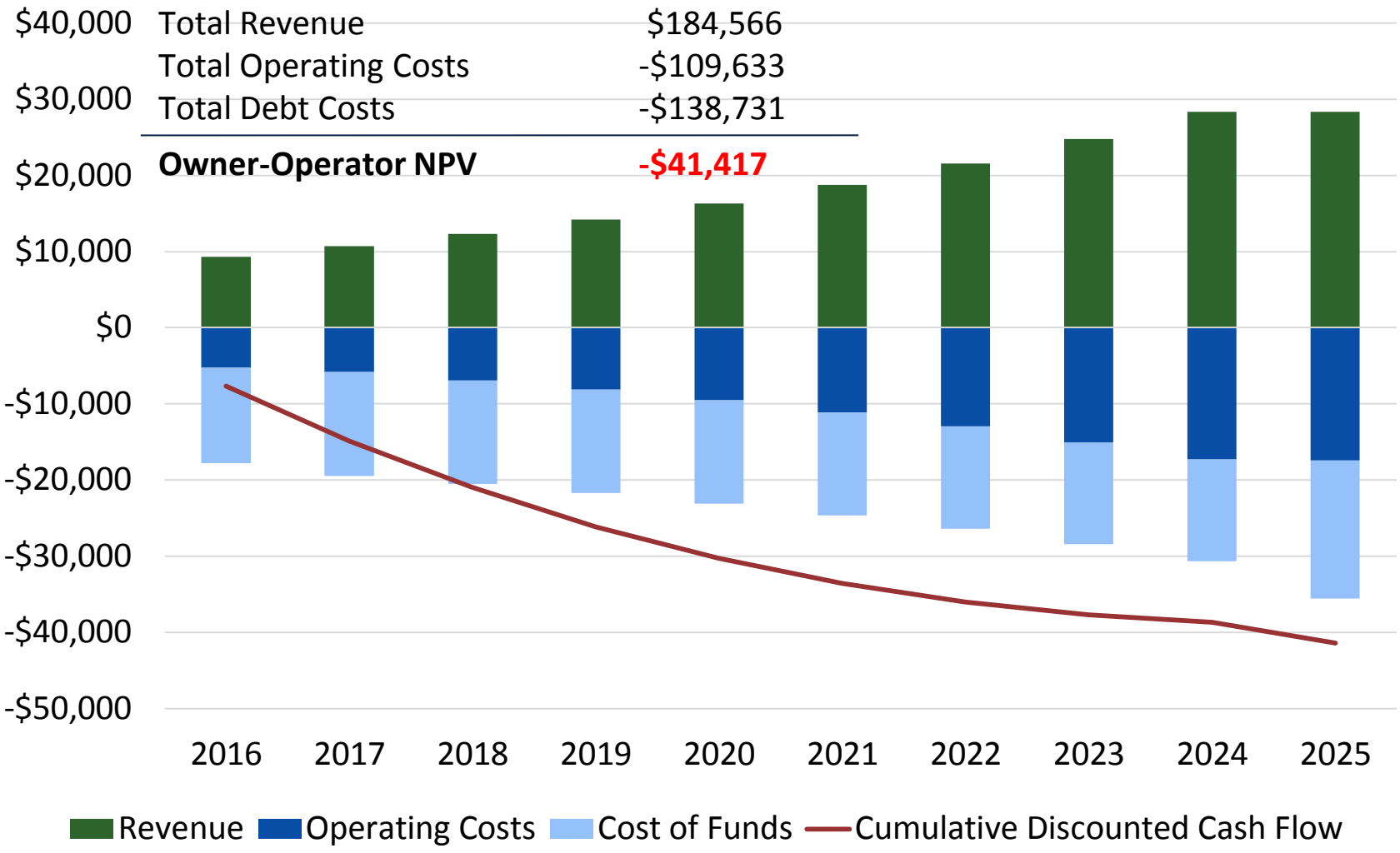
Source: Idaho National Laboratory and Washington State Department of Transportation, Orlando Utilities Commission, 2014.

DC Fast Charging use on West Coast Electric Highway in WA Before/After Pricing was Introduced (April 2014)



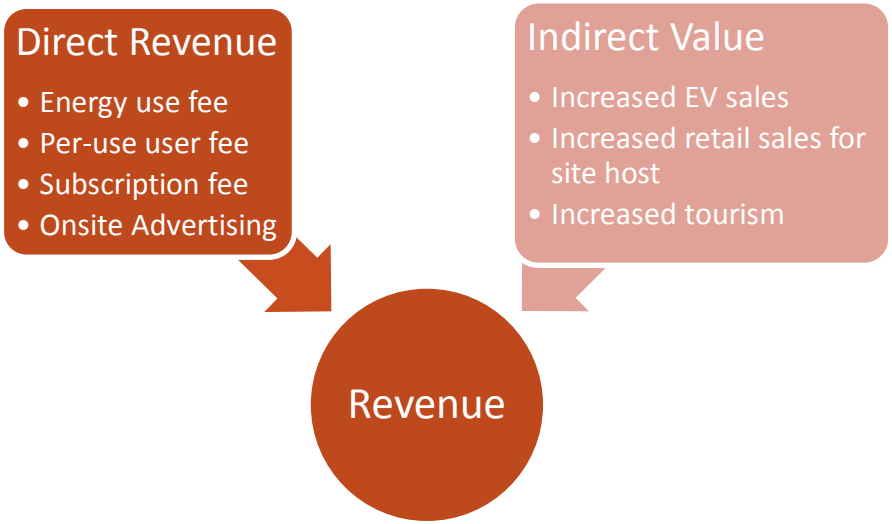
Source: Washington State Department of Transportation, 2014.

Discounted Cash Flow of DC Fast Charging Station Project in New York



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

- **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 deploy stations

Business Models that Capture Indirect Value of EV Charging Services

Sales Boost Business Model Example: Automaker Invests in a Charging Network

- **Value Proposition**
  - Automaker benefits from expanded access to EV charging infrastructure through increased EV sales
- **Form of funding**
  - Automaker directly transfers funds upfront to the charging station owner-operator
- **Target market for charging services**
  - All-electrics taking interregional trips that are longer than the expected range of their vehicles

Revenue Share Business Model Example: Local Businesses Pool Funds to Invest in a Charging Network

- **Value Proposition**
  - Businesses value increased sales from on-site charging
  - Clean energy marketing opportunities
- **Form of funding**
  - Local business funding pool
  - Annually transfer to owner-operator
- **Target market for charging services**
  - All-electric vehicles taking trips to tourism destinations
  - Plug-in hybrids at tourism destinations

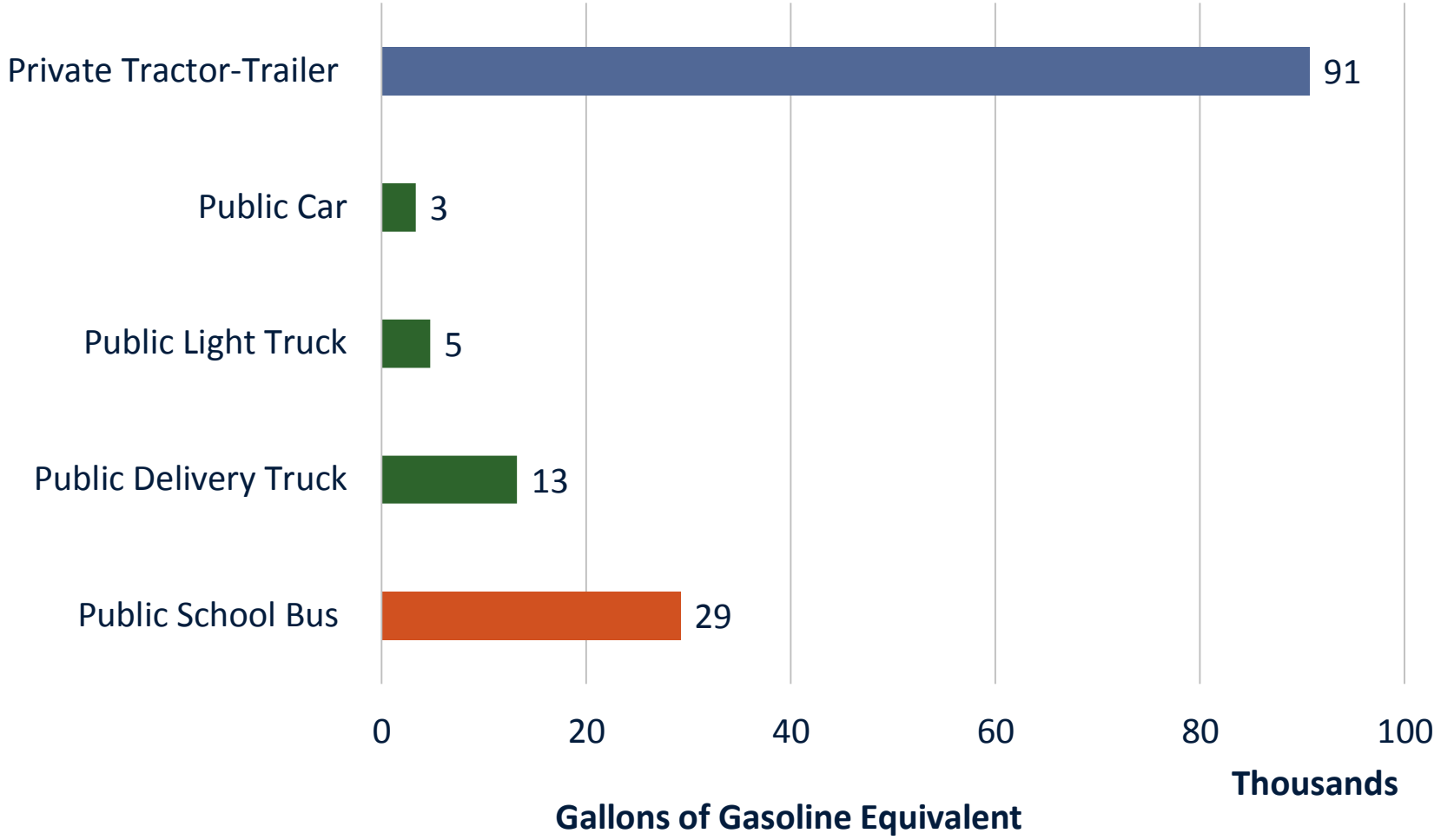
Summary of Key Findings for Public EV Charging

- **Private sector entities that gain indirect value from EV charging station deployment can play a critical role in improving the financial performance of EV charging stations**
- **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 could be scaled down to virtually nothing in 5 years

- **Findings indicate many opportunities for applying ESCO-like model in public and private fleets**
- **Key Strategic Questions to Assess the Benefits and Viability of NGV Fleets**

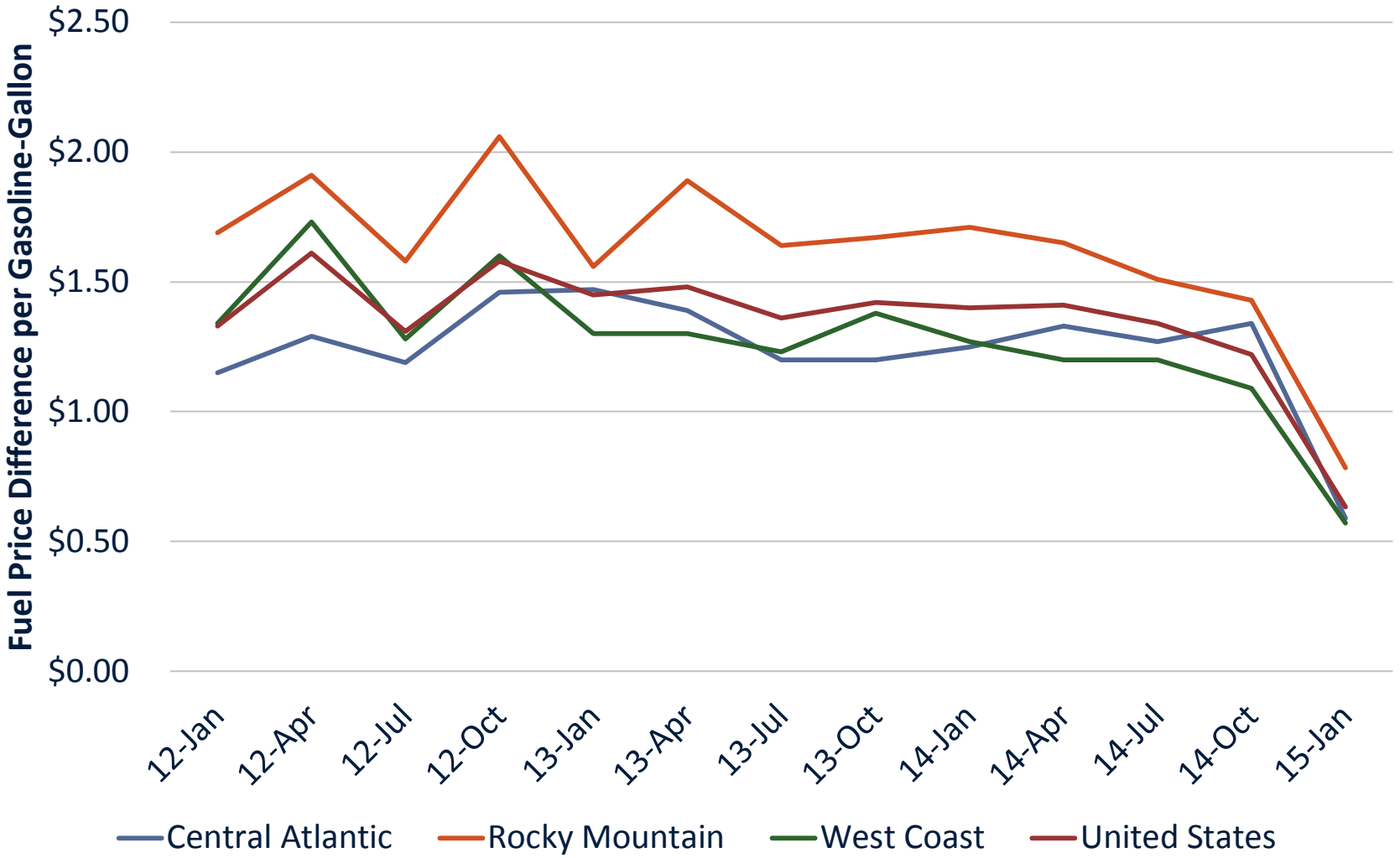
1. What is the potential to reduce petroleum use and emissions by incorporating NGVs into fleets?
2. What key factors affect the financial performance of NGV fleets?
3. Under what conditions will NGV fleet projects result in net cost savings and is there value to having energy service provider help with the transition?
4. What is the role of an energy service provider in facilitating NGV deployment?

Per-Vehicle Lifetime Average Petroleum Use Displacement (2012)



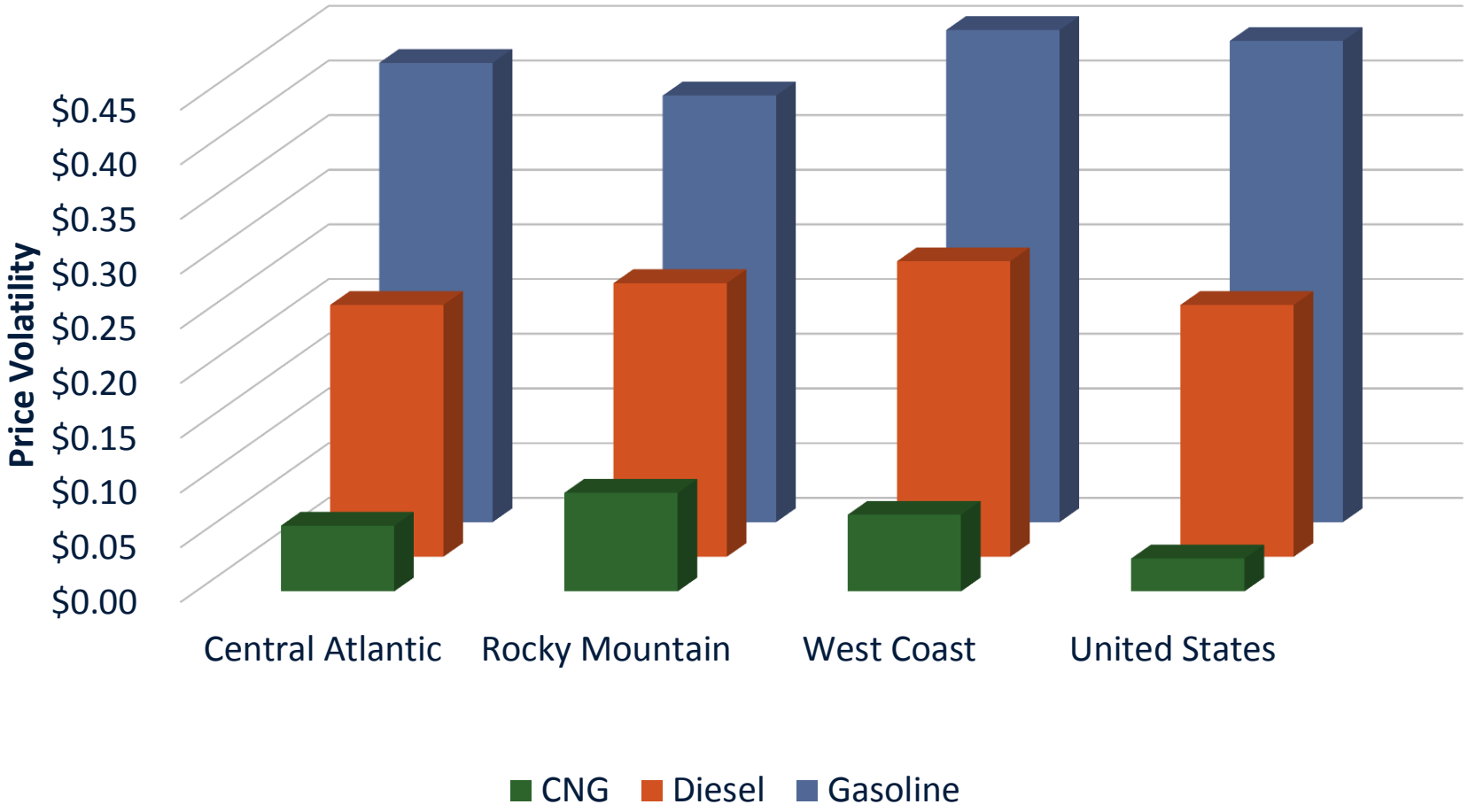
Source: American School Bus Council, U.S. EIA, FHWA, FHWA, VICE Model

Diesel-CNG Fuel Price Difference per Gallon from January 2012 to January 2015



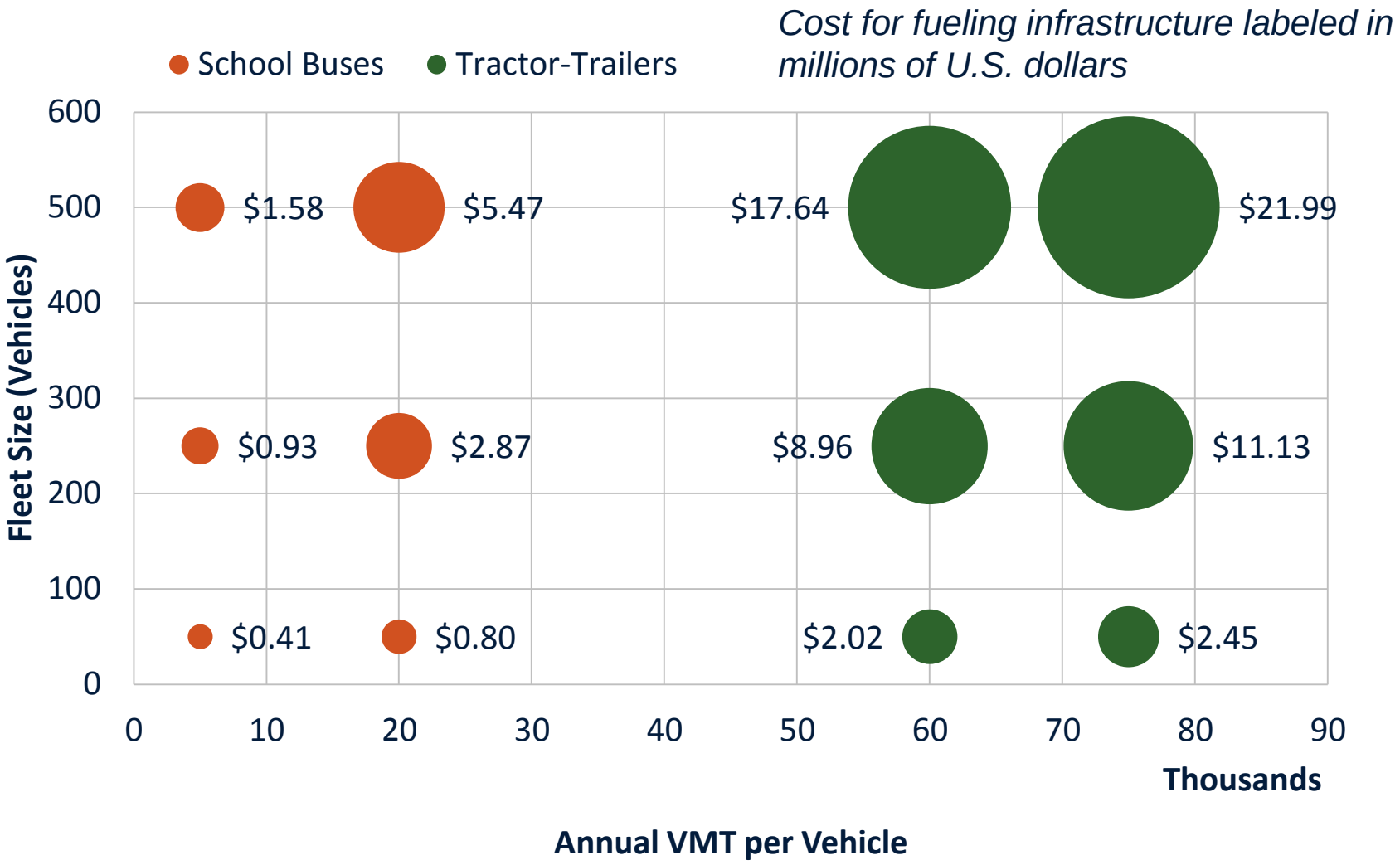
Source: Alternative Fuel Data Center

Price Volatility of CNG, Gasoline, and Diesel from January 2012 to January 2015

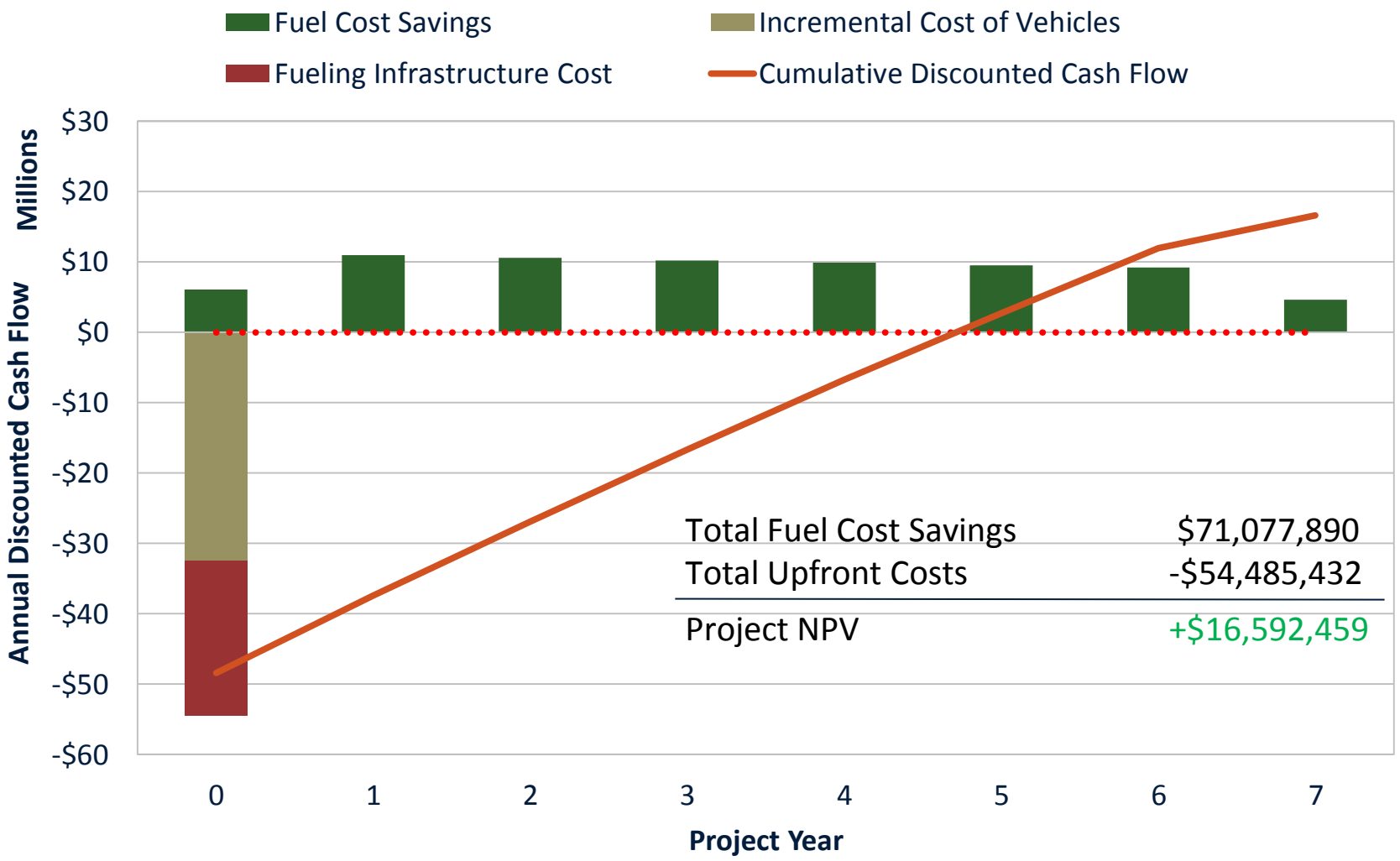


Source: Alternative Fuel Data Center

Fueling Infrastructure Costs for School Buses and Tractor-Trailers



Example Discounted Cash Flow for Tractor-Trailer Fleet Project with New Fueling Infrastructure



5 Factors that Affect Financial Performance of Converting to NGVs

Price difference between diesel/gas and CNG

- Single most important factor
- Large price differential can greatly improve financial performance

Fuel economy

- Low fuel economy vehicles are opportunity to reduce fuel costs
- Some NGVs have relatively low fuel economy compared to conventional vehicle counterparts

Total average annual fleet VMT

- Fleets with a higher average annual VMT present a greater opportunity for fuel cost savings

Vehicle lifetime

- Long life expectancies have more time to accumulate fuel cost savings

Fueling infrastructure

- Dedicated refueling infrastructure provide lower net savings
- Fleet ownership of fueling infrastructure enable acquisition of natural gas fuel for less than retail prices

Issues and Options for Energy Service Providers

- Barrier: Lack of Experience
- Leverage extensive experience with scope of technological solutions. Provide authoritative assessments on suitability of new technologies.

1. Identification and evaluation of project opportunities

- Barriers: Project Risk, Limited Resources
- Manage technology transition to address fleet resource constraints. Especially useful for fleets that already lease vehicles.

2. Management of technology transition

- Barriers: Budget Constraints, Public Fueling Dependency
- Help public fleets avoid upfront capital outlays. Construct contracts that prioritize fueling station access over ownership.

3. Alternatives to equipment ownership

- Barrier: Project Risk
- Use scenario analysis to reduce risk and provide fleet manager an understanding of project's financial viability. Construct contracts to account for cost savings approach of NGV conversion projects and provide cost protection for both parties.

4. Performance guarantees and fuel cost savings

- Barrier: Project Risk
- Bundle fleet NGV conversion projects with more profitable building energy efficiency projects to (MAKE) vehicle projects more attractive to investors.

5. Bundling projects into a portfolio

- Barrier: Financial Performance
- Leverage public-private partnerships that encourage shared use of fueling stations to improve financial performance.

6. Partnership facilitation

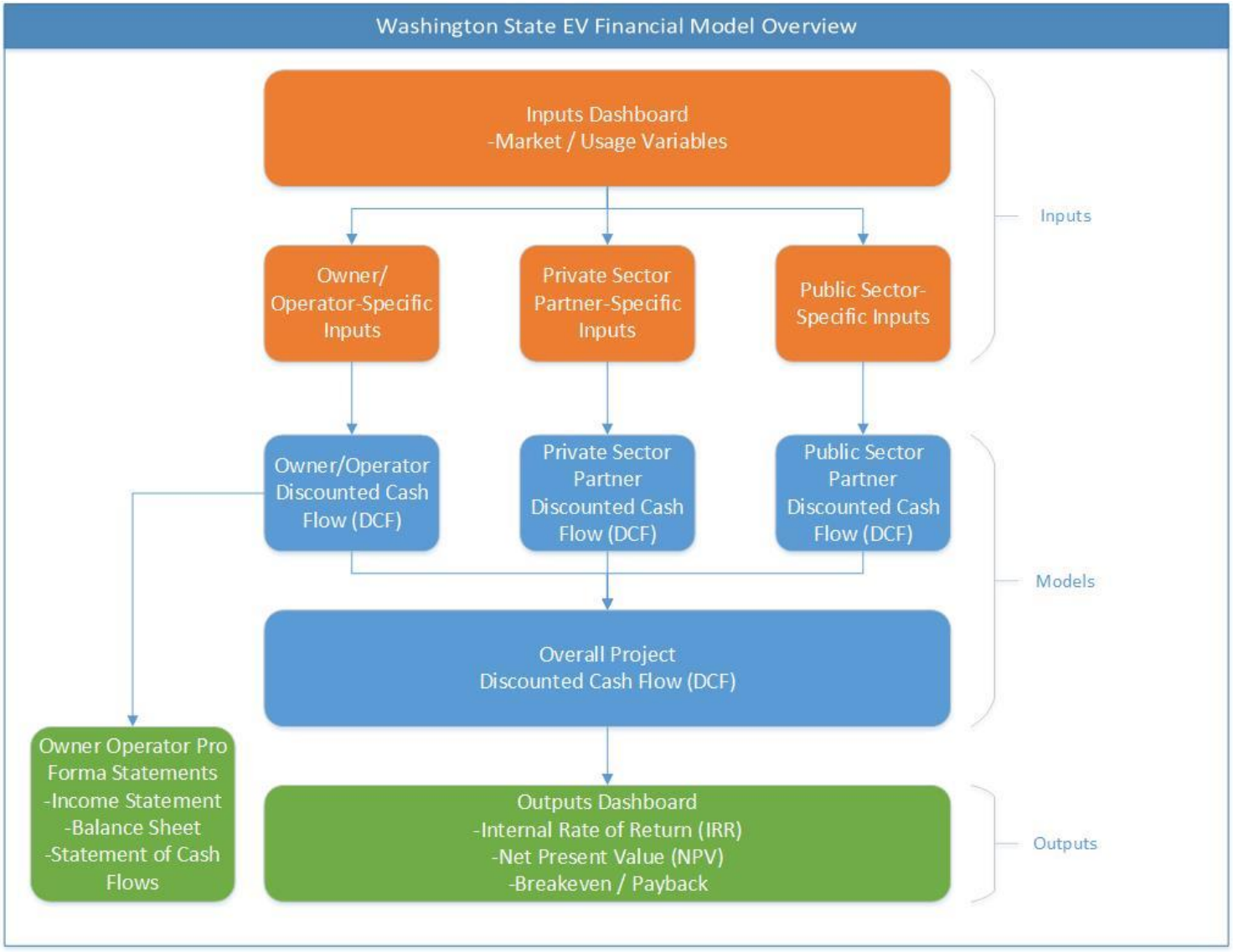
Part 1 Demonstration: Capturing Indirect Revenue Sources for Publicly Available Charging Infrastructure

Demonstrate the EV Charging Financial Analysis Tool and its application in sample use cases

Financial Analysis Approach

- **Define contributions from private sector partners who stand to benefit from an EV charging network**
  - Subsidize upfront cost of charging equipment
  - Share portion of indirect revenue from EV charging use with owner-operator
- **Evaluate charging station project financial performance after private sector partners share value with owner-operator of charging services**
- **EV Charging Financial Analysis Tool**
  - Developed by C2ES and Cadmus Group for financial analysis (*download for free at www.c2es.org*)
  - Empowers businesses and policymakers to evaluate various financial arrangements for EV charging projects
  - Provides perspectives of owner-operator, private sector partners, and public sector
  - Use cases can be imported and exported so you only need one copy of the tool
  - Microsoft Excel-based – unprotected and publicly available

Financial Analysis Tool – Model Structure



Financial Analysis Tool – Inputs

Charging Station Inputs

Expected equipment lifespan [years] - All equipment types	10

Charging Station Assumptions - Type 1

Charging station type	DC fast charging (highway)
Charging Station Capital Cost [Gross Fixed Assets / Plant, Prop. & Equip.]	
Equipment costs	
Charging station equipment cost (per station) [$]	$ 35,000.00
Installation and siting costs	
Construction and equipment installation cost (per station) [$]	$ 26,000.00
Electric utility upgrades and grid interconnection cost (per site) [$]	$ 20,000.00
Lease and property transaction costs (per site – one-time fee) [$]	$ 6,000.00
Host site identification and screening (per site) [$]	$ 5,000.00
Total number of stations [#]	6
Total number of sites [#]	6
Total initial Type 1 station capital required [$]	**$ 552,000.00**
Annual depreciation	$ 55,200.00

Financial Analysis Tool – Discounted Cash Flow

Private Sector Discounted Cash Flow Model

			2015	2016	2017	2018	2019	2020
Revenue				$ 49,467	$ 49,467	$ 49,467	$ 49,467	$ 49,467
Operating Costs				$ (88,174)	$ (25,174)	$ (25,174)	$ (25,174)	$ (25,174)
EBITDA				$ (38,707)	$ 24,293	$ 24,293	$ 24,293	$ 24,293
Dep & Amortization								
Operating Income (EBIT)				$ (38,707)	$ 24,293	$ 24,293	$ 24,293	$ 24,293
Interest Expense								
Income Before Taxes (EBT)				$ (38,707)	$ 24,293	$ 24,293	$ 24,293	$ 24,293
Taxes				$ 12,231	$ (7,677)	$ (7,677)	$ (7,677)	$ (7,677)
Cash Flow from Operations				$ (26,475)	$ 16,617	$ 16,617	$ 16,617	$ 16,617
Change in Non-cash Assets								
Change in Liabilities								
Free Cash Flow				$ (26,475)	$ 16,617	$ 16,617	$ 16,617	$ 16,617
Terminal Value								
Total Free Cash Flow		$	-	$ (26,475)	$ 16,617	$ 16,617	$ 16,617	$ 16,617
Discount Factor (WACC)	10.33%		1.000	0.906	0.822	0.745	0.675	0.612
Discounted Cash Flows		**$**	-	**$ (23,996)**	**$ 13,651**	**$ 12,373**	**$ 11,214**	**$ 10,164**
Cumulative Discounted Cash Flows		**$**	-	**$ (23,996)**	**$ (10,346)**	**$ 2,027**	**$ 13,241**	**$ 23,405**
Net Present Value		$	61,613					
Internal Rate of Return			46.8%					
Discounted Payback			3					

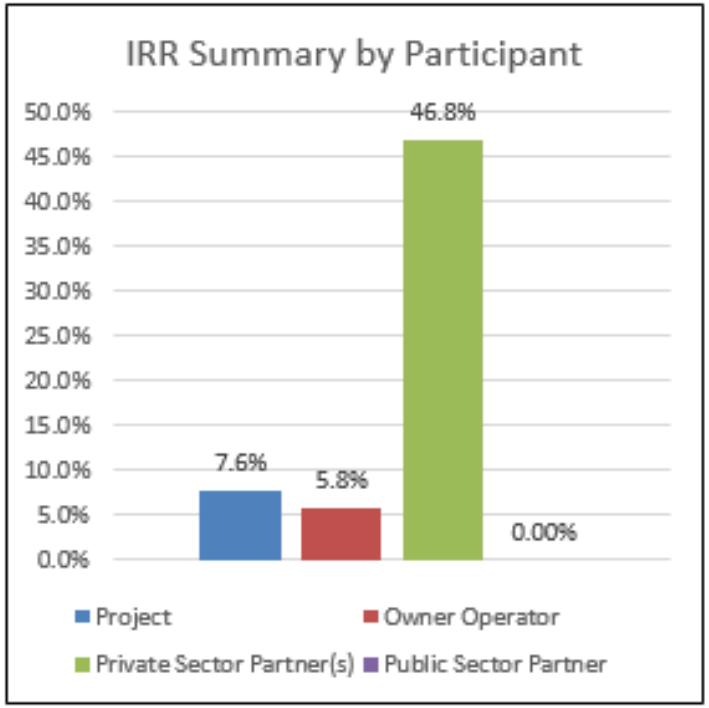
Financial Analysis Tool – Outputs

Financial Performance Statistics

Project		
Total Capital Investment	$	789,955
Total Net Present Value	$	227,675
Total Internal Rate of Return (IRR)		7.6%
Discounted Payback (Years)		8.0
Owner Operator		
Total Capital Investment (Equity)	$	315,982
Total Net Present Value	$	165,747
Total Internal Rate of Return (IRR)		5.8%
Discounted Payback (Years)		9.0
Private Sector Partner(s)		
Total Capital Investment	$	-
Total Other Contributions	$	63,000
Total Net Present Value	$	61,613
Total Internal Rate of Return (IRR)		46.8%
Discounted Payback (Years)		3.0
Public Sector Partner		
Total Capital Investment	$	-
Total Other Contributions	$	-
Total Net Present Value	$	-
Total Internal Rate of Return (IRR)		N/A
Discounted Payback (Years)		N/A
Other Non-Partner Private Sector		
Total Capital Investment (Loans)	$	473,973

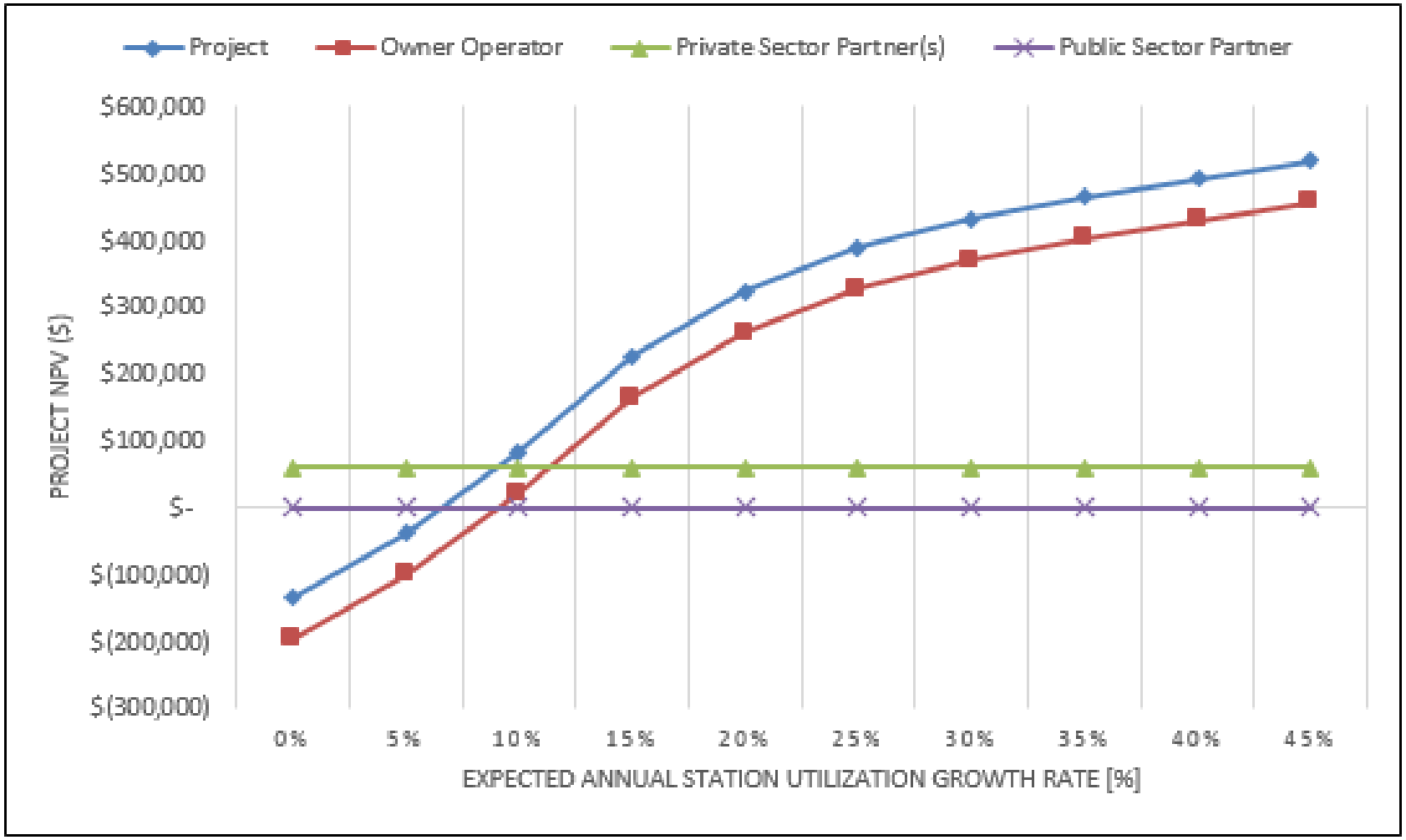
Charging Infrastructure Statistics

Total New Sites
15
Total New Stations
6
Number of Charging Sessions Provided
48,545
kWh of Charging Provided
728,175



Financial Analysis Tool – Outputs

Sensitivity Analysis #1



Example in NY: 10 DC Fast Charging Stations and 50 Level 2 Stations with Automaker Subsidy

- **Even with a $130,000 subsidy from an automaker, project still loses money**

	No Subsidy	With Automaker Subsidy
Total project level perspective		
Total capital investment (spent on charging station deployment)	$1,373,436	$1,386,436
NPV	–$452,961	–$317,930
Payback period	No payback	No payback
Owner-operator perspective		
Funds spent on stations (equity)	$549,375	$554,575
Funds spent on stations (debt)	$824,062	$831,862
NPV	–$465,977	–$399,807
Payback period	No payback	No payback
Automaker perspective		
Funds transferred to owner operator initially	N/A	$130,000
Funds transferred to owner operator annually	N/A	$0
NPV	N/A	+$60,456
Payback period	N/A	5 years

Same Example in NY with Public Sector Interventions (Near Term: 2016-2025)

- **Public Sector Interventions**
  - Low-Interest Loan: $582,303 at 3%, 10 year term
  - Grant: $443,660
  - Institute a rebate for EVs up to $1,500 for plug-in hybrid electric vehicles and $2,500 for all-electric vehicles; the rebate would last for five years.
- **Project Capitalization**
  - Total project cost = $1,386,436
    - 8% owner-operator equity
    - 30% private loans
    - 30% public loans
    - 32% public grant
  - Private sector partner (automaker) contributes $130,000 up front

Financial Performance

Owner-operator	
NPV	+$226,457
Payback	5 years
Automaker	
NPV	+$60,456
Payback	5 years
Public sector	
NPV	–$443,660
Payback period	N/A
Total project level	
NPV	–$161,640
Payback period	N/A

Same Example in NY without Public Sector Interventions (Medium Term: 2021-2030)

- ***No public subsidies are needed***
  - Larger EV market
  - Lower equipment costs
- **Public Sector Interventions**
  - Vehicle rebate ends in 2020
  - No loans or grants are issued for this project
- **Project Capitalization**
  - Total project cost = $1,275,258
    - 40% owner-operator equity
    - 60% private loans
  - Private sector partner (automaker) contributes $130,000 up front

Financial Performance

Owner-operator	
NPV	+$210,056
Payback	6 years
Automaker	
NPV	+$60,456
Payback	5 years
Public sector	
NPV	N/A
Payback period	N/A
Total project level	
NPV	+$315,843
Payback period	5 years

Part 2 Demonstration: Applying the ESCO Model to Public and Private Fleet Natural Gas Vehicles

Demonstrate the U.S. Department of Energy's VICE Model and showcase its application to support decision making for natural gas vehicle fleets.

Financial Analysis Approach

Fleet Sizes

- Fleets consisting of 50, 250, and 500 vehicles

Annual VMT

- Fleets with 5, 10, 15, and 20 thousand annual VMT for school bus and public light-duty fleets
- For tractor-trailer fleets, scenarios were analyzed for 60, 65, 70, and 75 thousand annual VMT

Fueling Infrastructure

- Projects with and without new fueling infrastructure costs

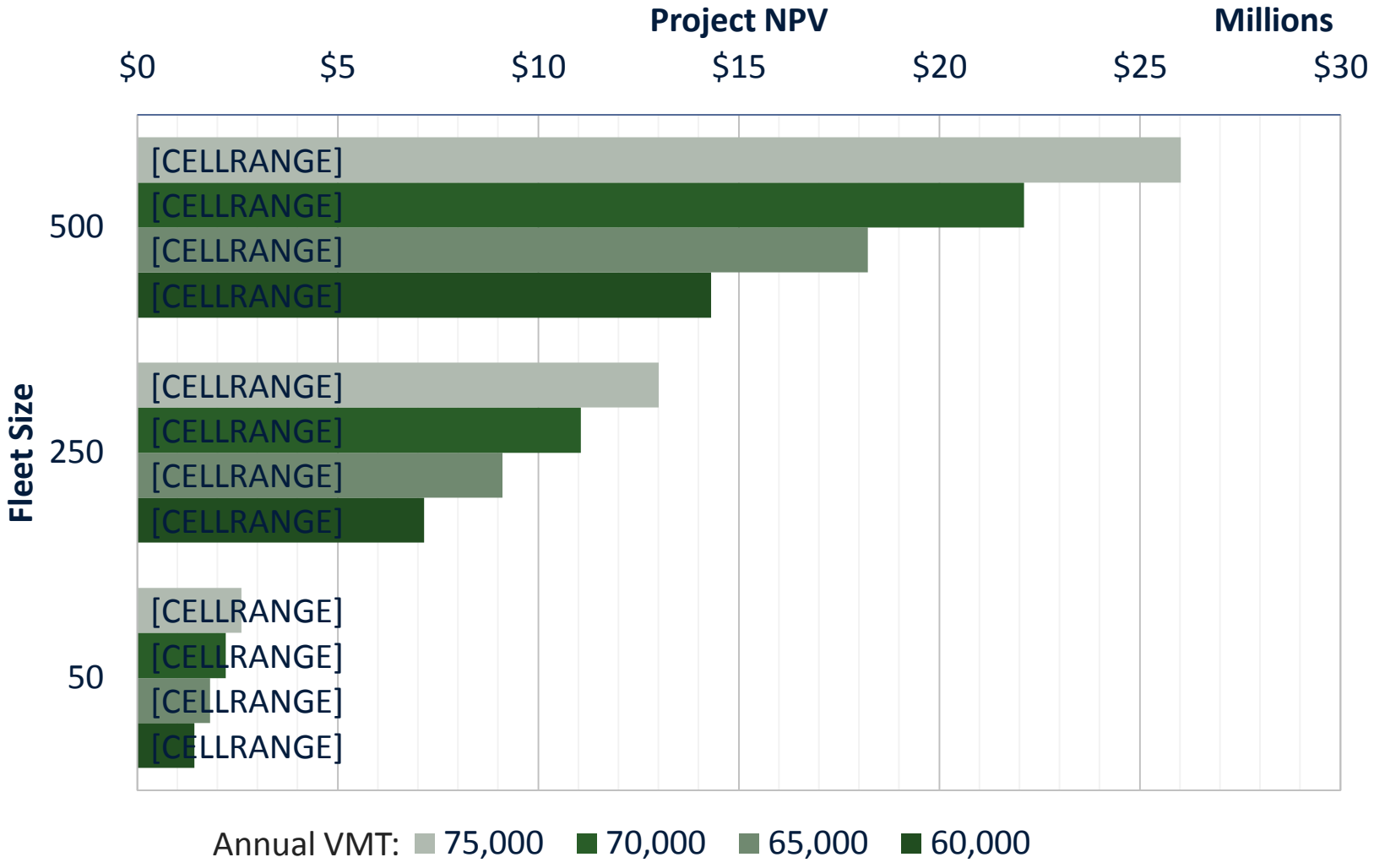
Vehicle Performance and Use Assumptions

Vehicle Type	Base fuel Used	2012 Average VMT (Miles/Year)	Fuel Economy (MPG)	Reduced CNG Fuel Economy (%)	Expected Life (Years)
Tractor Trailer	Diesel	66,161	5.8	5.3%	7
School bus	Diesel	12,000	7	12.5%	15
Delivery Truck	Gasoline	13,469	6.6	5.3%	7.4
Light Truck	Gasoline	11,882	18.5	5.3%	6.5
Passenger Car	Gasoline	11,265	24.9	5.3%	6.5

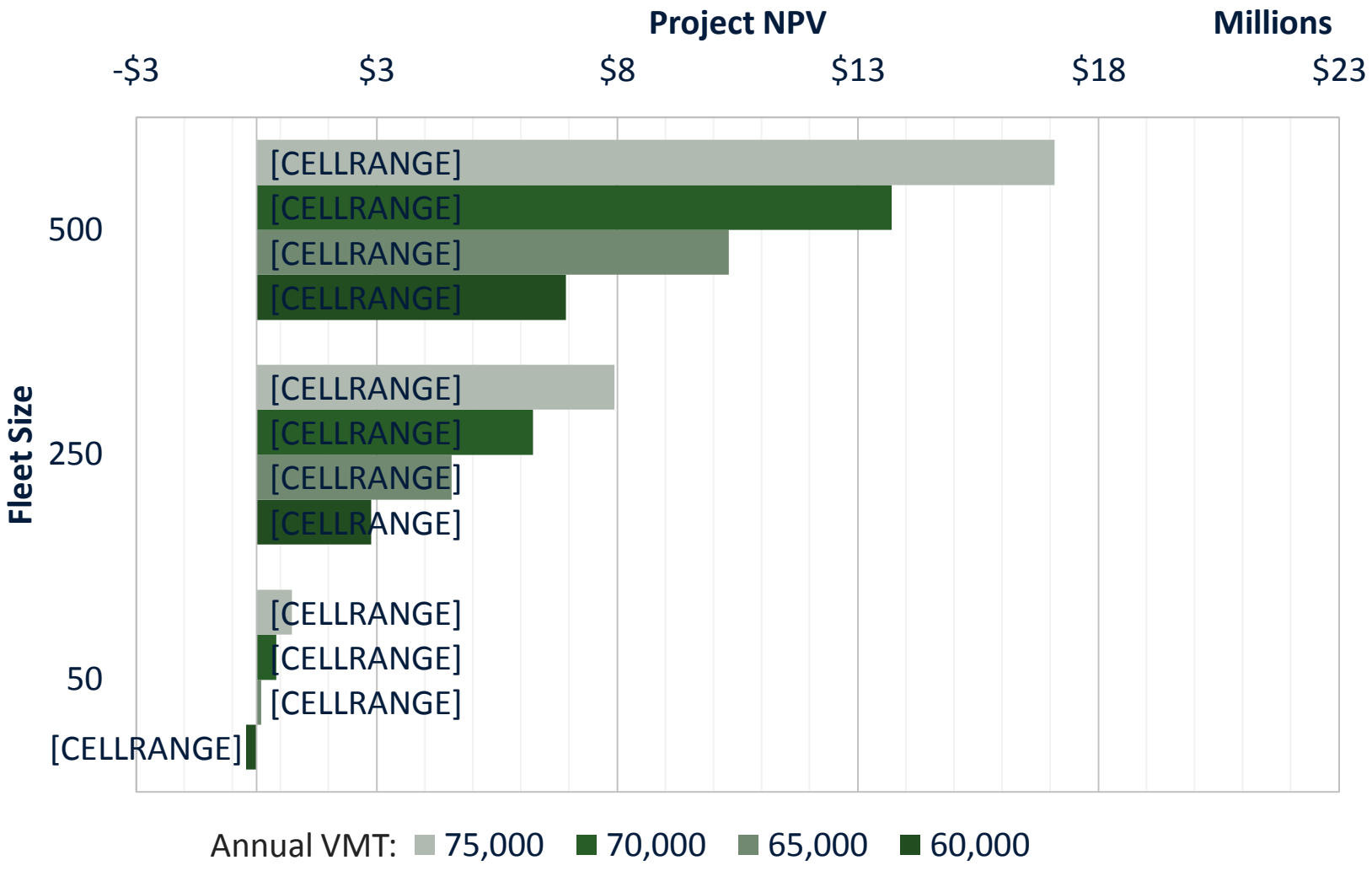
About the VICE Tool

- **Vehicle and Infrastructure Cash-Flow Evaluation (VICE) tool**
  - Developed by National Renewable Energy Laboratory
  - Features cost calculator that demonstrates ways net savings are sensitive to various assumptions such as fleet characteristics, fuel price, equipment costs, and operation and maintenance costs
  - Download at: http://www.afdc.energy.gov/fuels/natural_gas_infrastructure.html
- **C2ES modified the VICE tool to allow for automated testing of scenarios for different VMT, fleet size, infrastructure needs, and fuel prices**
  - Automation allowed C2ES to run > 100 scenarios very easily
  - Other customizations allowed for unique outputs, such as share of savings for energy service provider

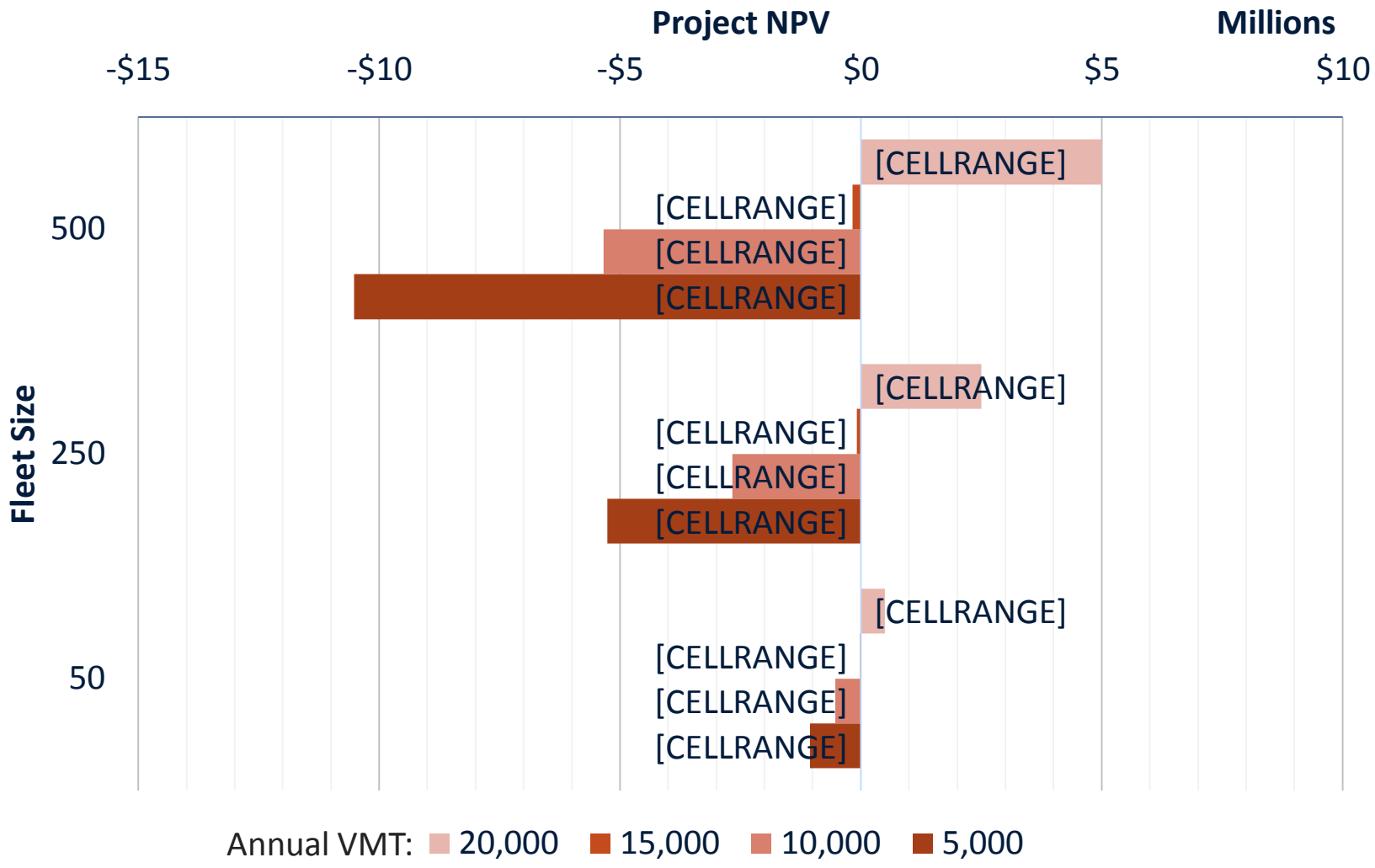
Tractor-Trailer Fleet without Fueling Infrastructure Scenario Analysis Results



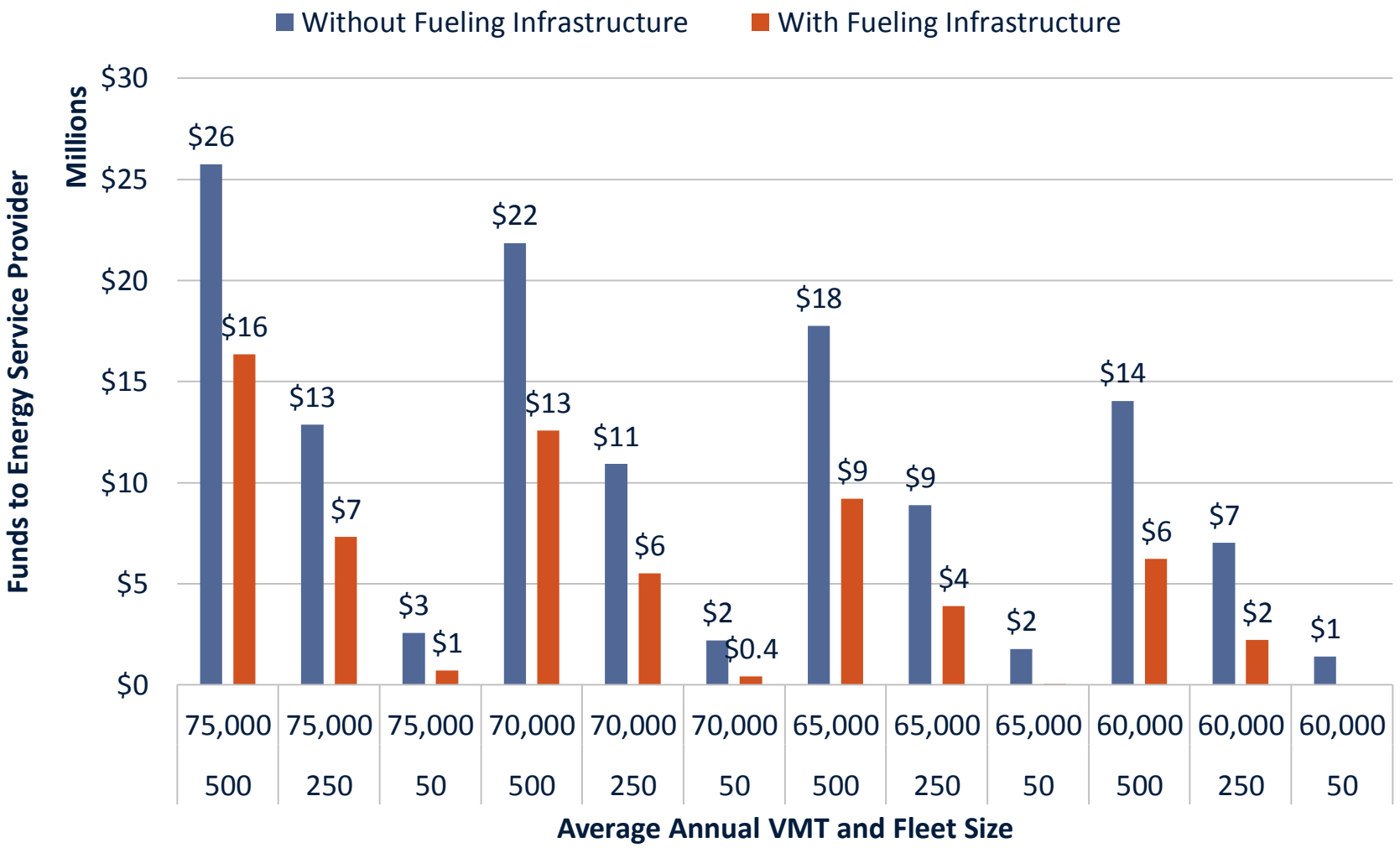
Tractor-Trailer Fleet with Fueling Infrastructure Scenario Analysis Results



School Bus Fleet without Fueling Infrastructure Scenario Analysis Results



Available Net Fuel Cost Savings for Tractor-Trailer Fleet Operators to Purchase Services from an Energy Service Provider



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