Exploring the "How To" of EV Cost-Effectiveness

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Agenda

- Who is MCR

- AES Indiana (AESI) EV Program Portfolio

- California Standard Practice Manual (CSPM) and National Standard Practice Manual (NSPM)

- Toward EV Cost-Effectiveness Best Practices
  - Discussion on AESI Approach, Modeling Inputs and Assumptions

Objectives

- Quick(ish) presentation of facts

- Extended discussion period seeking to advance toward EV cost-effectiveness best practices by talking about approach, assumptions, inputs

Who is MCR

Management Consulting to Utilities since 1999

Regulatory Services
Pre-filing Reviews
Rate Case Management
Strategic Research and Analysis
Modern Rate Design Strategies
Regulatory Strategy and Filings

Products & Services (EE)
Strategy and Program Design
Process and Data Management
Program Implementation
Program Management & Administration
Program Tracking & Reporting
Evaluation, Measurement & Verification ("EM&V")

Strategic and Financial Advisory
Corporate planning
Natural gas and electric strategies
Regulatory, finance and investor relations

Financial Planning and Analysis
Financial Forecasting
Enterprise Risk Management
Strategic Planning
Capital Allocation
Financial Processes & Systems

Transmission Strategy
Formula Rate Analysis
FERC Filings
Strategic Economic Analysis
Transmission Cost/Rate Competitiveness

Nuclear Generation
Zero-Base Budgeting
Capital Project Evaluation
Life Cycle Management Planning
Long Range Planning
Management Reporting
Capitalization Policies and Procedures

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AESI EV Portfolio

Why and When

- Indiana House Enrolled Act 1221 of 2022
  - Utility EV activities
  - Codified as Indiana Code ch. 8-1-43 (public use EV programs) and 8-1-2.5 (alternate rate structures for EV)

- AES Indiana proposed EV Plan
  - Ten EV programs, rates, and tariffs
  - Indiana Utility Regulatory Commission (IURC) approved nine of the ten proposed offerings on November 22, 2023

The Approved Portfolio

EVSE[1] Rebates	Fleet Solutions	Level 2 Public Charging Rate
EVSE Rebates for DAC[2]	Managed Charging	DCFC[3] Public Charging Rate
Managed Charging	EVSE Lease Tariff	
Off-Peak Incentive		

1 Electric Vehicle Supply Equipment
2 Disadvantaged Communities
3 Direct Current Fast Charging

CSPM and NSPM

Approval Requires Cost-Effectiveness

- Like most states, Indiana and the IURC reference the CSPM (California Standard Practice Manual for Economic Analysis of Demand-Side Programs and Projects):
  - TRC: Total Resource Cost Test, looking at total (utility and participant) costs and benefits from an energy-only perspective.

  - SCT: Societal Cost Test, the TRC adding consideration of non-energy impacts.

  - PCT: Participant Cost Test, looking at the quantifiable costs and benefits from the participant's perspective.

  - RIM: Rate Impact Measure Test, looking at what happens to rates or bills.

But CSPM Didn't Contemplate EV

- Problem:
  - CSPM last fully updated in 2001
  - EV were not yet a "thing"
  - Fuel substitution (switching) was primarily electric to gas

- Solution:
  - MCR and AESI looked to the National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources (NSPM)

NSPM: What

- Broadens the lens through which cost-effectiveness is considered.
  - CSPM: Energy-only perspective (except perhaps SCT and "mutations" of TRC)
  - NSPM: Holistic perspective
    - Acknowledgement of, and alignment with, policy drivers
    - Full range of costs and benefits
    - Symmetrical treatment of costs and benefits

National Standard Practice Manual
for Assessing Cost-Effectiveness
of Energy Efficiency Resources

nesp
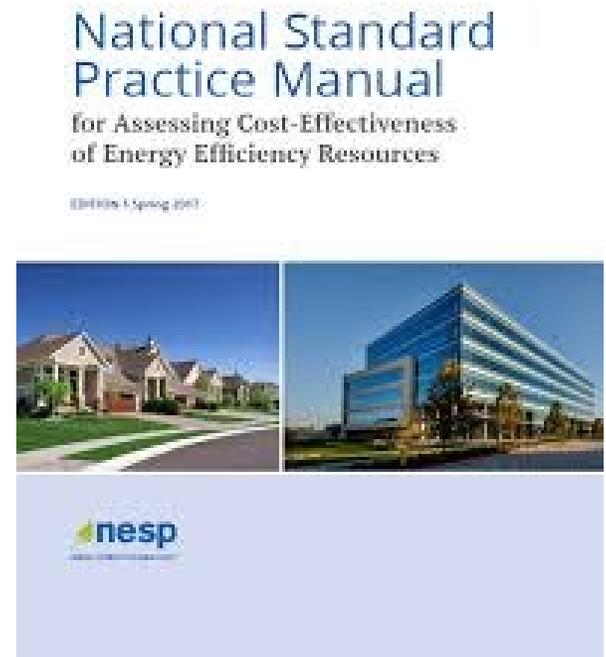
NSPM: Why

- Rapidly being embraced by regulators; energy, environmental, and social justice advocates; many utilities.

- NSPM became an appropriate resource for thinking through how AESI might address many of the issues associated with conversion from internal combustion engine (ICE) vehicles to EV.

NSPM References and Application
May 2025

Toward EV Cost-Effectiveness Best Practices

Discussion on AESI Approach, Modeling Inputs and Assumptions

Discussion Part 1: Costs and Benefits

What's a Cost? What's a Benefit?

Term	TRC	SCT	PCT	RIM
Program Costs	Cost	Cost		Cost
Customer Incentives			Benefit	Cost
EVSE	Cost	Cost	Cost	
Vehicle (incremental)	Cost	Cost	Cost	
Vehicle O&M (incremental)	Cost	Cost	Cost	
Vehicle Fuel – Avoided Wholesale Fossil	Benefit	Benefit		
Vehicle Fuel – Retail Electric	Cost	Cost	Cost	
Vehicle Fuel – Avoided Retail Fossil			Benefit	

What's a Cost? What's a Benefit? (continued)

Term	TRC	SCT	PCT	RIM
Utility Avoided Costs	Benefit	Benefit	Benefit	
Incremental Utility Infrastructure Costs			CIAC is Cost	
Emissions Reductions		Benefit		
Increased Utility Revenue				Benefit

Discussion Part 2: Inputs and Assumptions

Economic Inputs

Topic	Term	Value
AESI Line Loss Rate	Combined kWh and kW	5.40%
Inflators/Deflators	Inflation	2.16%
	WACC[4]	6.65%
	Societal Discount Rate	3.43%
CIAC Rate[1]	C&I only	40.00%
Coincidence Factor[2]	At peak	62.50%
EUL[3]	Average EV and EVSE	12

1 Contributions in aid of Construction

2 Percent of kW occurring in peak billing period

3 Estimated useful life

4 Weighted average cost of capital

Fuel Inputs

Topic	Term	Value
AESI Retail Rates	Average Res. $/kWh	$0.1249
	Average CI $/kWh[1]	$0.1315
Fossil Fuel Prices	Gasoline – Retail	$3.81
	Diesel – Retail	$5.51
	Avoidable Pct. Of Retail	92.00%
Heat Content of Fuel	Gasoline BTU/gallon	120,286
	Diesel BTU/gallon	137,381
	Electricity BTU/kWh	3,412

1 Rolls in kW demand rates

Emissions Inputs

Topic	Term	Value
Carbon (CO_2)	Gasoline lbs./gallon	19.37
	Diesel lbs./gallon	22.46
	EV lbs./mile	0.4851
	Social Cost of Carbon	$51.00

Charger Cost Inputs

Topic	Term	Value
Charger Costs	Level 1 – equipment	$300
	Level 1 – installation	$0
	Level 2 (res.) – equipment	$700
	Level 2 (res.) – installation	$1,500
	Level 2 (CI) – equipment	$6,000
	Level 2 (CI) – installation per port	$4,000
	DCFC (L3) – equipment per port	$50,000
	DCFC (L3) – installation per port	$50,000

Charger and Charging Inputs

Topic	Term	Value
Charger Efficiency	Level 1	85.00%
	Level 2	95.00%
	DCFC (L3)	99.00%
Charger kW/port	Level 1	1.80
	Level 2	7.20
	DCFC (L3)	150.00

Charger and Charging Inputs (continued)

Topic	Term	Value
Ports per Charger	Level 1	1
	Level 2	1
	DCFC (L3)	2
Vehicles per Port	Level 1	1
	Level 2 - Residential	1
	Level 2 – CI	2
	DCFC (L3)	2

Vehicle First Cost Inputs

Topic	Term	Value
Vehicle Costs	Light Duty Fossil	$46,329
	Light Duty Electric	$55,600
	Medium Duty Fossil	$50,000
	Medium Duty Electric	$67,000
	Heavy Duty Fossil	$130,000
	Heavy Duty Electric	$220,000
	Bus Fossil	$85,000
	Bus Electric	$125,000

Vehicle O&M Cost Inputs

Topic	Term	Value
Vehicle O&M Costs	Light Duty Fossil $/mile	$0.0610
(excludes tires)	Light Duty Electric $/mile	$0.0310
	Non-Residential Fossil $/mile	$0.1700
	Non-Residential Electric $/mile	$0.1200

Other Vehicle-Related Inputs

Topic	Term	Value
Federal Tax Credit	Residential EV	$1,567
	Non-Residential EV	30.00%
Annual Vehicle Miles	Light Duty	14,278
	Medium Duty	23,725
	Heavy Duty	80,550
	Bus	43,800

Vehicle Efficiency Inputs

Topic	Term	Value
Vehicle Efficiency	Light Duty Fossil miles/gallon	24
	Light Duty Electric kWh/mile	0.3260
	Medium Duty Fossil miles/gallon	13
	Medium Duty Electric kWh/mile	0.5000
	Heavy Duty Fossil miles/gallon	9
	Heavy Duty Electric kWh/mile	1.2500
	Bus Fossil miles/gallon	7
	Bus Electric kWh/mile	1.6700

1. Cost-effectiveness testing for EV is still a new application.

2. Legacy CSPM-based approaches may not be ideal.

3. The NSPM may provide a better path for utilities.

4. "It's not the test, it's what in the test" so we need to get to best practices.

Contact Information

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Appendix

TRC: Total Resource Cost Test

"The test measures the net effect of the impacts from the fuel not chosen versus the impacts from the fuel that is chosen as a result of the program." (CSPM p. 18).

$$BTRC = \sum_{t=1}^{N} \frac{UAC_t + TC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

$$CTRC = \sum_{t=1}^{N} \frac{PRC_t + PCN_t + UIC_t}{(1+d)^{t-1}}$$

See appendix for equation terms

SCT: Societal Cost Test

"A measure of the economic efficiency implications of the total energy supply system" (CSPM p. 18).

A variant of the Total Resource Cost test that adds monetized non-energy impacts and applies a lower discount rate to present value calculations.

$$BTRC = \sum_{t=1}^{N} \frac{UAC_t + TC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

$$CTRC = \sum_{t=1}^{N} \frac{PRC_t + PCN_t + UIC_t}{(1+d)^{t-1}}$$

See appendix for equation terms

PCT: Participant Cost Test

"A measure of the quantifiable benefits and costs to the customer due to participation in a program" (CSPM p. 8)

CSPM caveat: PCT only addresses quantifiable factors, but consumers make decisions in large part on non-quantifiable ones.

$$BP = \sum_{t=1}^{N} \frac{BR_t + TC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{AB_{at} + PA_{at}}{(1+d)^{t-1}}$$

$$C = \sum_{t=1}^{N} \frac{PC_t + BI_t}{(1+d)^{t-1}}$$

See appendix for equation terms

RIM: Rate Impact Measure Test

"What happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program" (CSPM p. 13).

Often called the non-participant test and hotly debated as to whether it is appropriate or relevant.

$$B_{RIM} \sum_{t=1}^{N} \frac{UAC_t + RG_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at}}{(1+d)^{t-1}}$$

$$C_{RIM} \sum_{t=1}^{N} \frac{UIC_t + RL_t + PRC_t + INC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{RL_{at}}{(1+d)^{t-1}}$$

See appendix for equation terms

CSPM Equation Terms

- (1 + d)   (1 + d) terms reflect the fact that the tests all consider present values over the estimated useful life of the measures at a discount rate of d

- Subscript t   References the time period

- Subscript at   References the alternate fuel

- BR   Bill reductions experienced by the participant

- TC   Tax credits received by the participant

- INC   Incentives paid to participants

- AB   Avoided bills experienced by participants related to alternate fuels

- PA   Participant avoided costs associated with measures not chosen

- PAC   Participant avoided costs for the fuels not chosen

CSPM Equation Terms (continued)

- PC   Participant costs

- BI   Bill increases experienced by the participant

- UAC   Utility avoided supply costs

- UIC   Utility incremental supply costs

- RG   Revenue gain to the utility from increased sales

- RL   Revenue loss to the utility from decreased sales

- PRC   Program costs to the program administrator

- PCN   Net participant cost