Discussing the Ratepayer Benefits of EVs On the Electrical Grid

Webinar Series on Transportation Electrification Sponsored by Edison Electric Institute and the U.S. Department of Energy

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About the Webinar Series

Edison Electric Institute (EEI) and U.S. Department of Energy (DOE) have sponsored this series of webinars. We have covered;

- "Why should electric companies engage in transportation electrification activities?"
- "What are the different transportation markets and what helps make them succeed?"

Based on feedback from audience participants, this third webinar will discuss ratepayer benefits derived from utility investment in transportation electrification programs.

- We've invited the Electric Power Research Institute to discuss a recent study and model they've created to value the benefits of EVs on the electrical system

Special thanks to Clean Cities U. S. Department of Energy for supporting this initiative

What We Will Cover Today

- Setting the scene
- Introduction to EPRI's "The Economic Value Of Transportation Electrification"
- Facilitated Q&A with audience participation

Setting The Scene

- Rocky Mountain Institute Report
- National Renewable Energy Laboratory PEV Studies
- Black & Veatch Utility Strategic Directions Report

Rocky Mountain Institute's EV Report

EV charging alone can be integrated into the electricity system in ways that deliver **net benefits to utility customers,** shareholders, vehicle owners, and society at large.

Proactive Utilities can…

- Avoid/delay new investment in grid
- Optimize existing grid assets and exte
- Enable greater integration of ren
  natural-gas gen. for dispatchab
  renewables production curtail
- Reduce electricity and transpo
- Reduce petroleum consumption,
- Improve energy security
- Provide multiplier benefits from increased
  the community
- Supply ancillary services to the grid, such as frequency regulation and power factor correction

Impact of VW Settlement?
Growing PEV intros?
Higher power charging?

Reactive Utilities risk…

- tening life of grid components
- ater investment in gas- fired peak and
- ss efficient
- sts of electricity for all consumers
- ation of variable renewables, and
- rtailment of renewable generation when
  exceeds demand
- Increasing grid-power emissions
- Making the grid less stable and reliable

NREL PEV Studies

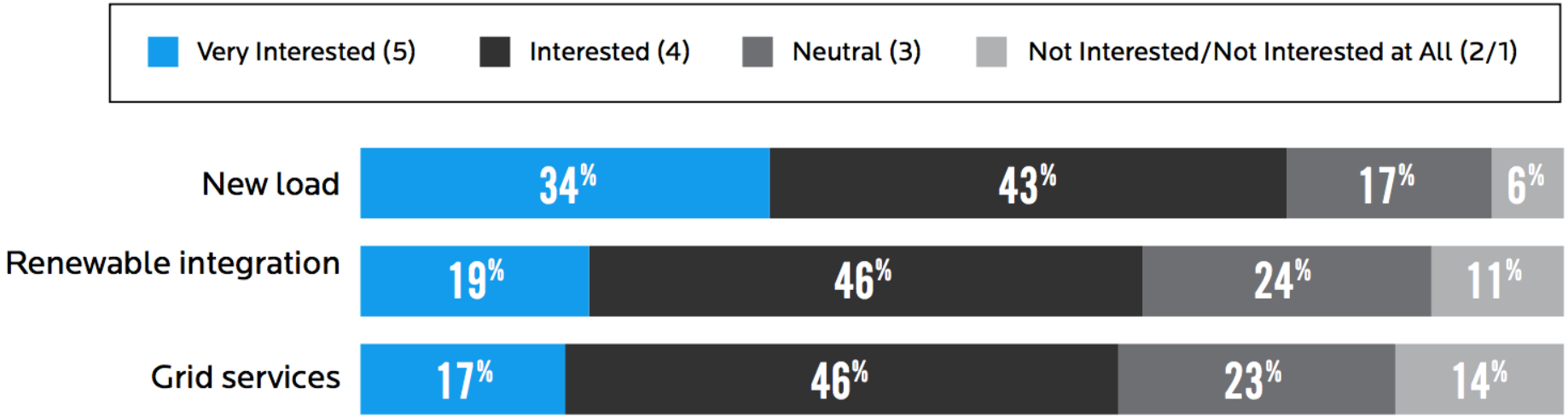
- NREL researchers are extensively studying interactions between PEVs, utility grids and renewables such as wind and solar;
  - In most scenarios explored, distribution transformers have enough excess capacity to charge PEVs
  - In most usage scenarios, PEVs actually benefit the utility grid

Black and Veatch Utility Strategic Directions Report

Annual Electric Industry series of reports- year snapshots over a decade.

- Online survey reflecting input from 672 qualified utility, municipal, commercial and community stakeholders
- IOUs (32.2%); POUs (30.3%); Coops (17.1%); IPPs (14.6%); Other (5.8%)

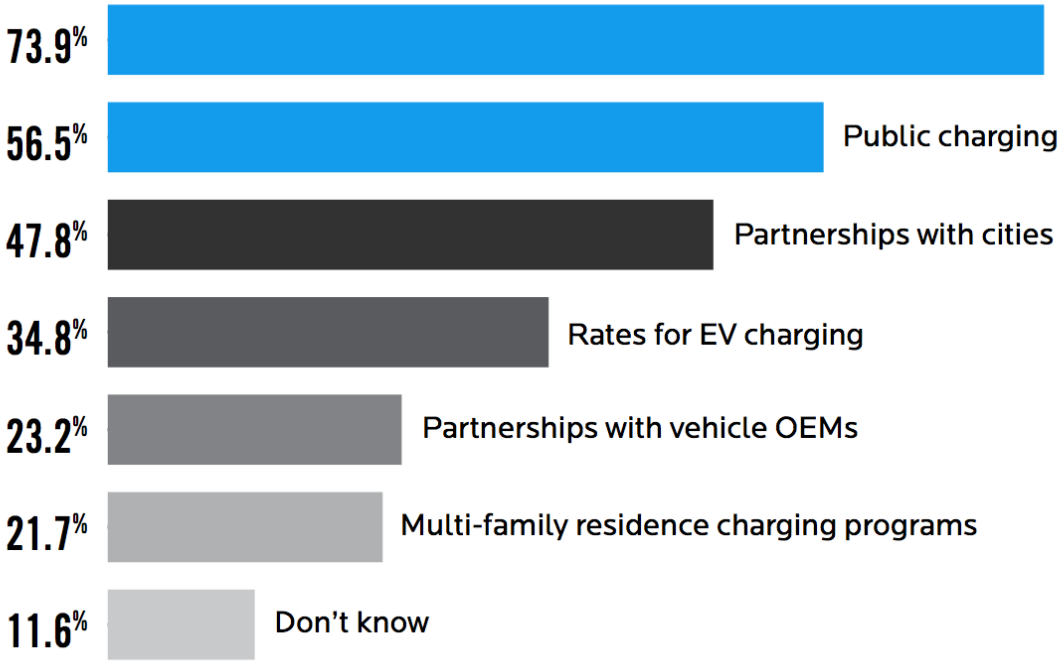
What is your level of interest in the following as a potential revenue stream for EVs? Please rate each on a 5-point scale, where a rating of "5" means "Very Interested" and a rating of 1 means "Not Interested At All." (Select one choice per row.)



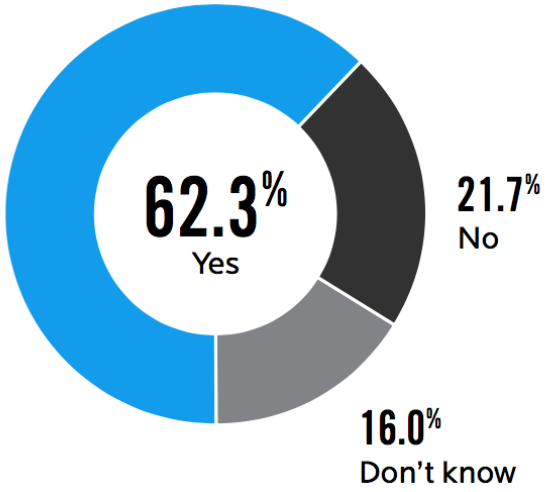
Source: Black & Veatch

Black and Veatch Utility Strategic Directions Report-Cont.

Does your organization support the adoption of any of the following EV programs or technologies? (Select all that apply.)



Is your organization examining/studying the regulatory environment surrounding EV infrastructure? (Select one choice.)



Source: Black & Veatch

Introduction to EPRI Study

The Ratepayer Benefit of Transportation Electrification

November 8, 2016

Marcus Alexander

Manager, Vehicle Systems Analysis

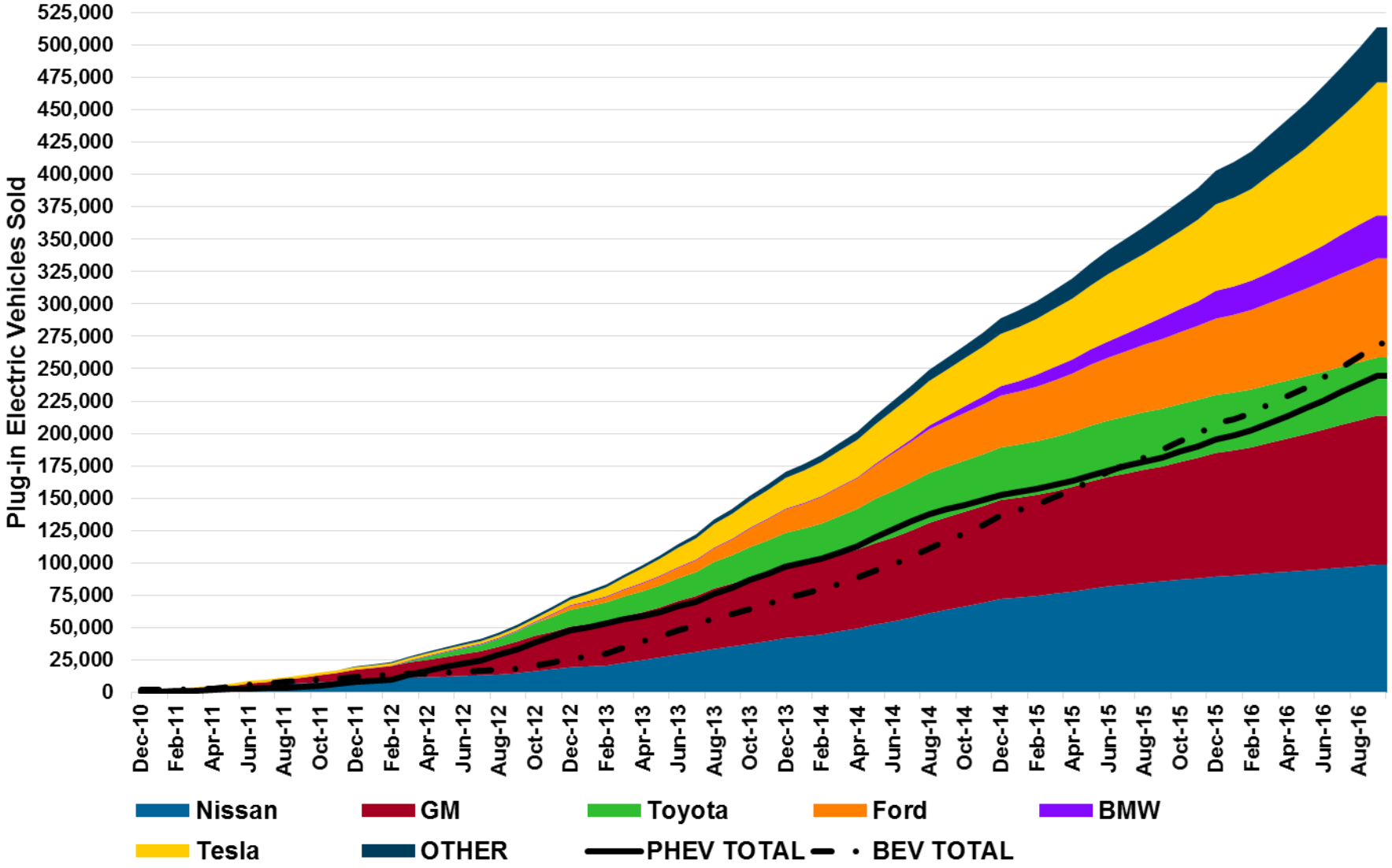
Purpose of the EPRI Ratepayer EV Benefits Analysis

- Why EPRI did this study
  - Transportation Electrification (TE) could represent a net benefit to all ratepayers
  - Utilities helping to facilitate the market could amplify these benefits
  - Measures could range from basic customer education, facilitating easy, seamless grid connection to rate-basing infrastructure deployment
  - **It's not about trying to allocate a ratepayer dollar spent to a vehicle sale**
- How utilities should use this study and model
  - Can be used to look at the high-level benefits of TE (for both internal and external use)
  - By providing local market data, EPRI could produce more detailed results for use in regulatory filings

What we'll cover today

- Overview of the EPRI EV Ratepayer Benefits Analysis
- High level summary of regulator cost/benefit tests such as Total Resource Cost Test (TRC) and Ratepayer Impact Measure Test (RIM) tests
- Analysis methodology
- Results from two sets of scenarios
  - Charging location comparison
  - High/Low gas price comparison
- High level summary

Background



Background on the model used in this analysis

- This work was originally based on a model used by E3 to analyze the California market; this was extended to model characteristics of three utilities across the country
  - A mid-size Southwest electric company
  - A large Midwest electric company
  - A mid-size Midwest electric company
- Wanted to design a model that **would work across the country**
- Assumptions can be changed to match local conditions
- Looked at implications on RIM and TRC tests on at least three different cases
  - Home dominant charging
  - Away from home dominant charging
  - Fuel prices
- This has lead to a model that is constantly being refined to enable use in a variety of regions across the country
- This model is intended to produce a basic result quickly, and to allow EPRI to work together with utilities to produce a more detailed analysis of a particular service territory

Methodology

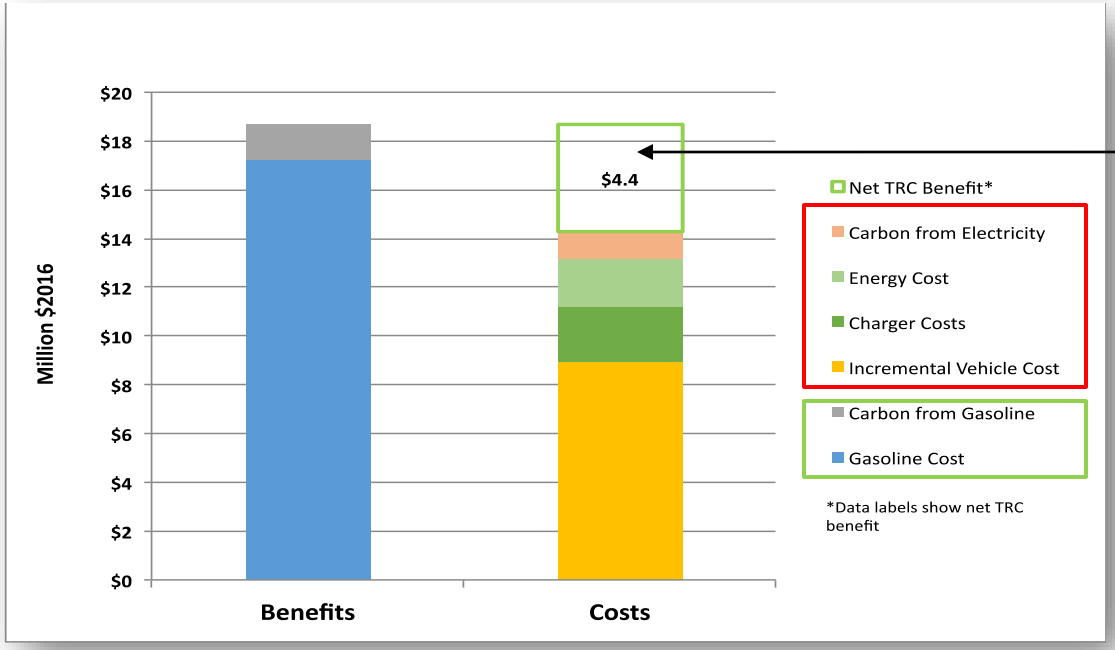
- Collect data on fuel prices
- Estimate future vehicle prices
- Calculate high level cost of service for electricity and customer bills revenue
- Construct different scenarios for infrastructure rollout, external costs, or other elements of interest
- Allocate costs and benefits based on requirements of regulator test (RIM and TRC)

High level summary of Regulator TRC and RIM tests

	Total Resource Cost (TRC)	Ratepayer Impact Measure (RIM)	Social Cost Test (SCT)
Incremental vehicle costs (EV over ICE)	cost		cost
Gasoline savings (through avoidance)	benefit		benefit
Federal vehicle EV tax credits	benefit		benefit
Utility EV monthly bills (annualized)		benefit	
Customer-side infrastructure costs	cost	cost*	cost
EV electricity costs	cost	cost	cost
Grid capacity costs	cost	cost	cost
T&D costs	cost	cost	cost
Incremental electricity GHG costs	cost	cost	cost
Gasoline GHG reductions	benefit	benefit	benefit
Other social effects			cost/benefit

* Only the portion rate-based by the electric company is included here

How can we tell if these tests pass?



The larger this box is, the more the program's benefits outweigh the costs

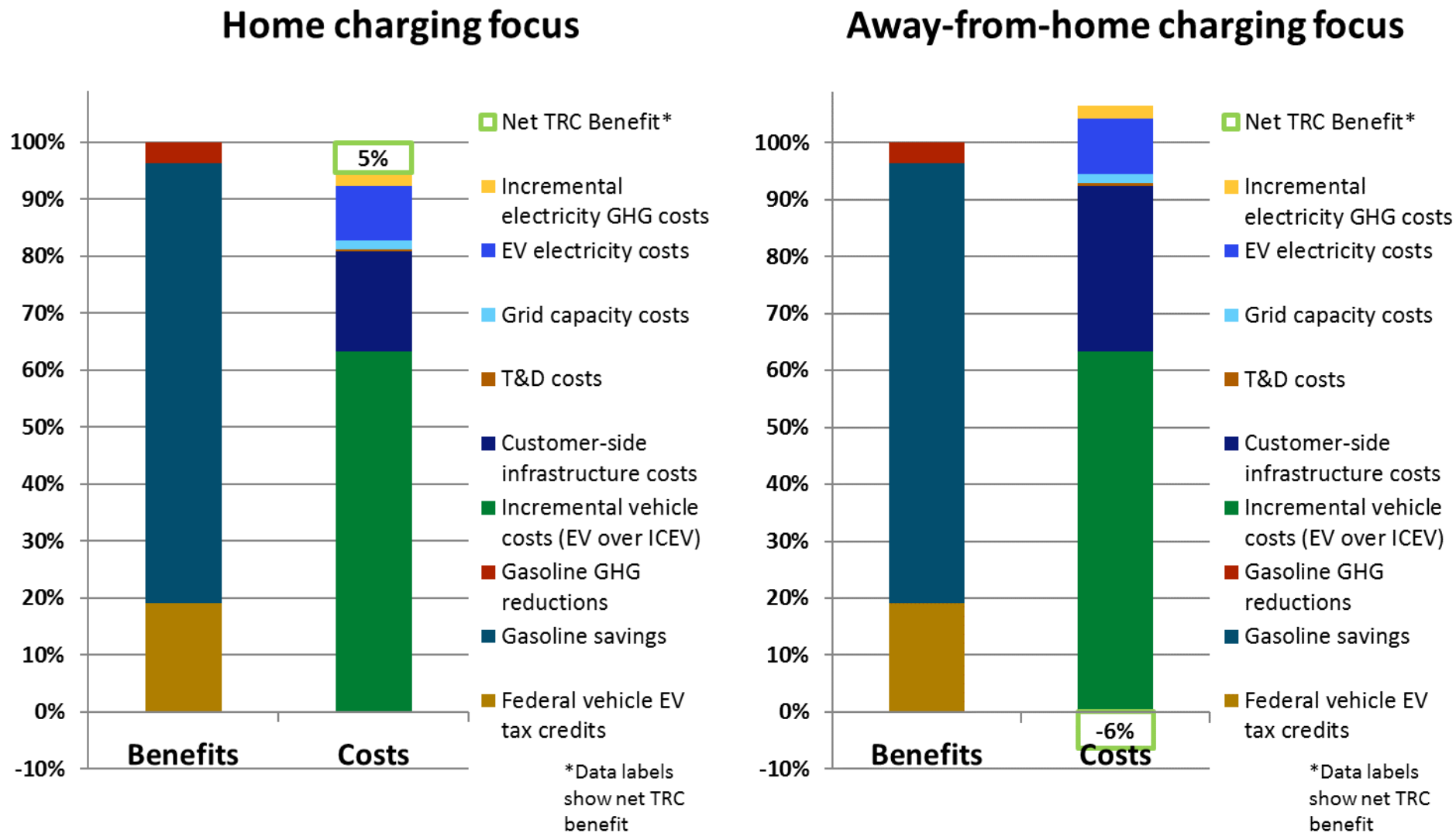
If it's negative, the test is telling us that costs outweigh benefits

Assumptions 1 – What are the effects of different charging locations?

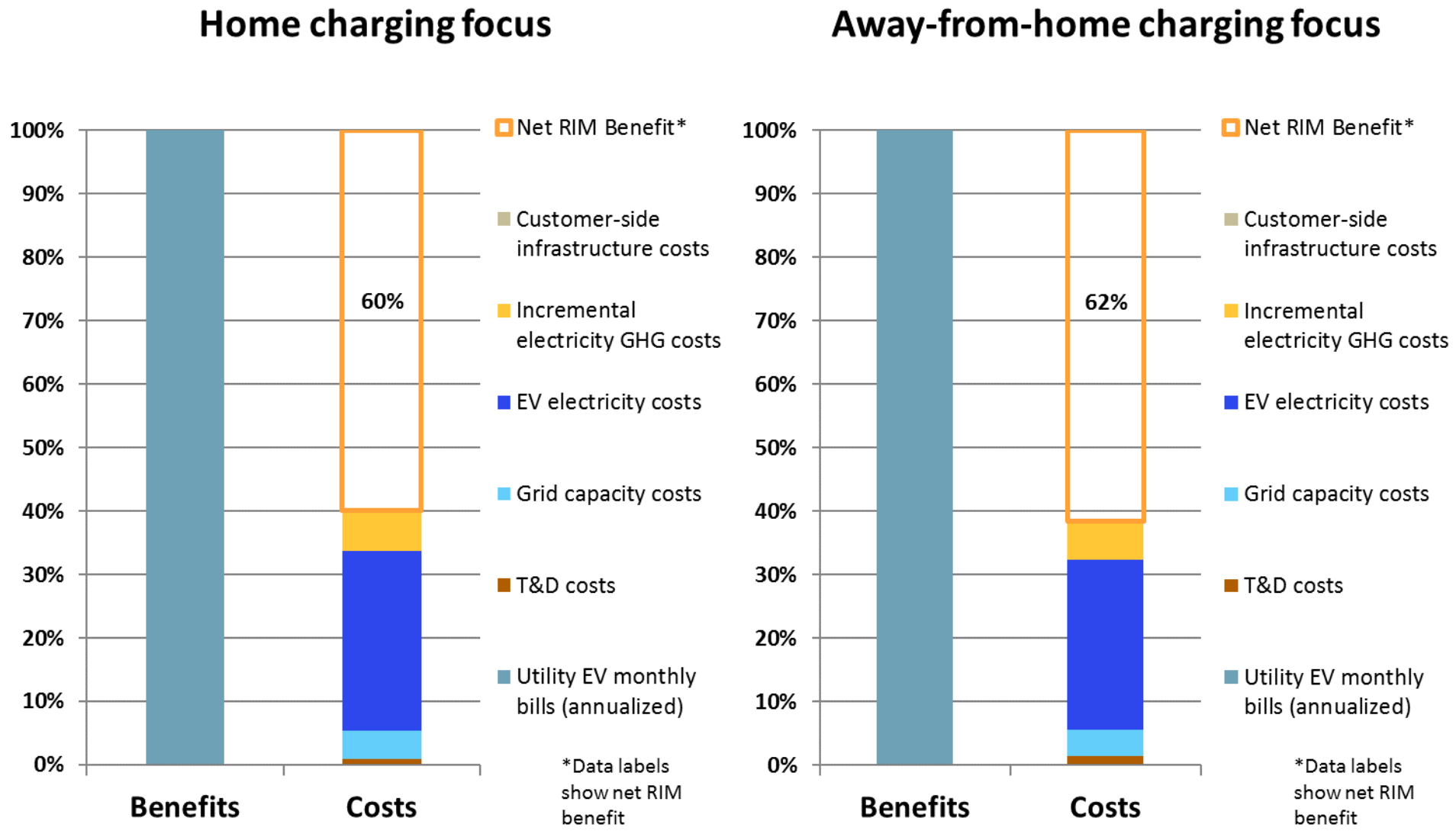
- Away-from-home charging is more expensive to provision than at-home charging

Charging behavior scenario	Home charging	Away-from-home charging
More home charging	80%	20%
Equal charging (base scenario)	50%	50%
More public charging	20%	80%

Results – Total Resource Cost (TRC) with different charging locations



Results – Ratepayer Impact Measure (RIM) with different charging locations

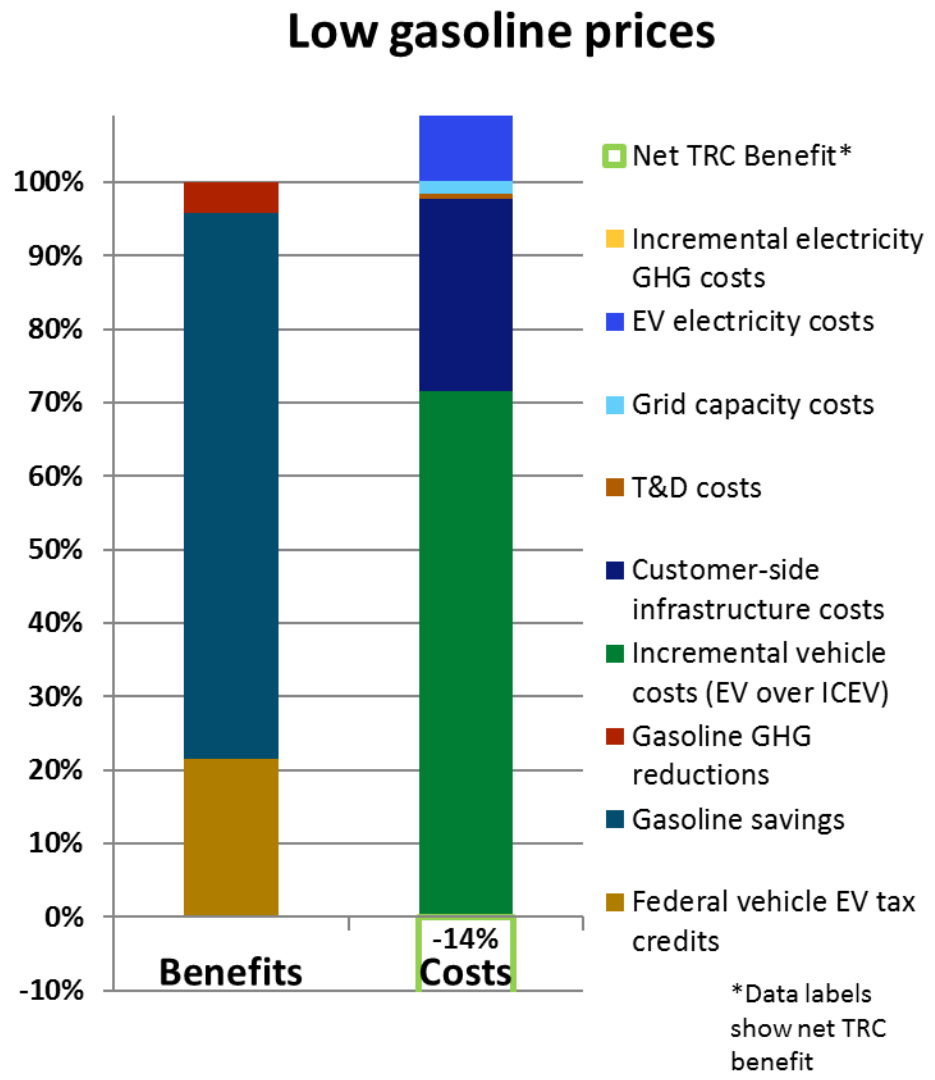


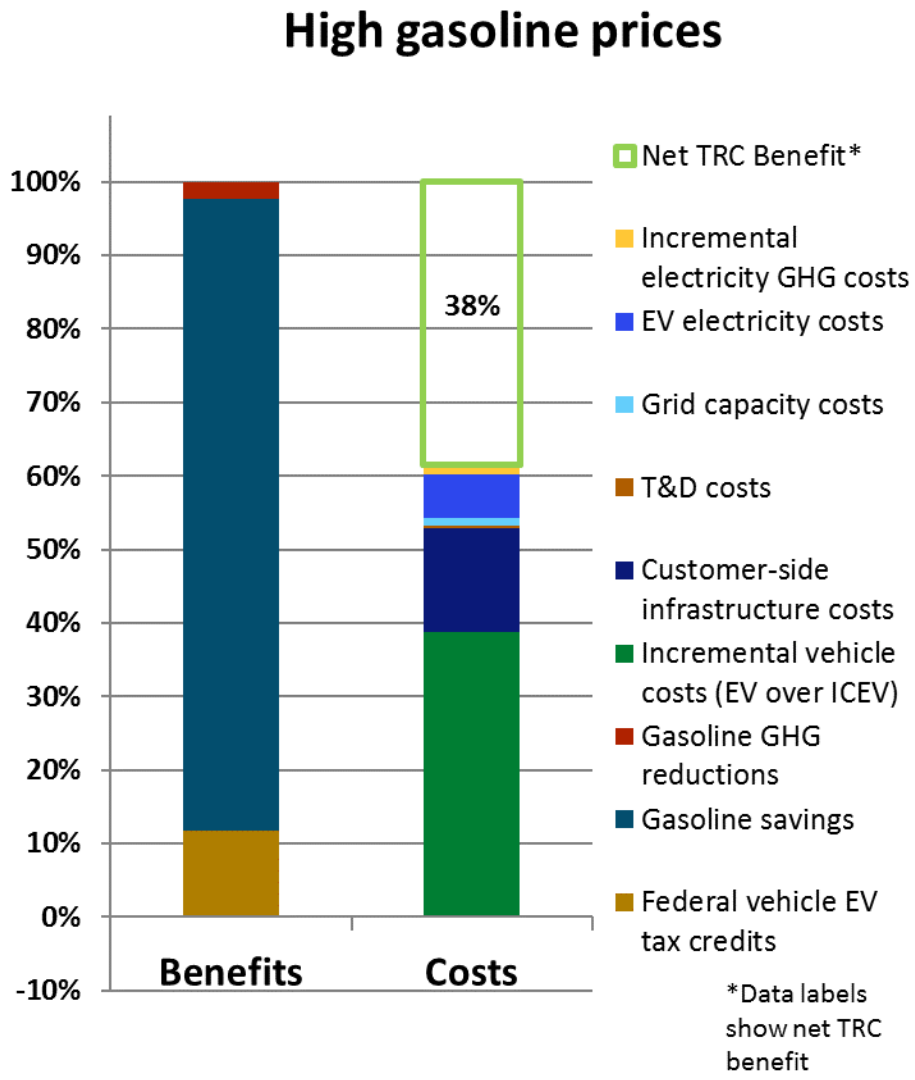
Assumptions 2 – What are the effects of gasoline prices?

- In the TRC test, the biggest benefit is gasoline savings
- This is problematic since this is speculative, and outside of any electric company's control
- What would happen if these changed significantly?

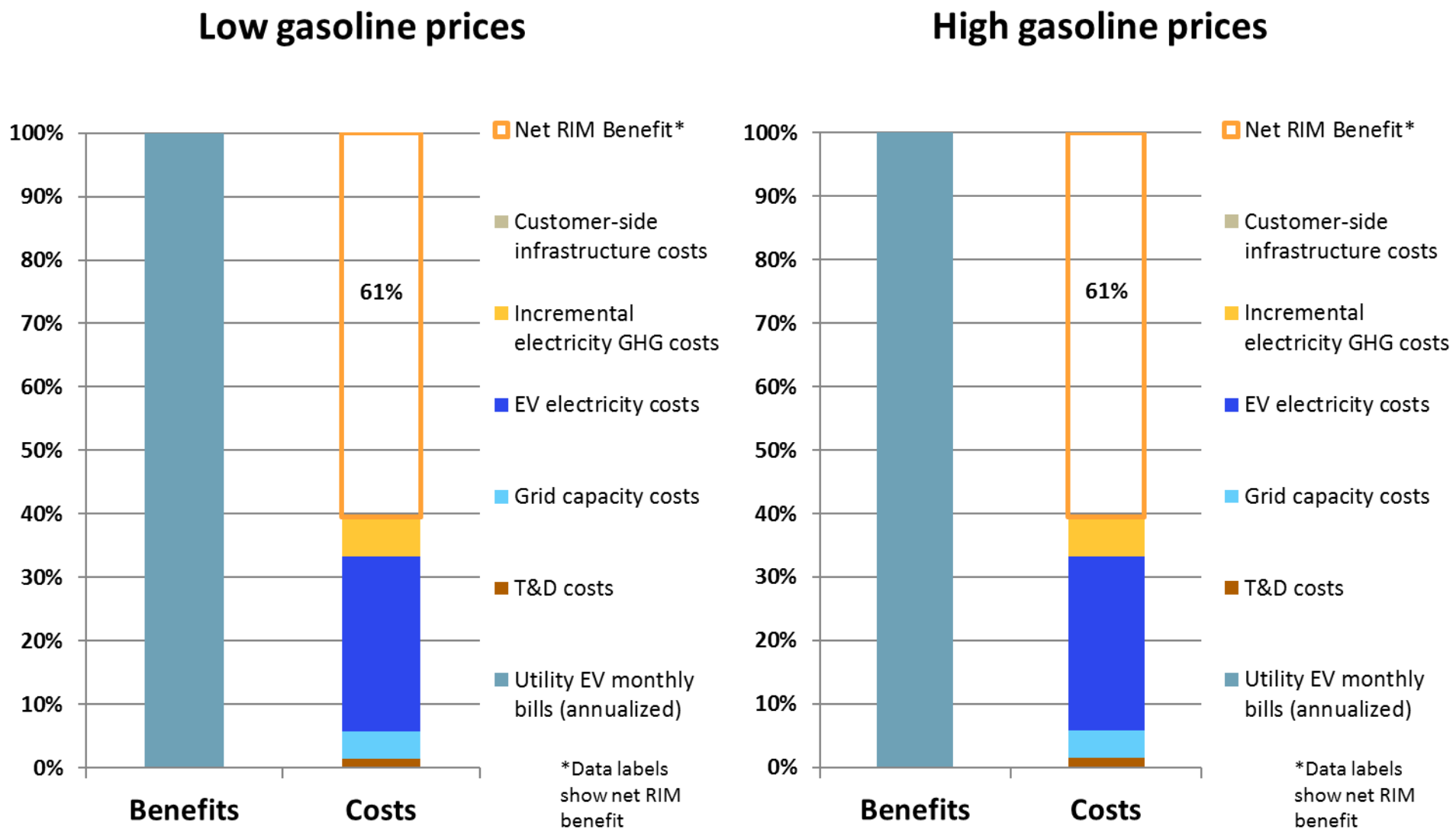
Gasoline price value	2016	Esc. rate	2025	2030	2035
Low gas price ($/gal)	2.03	1.9%	2.40	2.45	2.52
Medium gas price ($/gal)	2.03	3.5%	2.77	3.29	3.90
High gas price ($/gal)	2.03	9.4%	4.56	5.08	5.64

Results – Total Resource Cost (TRC) with low and high gasoline prices





Results – Ratepayer Impact Measure (RIM) with low and high gasoline prices



High level summary

- There are many factors that affect the overall cost/benefit comparison for utility electric vehicle programs
- Falling battery costs are making this comparison much more favorable over time, but other factors like varying gasoline prices have a large impact as well as being highly variable
- There is the potential for significant ratepayer benefits across the country- but more detailed analysis based on local market data may be required
- In thinking about utility program design, the main difficulties are estimating the effect of utility programs on the market
- It is also difficult to estimate the magnitude of social costs and benefits especially in markets without supporting policies (i.e. carbon and emissions programs)

Further information

- The results come from *The Value of Transportation Electrification*, EPRI report 3002007751:

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=3002007751

- EPRI is happy to discuss the report in more detail or work with individual utilities to determine more detailed local market results

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Together…Shaping the Future of Electricity