



Energy+Environmental Economics

# EV Cost Effectiveness and Implications for Utility Program Design

EVS29

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# Seattle City Light retained E3 to help inform electrification programs

## + Municipal utility serving Seattle and environs

- ~415,000 customers
- >90% hydropower

## + Support state goal of 50,000 light duty PEVs by 2020 (→ LDVs in SCL's territory)

## + Explore opportunities to electrify forklifts and buses



Photos courtesy of SCL website



# Project description

- + Develop plausible PEV adoption trajectories for light-duty vehicles, buses, and forklifts**
- + Investigate potential need for distribution grid upgrades to accommodate charging?**
- + Quantify costs and benefits**
- + Assess sensitivity to adoption, gasoline and carbon prices**
- + Identify opportunities for utility involvement with net ratepayer benefit**



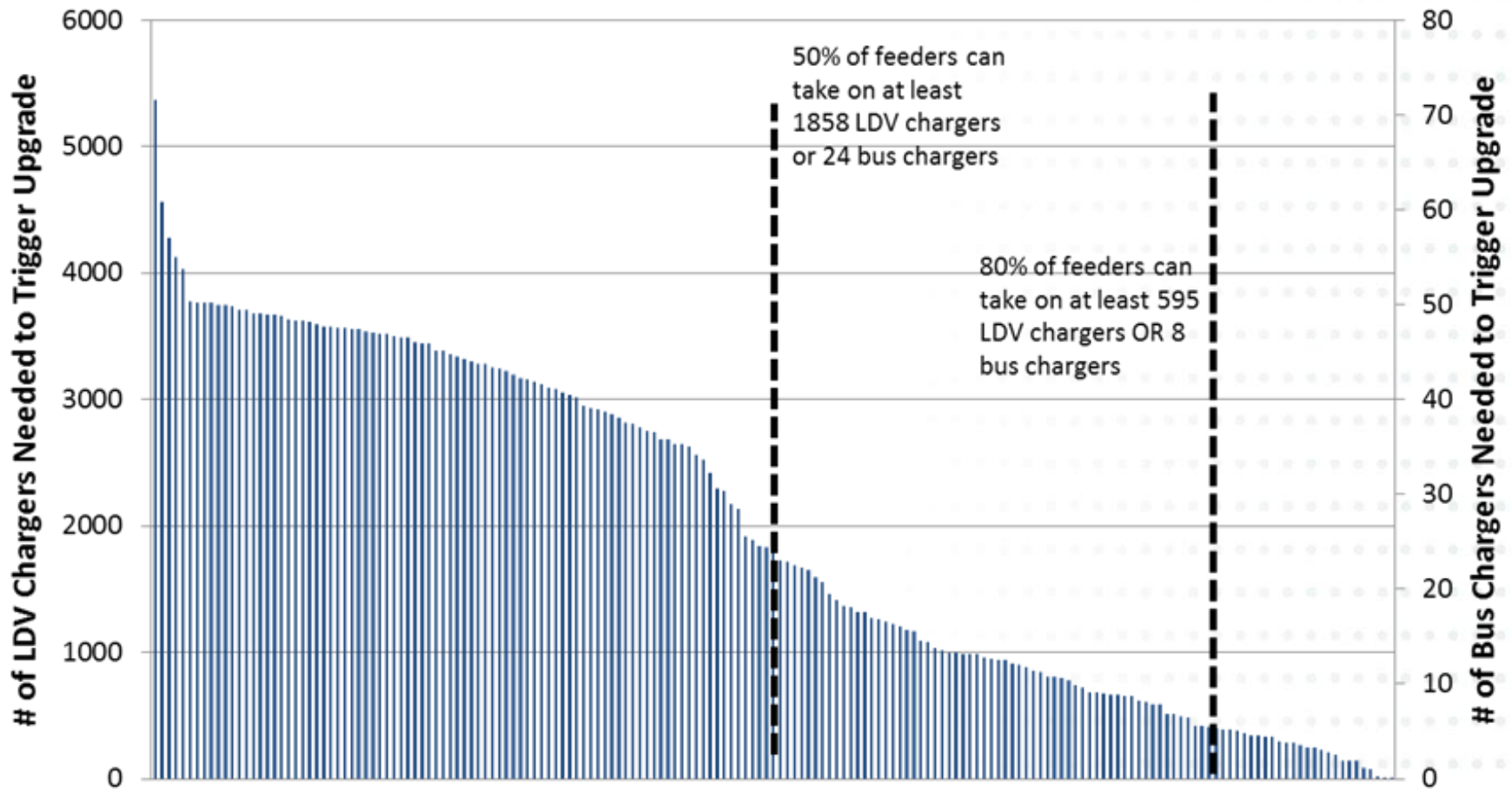
# Study adapted cost benefit tests used by utility regulators

| Cost Test                      | Key Question Answered                                                                        |
|--------------------------------|----------------------------------------------------------------------------------------------|
| Ratepayer Impact Measure (RIM) | Will utility rates increase for non-adopters?                                                |
| Total Resource Cost (TRC)      | Will the total costs of energy in the utility service territory decrease?                    |
| Societal Cost Test (SCT)       | Is society in Washington state better off? (Adds benefits from avoided externalities to TRC) |



# Distribution upgrade costs are low due to abundant existing available capacity

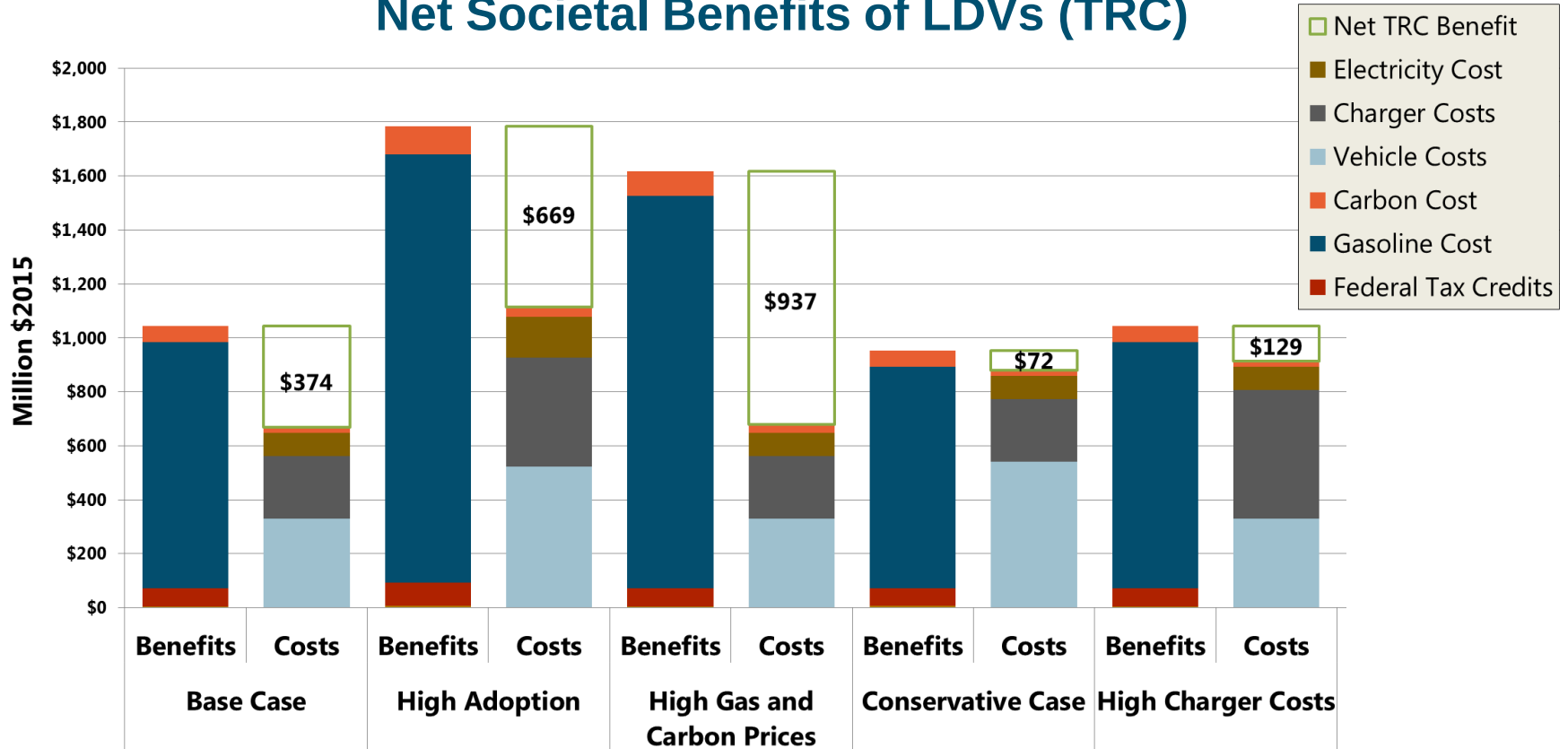
**SCL Available Capacity (2015)**





# LDV electrification yields societal benefits in all cases examined

## Net Societal Benefits of LDVs (TRC)

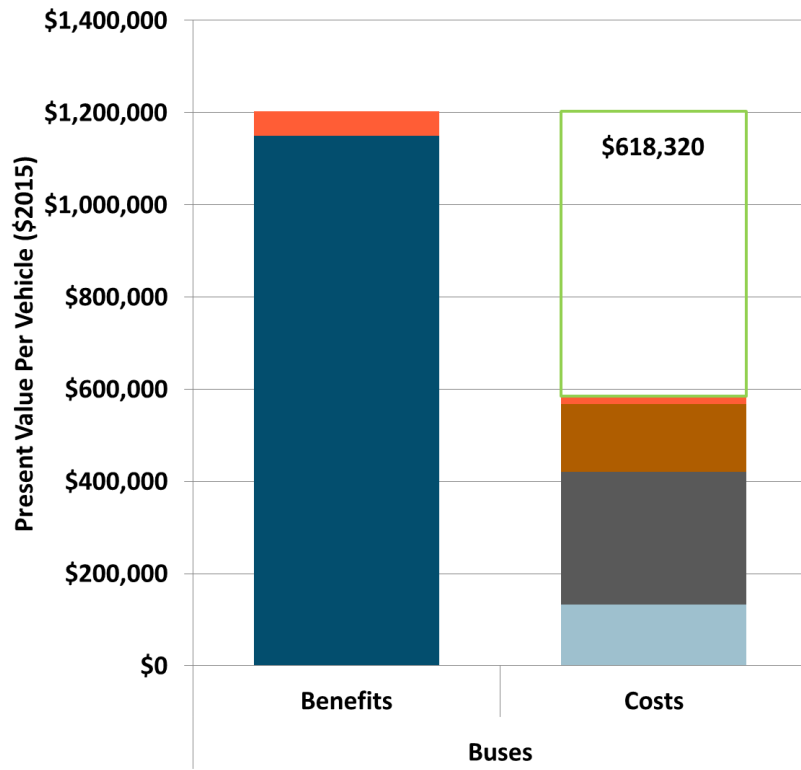




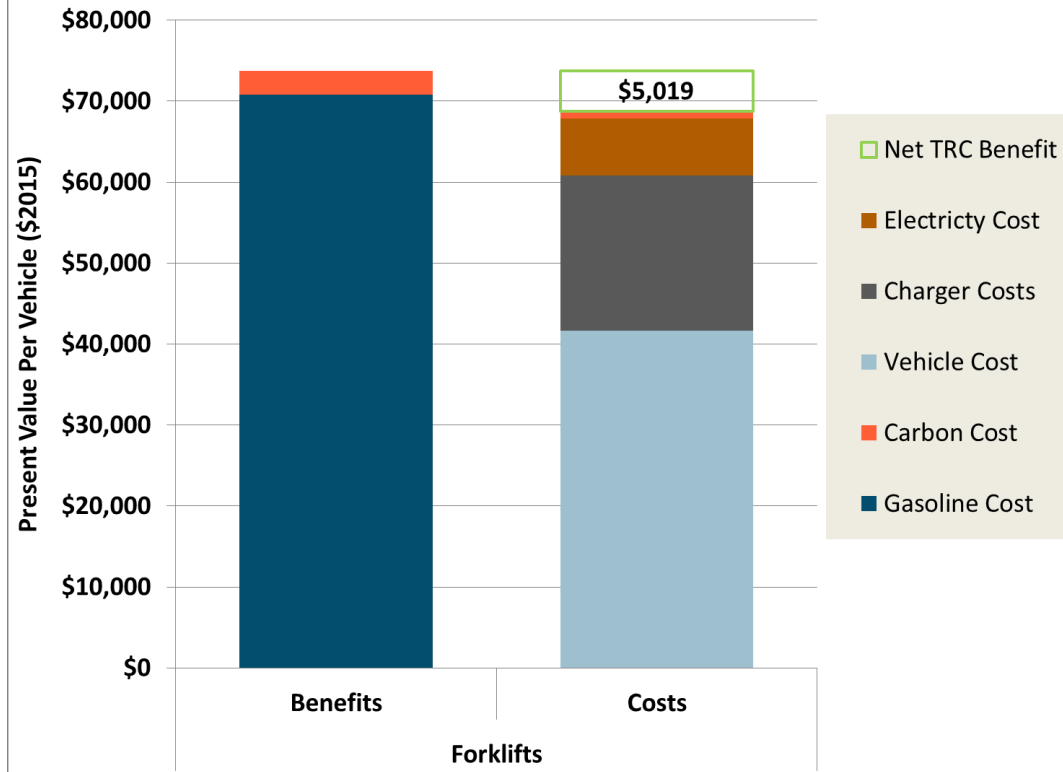
# Electrified buses and forklifts also have net societal benefits

## Net Societal Benefits of Buses & Forklifts (TRC) (Present Value Per Vehicle)

### Buses



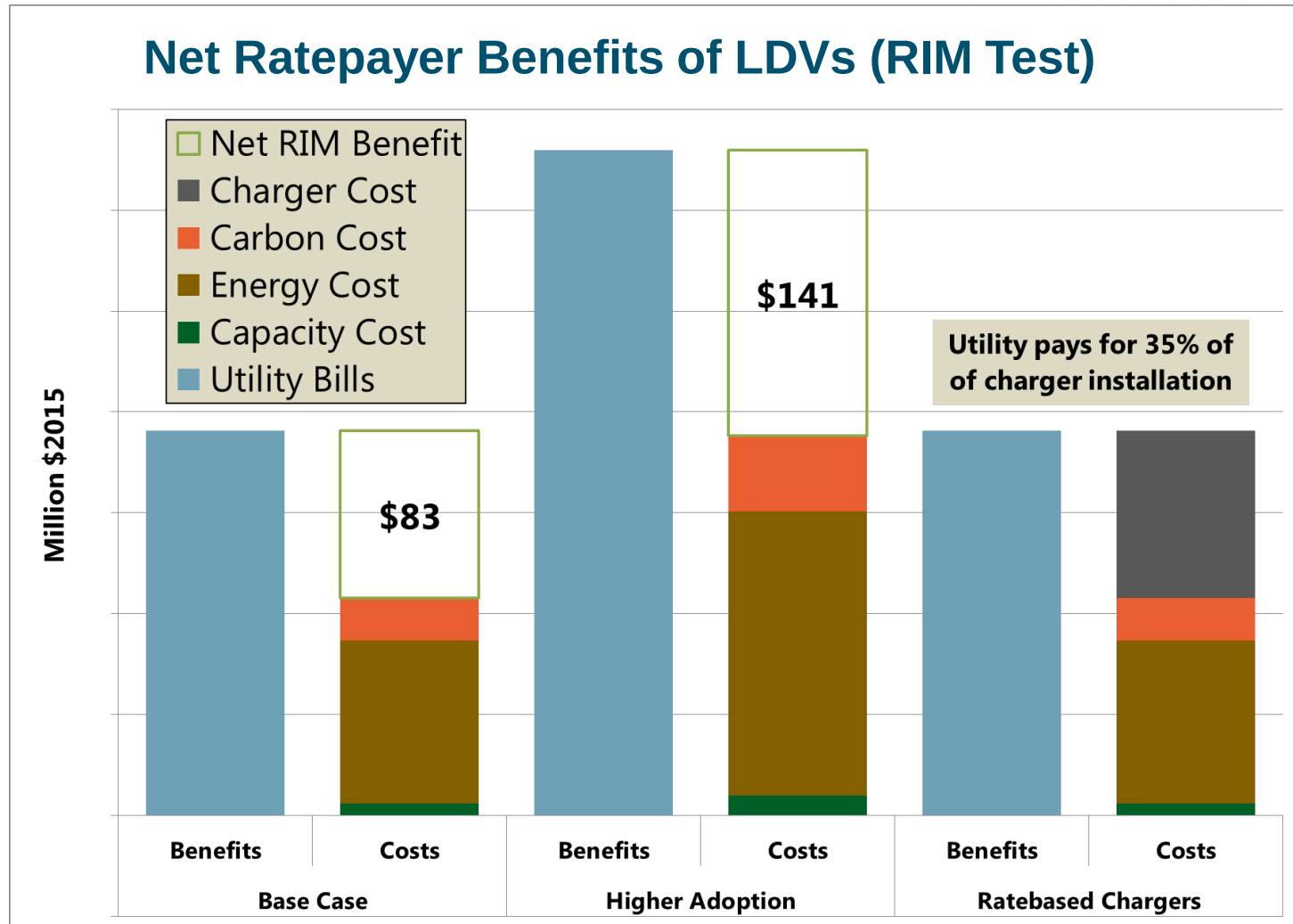
### Forklifts





# Ratepayers benefit from electrifying LDVs due to improved asset utilization

## Net Ratepayer Benefits of LDVs (RIM Test)





## Implications for Utility EV Incentives

- + Net RIM benefit defines maximum incentive spending without cost shift**
- + Results suggest that it is in ratepayer interest for SCL to develop some type of EV incentive or investment program**

| Vehicle Type | Maximum per-Vehicle Incentive<br>(net RIM benefit) |
|--------------|----------------------------------------------------|
| LDV BEV      | \$1,250                                            |
| LDV PHEV     | \$1,177                                            |
| Bus          | \$120,505                                          |
| Forklift     | \$14,668                                           |



# Utility and Ratepayer Perspective: PEVs are the opposite of PV and EE



GHG & Emissions



Total Energy Consumption



Utility Infrastructure



Retail Rates



**+ PV and EE shift costs to other ratepayers**

**+ EVs increase utility asset utilization → lower rates**



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# Thank You

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