

Oregon's Cap-and-Trade Program: An Economic Assessment

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HB2020: An Agenda for Economic Opportunity

Cap-and-Trade can:

- Promote innovation and efficiency
- Save enterprises and households money
- Secure a more sustainable future for Oregon



Why Cap-and-Trade Works

- Respect for property rights – private and public
- Based on voluntary exchange
- Leverages private information to find efficient pollution reduction
- Program design can accommodate adjustment needs.



Economic Benefits and Costs

Three main economic drivers:

1. Large scale adoption of efficient energy technologies, especially renewable electricity and vehicle electrification (costs for some, jobs for others).
2. Income/expenditure effects of energy savings (broad-based job creation).
3. Public health benefits of emission reductions.



Main Findings

1. Oregon can meet its 2050 climate goals in ways that achieve higher aggregate economic growth and employment.
2. Energy efficiency and renewable electrification offer broad-based savings to enterprises and households, which can be a potent catalyst for inclusive economic growth and job creation.
3. This will require a fundamental restructuring of the state's energy system, including
 - electrification of at least the light vehicle fleet,
 - deep decarbonization of the electrical sector, and
 - dramatically reduced direct natural gas use in heating and industrial applications
4. Recognizing sector needs for flexibility, adjustment costs for this economic transition can be substantially reduced.
5. Economic benefits of improved air quality, in terms of averted medical costs and premature mortality are substantial.

Macroeconomic Impacts

Change from Reference* in 2030

	Ref (levels)	Linear	Interim Target	Core
GDP (\$B)	\$366.0	1.08%	0.93%	1.08%
Consumption	\$184.5	1.07%	0.91%	1.07%
Jobs (%)	-	0.50%	0.44%	0.50%
Wages	-	0.22%	0.20%	0.22%
FTE ('000)	3,360	17	15	17
GHG (%)	-	-29%	-46%	-46%
GHG (MMTCO₂e)	44.2	31.2	23.9	23.9

Scenarios: (see also p. 15 of the report)

Ref: The baseline scenario. Reflects pre-HB202 policies (e.g. RPS, historical energy efficiency goals)
 Linear: Constant incremental emission reductions (-1.5MT per yr, 2021-2050).

Interim Target: More ambitious (-2MT per yr to 2035, -1MT thereafter).

Core: Interim Target scenario with 8%_certified offsets.

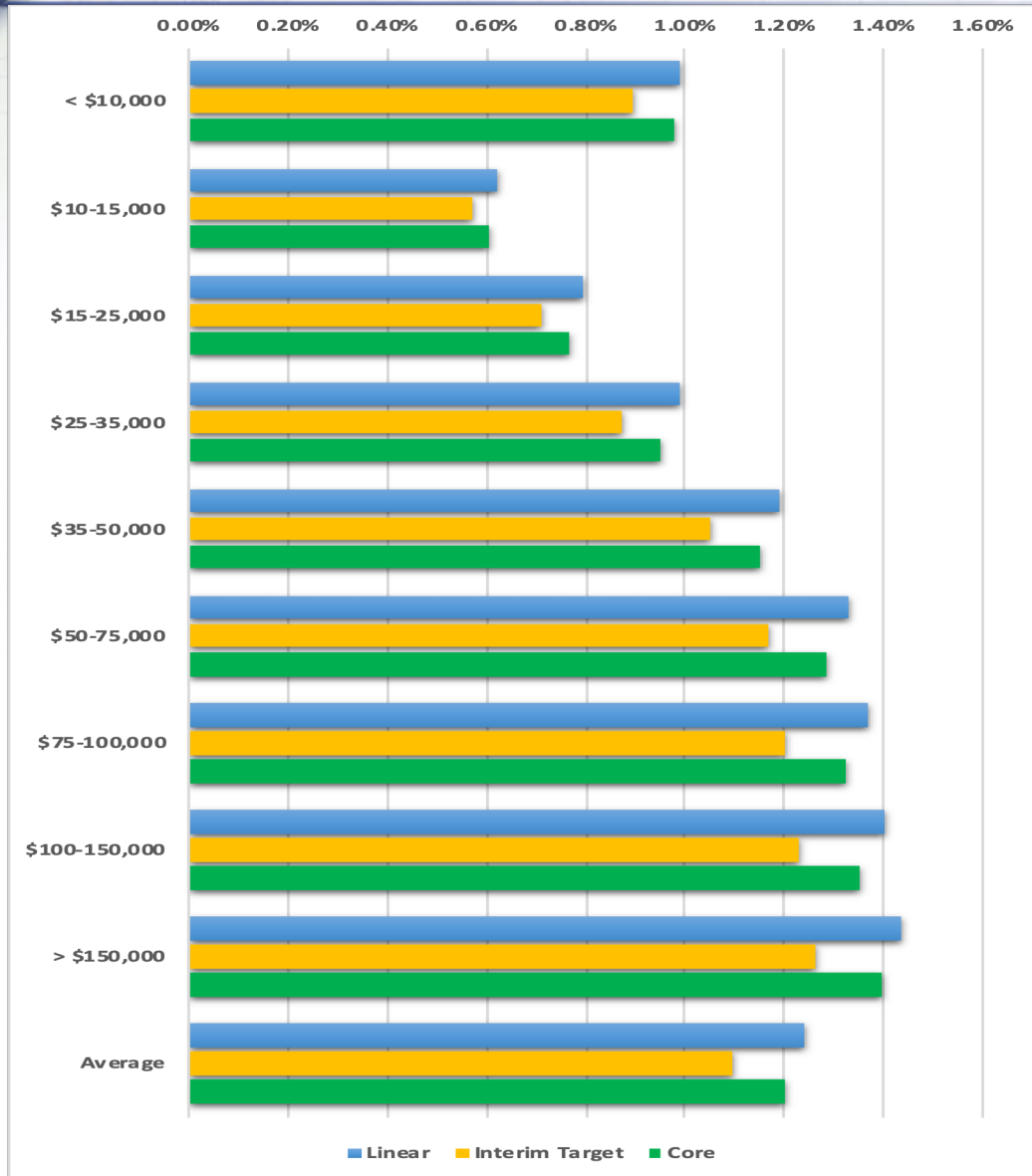
Change from Reference in 2050

	Ref (levels)	Linear	Interim Target	Core
GDP (\$B)	\$526.2	2.55%	2.19%	2.55%
Consumption	\$266.3	2.40%	2.02%	2.40%
Jobs	-	1.08%	0.93%	1.08%
Wages	-	0.46%	0.42%	0.46%
FTE ('000)	4,393	48	41	48
GHG (%)	-	-82%	-82%	-82%
GHG (MMTCO₂e)	48.5	8.7	8.7	8.7

*Differences in both tables are estimated with respect to the Reference scenario.

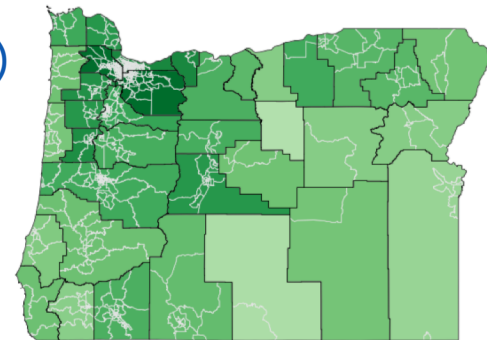
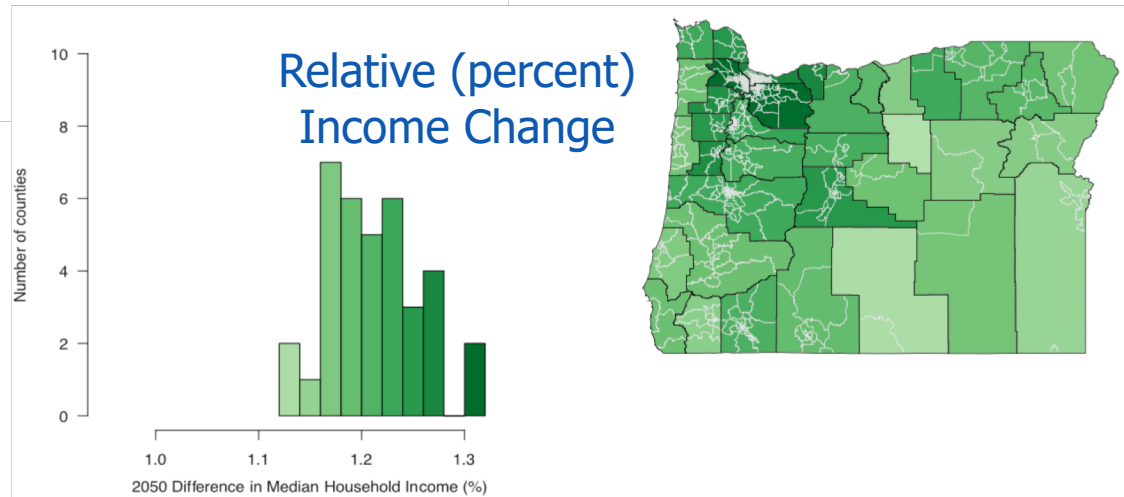
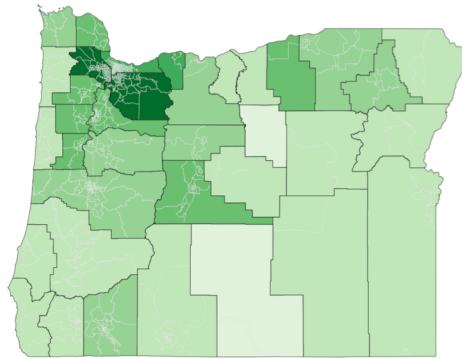
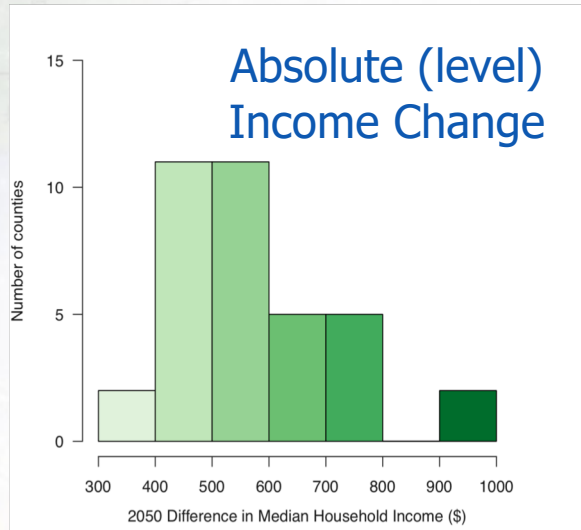
Household Real Income Impact by Tax Bracket

(Mit2050, percent change from Reference case in 2050)



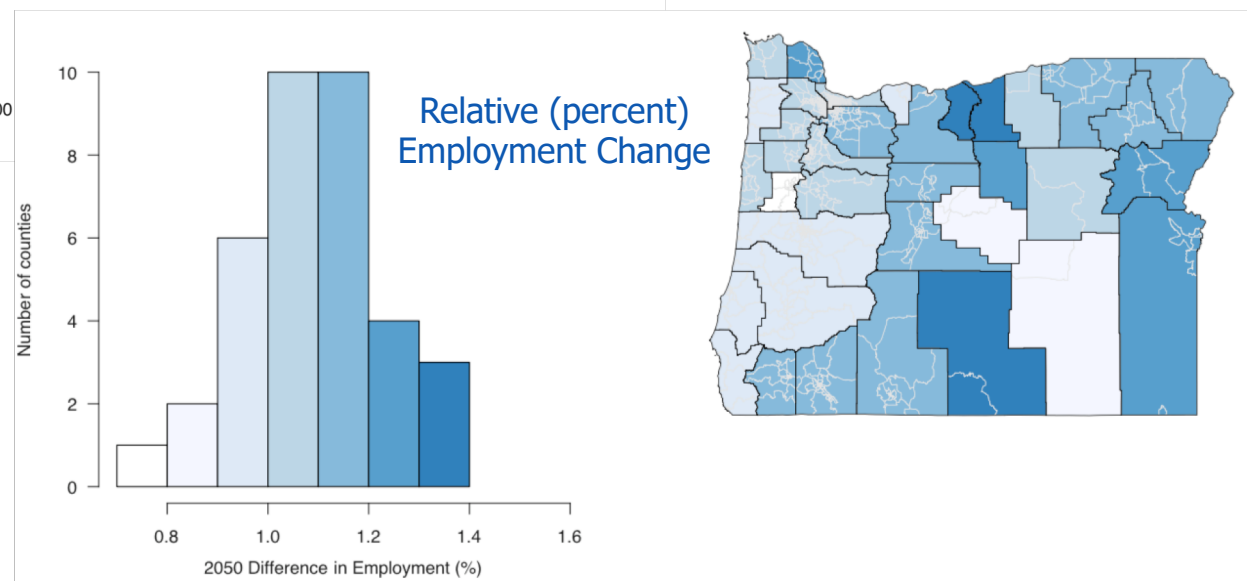
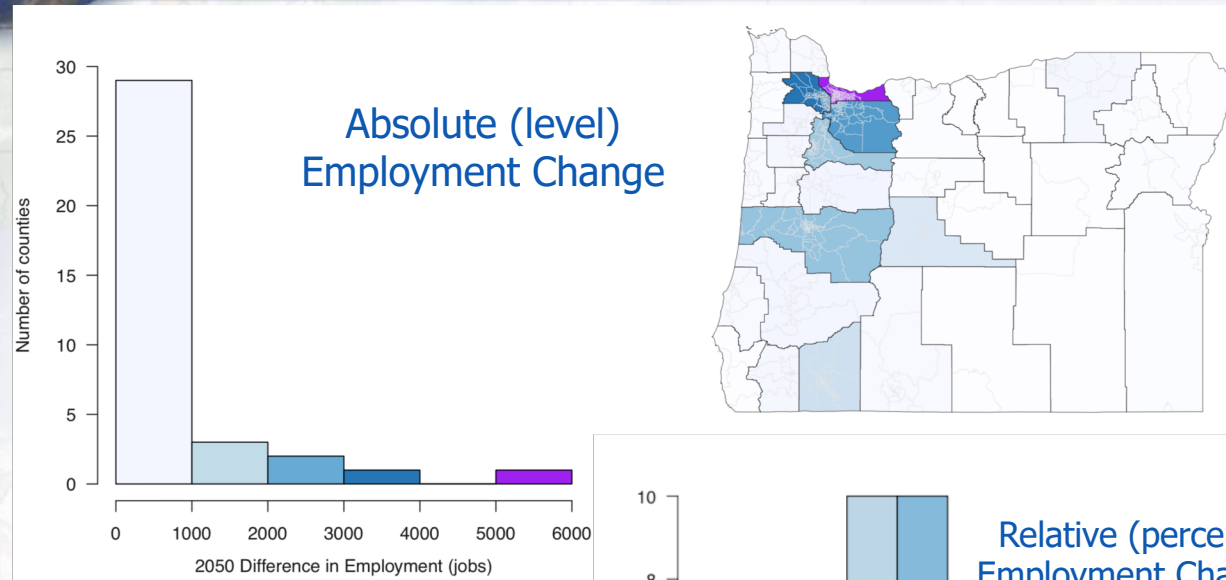
- Average household income rises in every tax bracket.
- Lowest income gain significantly because energy is a large share of income.
- For other households, energy savings increase with income.
- Employment and wage growth also contribute, but not all households will gain.

Median Household Income Growth 2050, Core Scenario



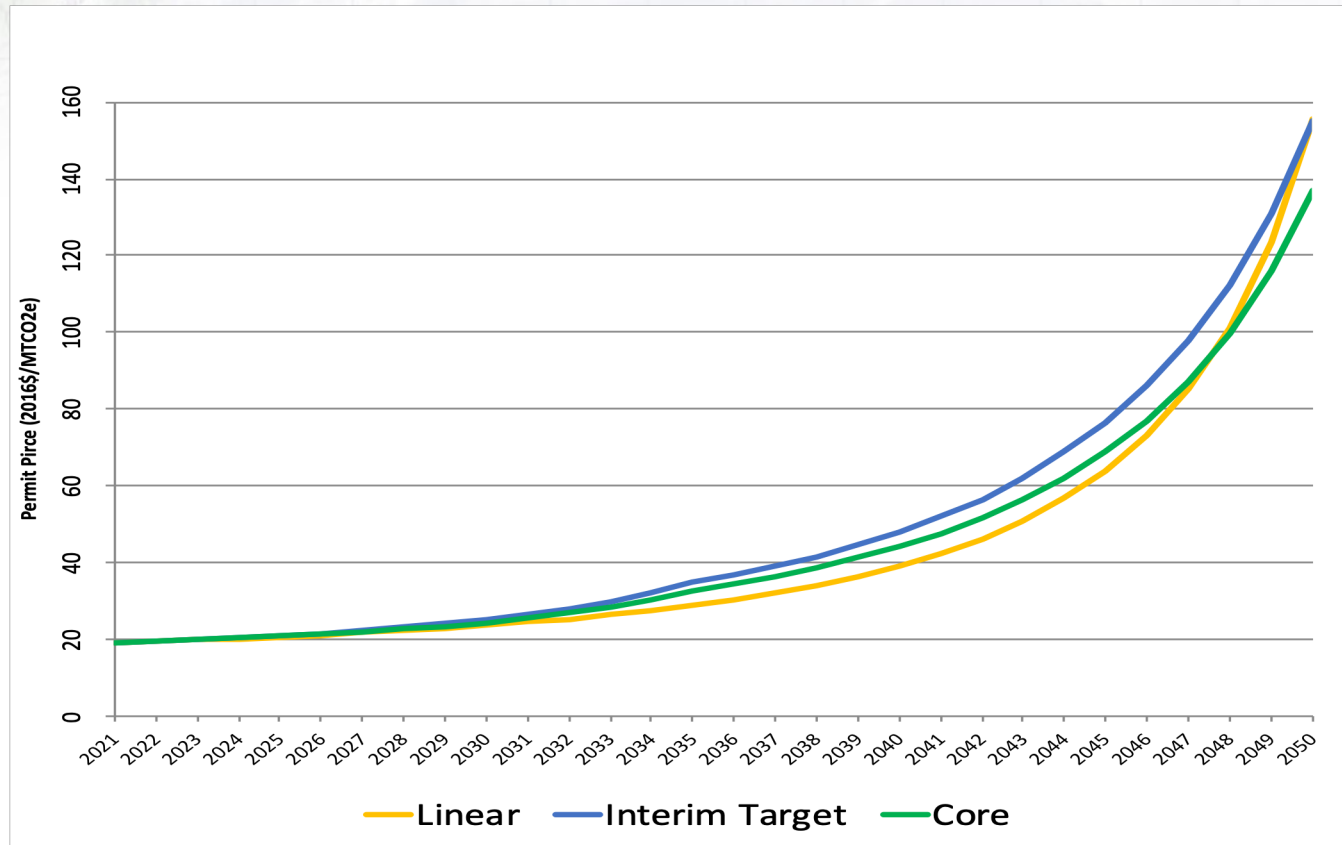
- Absolute income gains are higher in higher income counties, but
- Relative income gains are much more uniform.

Net Job Creation by County 2050, Core Scenario



- As with income, employment growth from energy savings is quite inclusive across the state.
- Greater relative gains outside major urban areas.

Permit Prices



- Rising slowly for the first two decades.
- Price effects for fossil fuels in single-digit percentages.
- Far below oil price risk, improving energy security.
- Plenty of opportunities and incentives for innovation in the last decade.
- Within the range of WCI expectations, opening a larger market for risk management.

Example of Market Evidence: California's Permit Price History



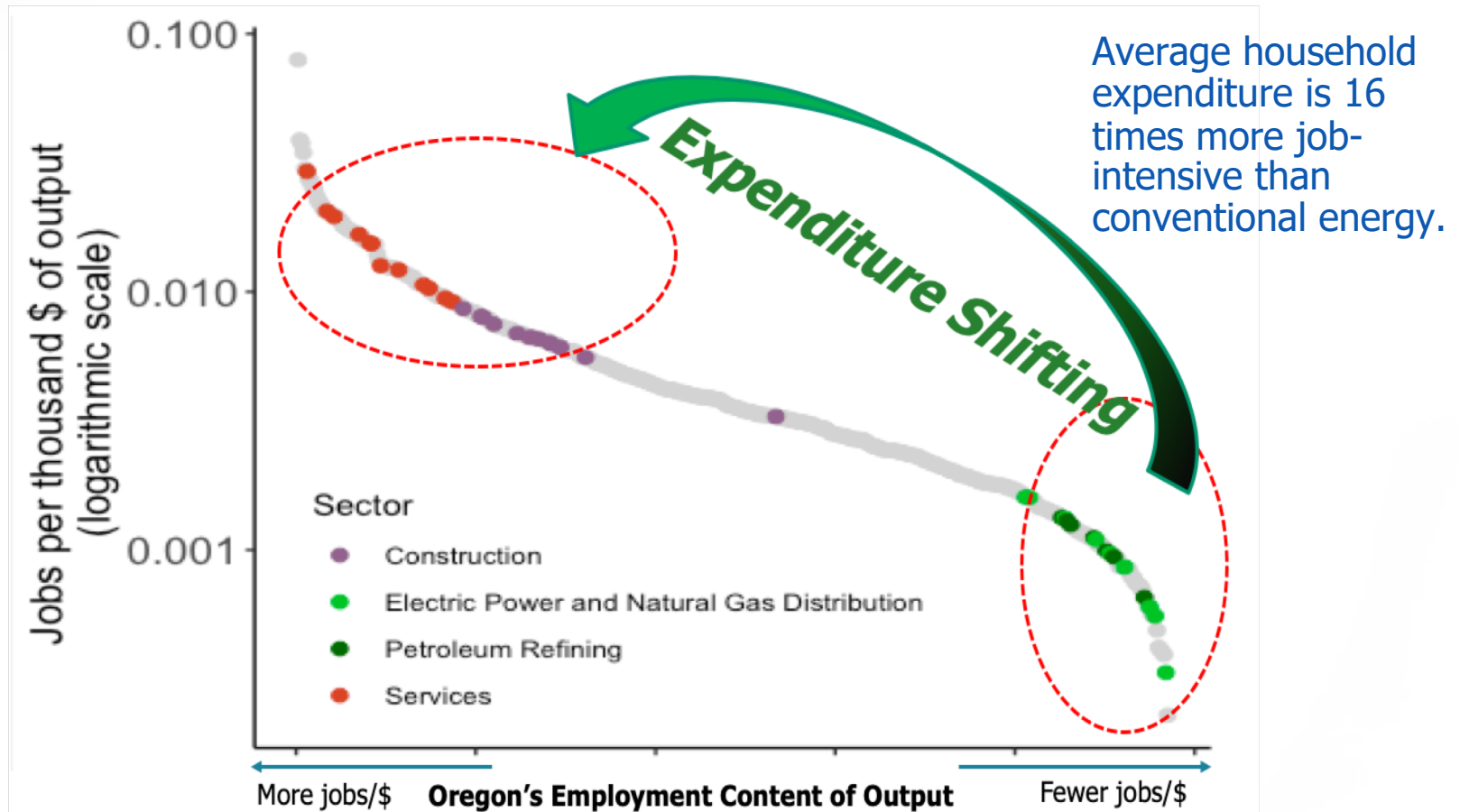


Energy Efficiency and Growth

- Promoting efficiency in both energy production and use saves money for households and enterprises
- These savings will be diverted to other expenditures, the majority of which go to in-state services:
 - which employ workers of all skill levels and demographics
 - which are non-tradable, meaning these new jobs cannot be outsourced.

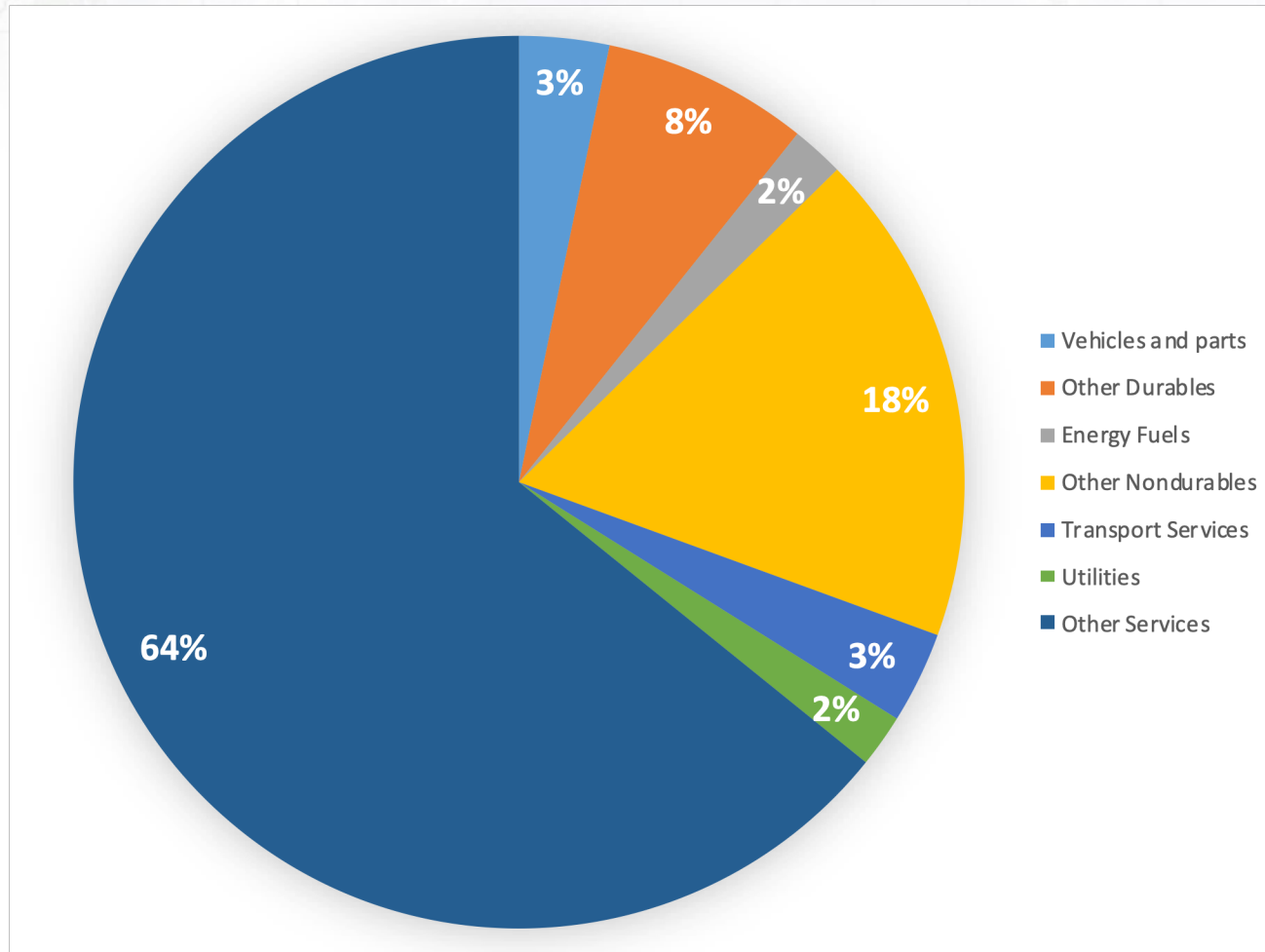
Why it works

- The energy supply chain is among the least job-intensive in the economy.
- Shifting expenditure from energy to services stimulates new job growth.



485 Sectors of the Oregon economy, ordered by job-intensity (vertical axis).

Like the US as a Whole, Household Spending is Dominated by Services





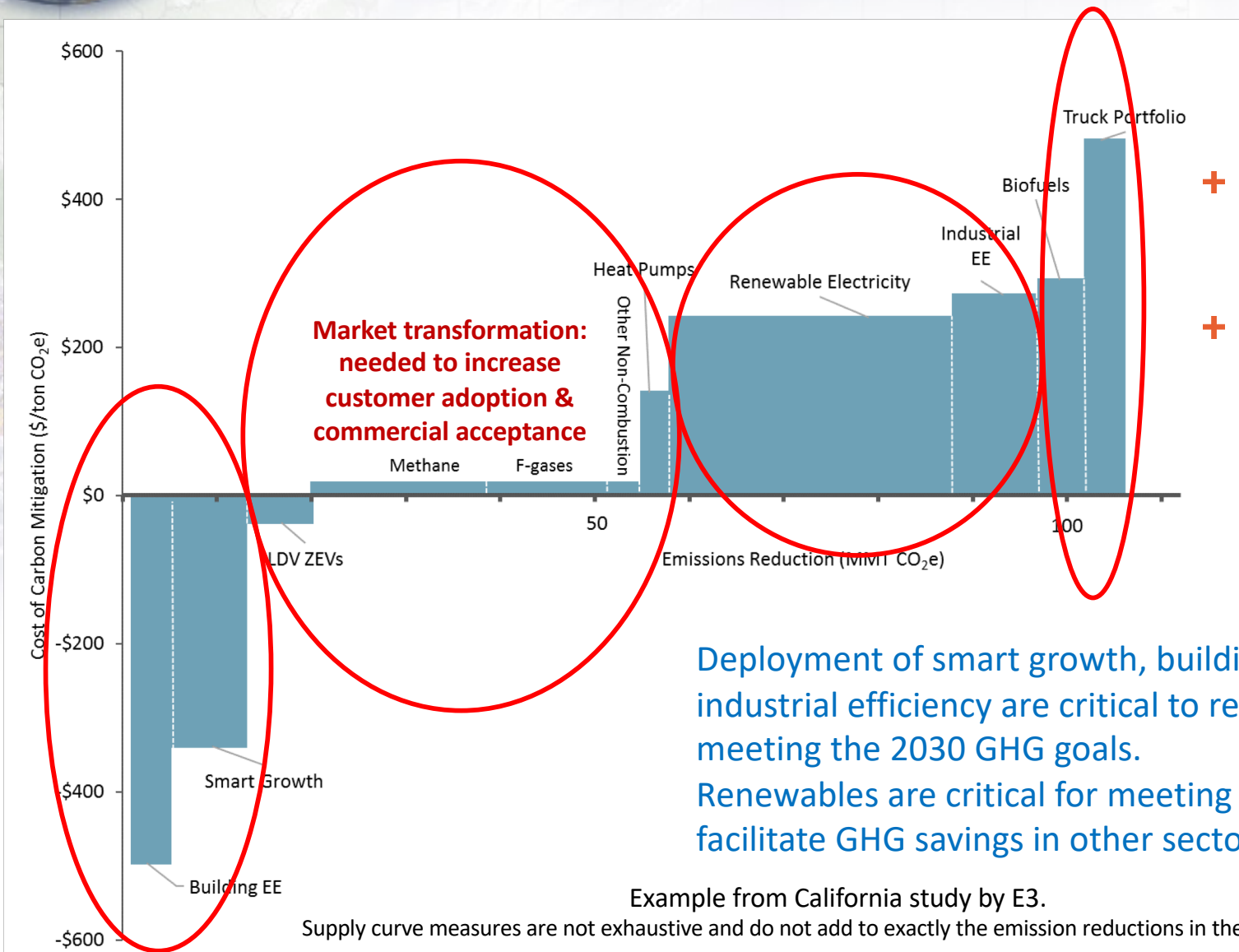
Where do Savings Come From?

This study only considers cost saving technologies that are already available.

- Efficiency solutions for enterprises and households
- Renewable electric power generation
- Vehicle electrification

In every category, available technologies can deliver net savings and innovation potential remains significant.

Technology Options for Oregon to Reach 2030 Emission Targets (2016\$)

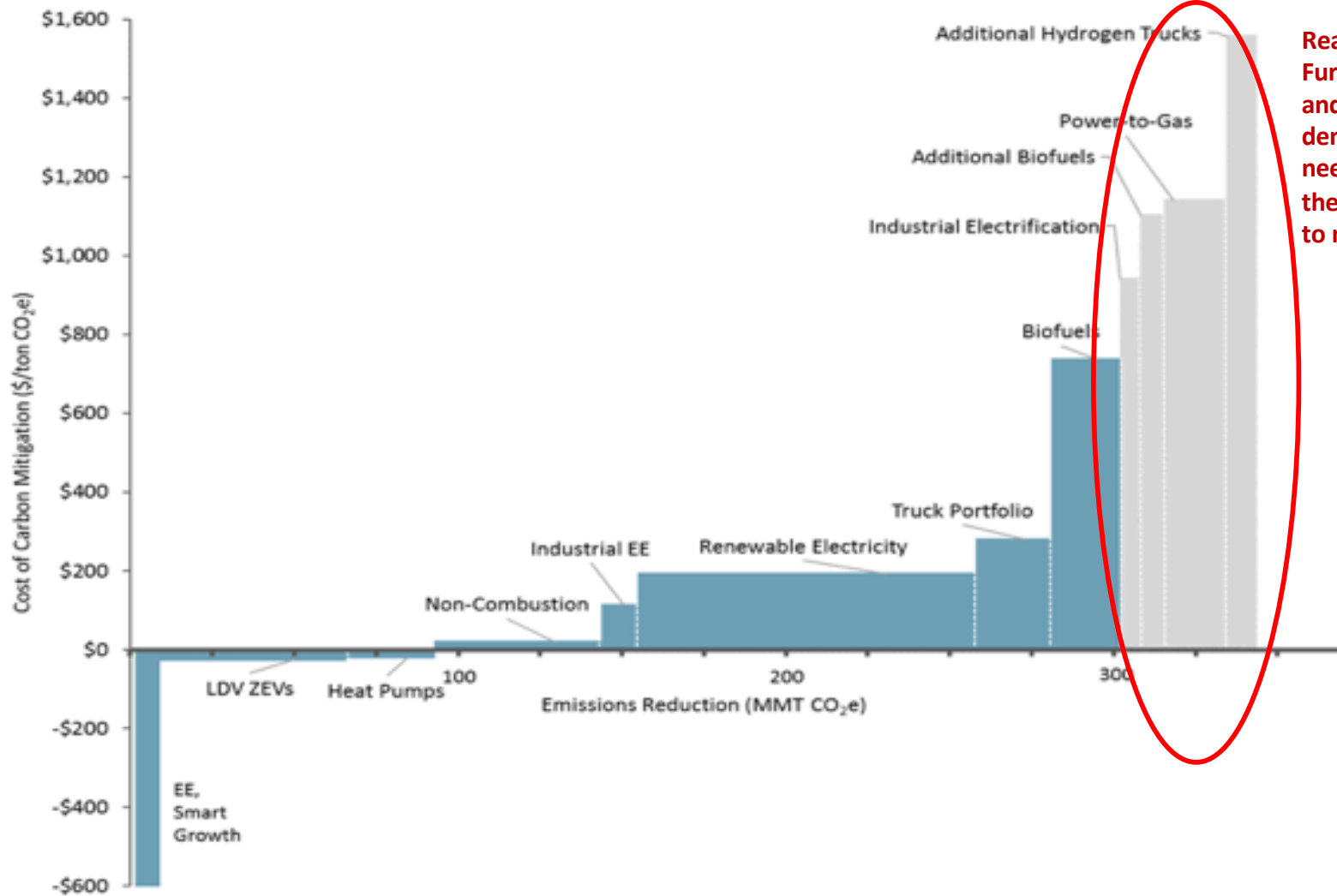


- + All of these measures represent available technologies.
- + Emission reductions are limited by adoption feasibility rather than by technical potential

Example from California study by E3.

Supply curve measures are not exhaustive and do not add to exactly the emission reductions in the scenario due to interactive effects

Technology Options for Oregon to Reach 2050 Emission Targets (2016\$)

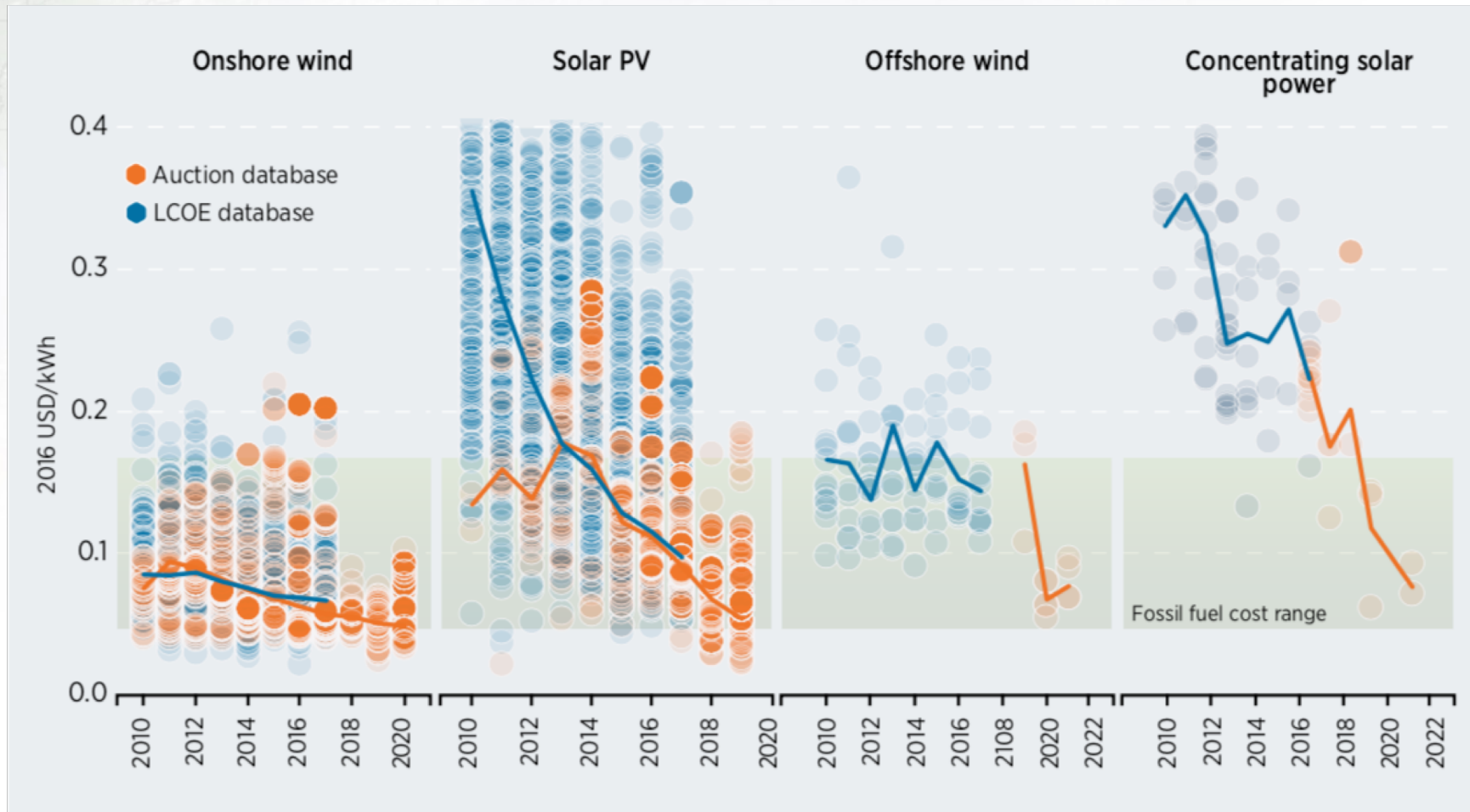


**Reach technologies:
Further innovation
and commercial
demonstration
needed to bring
these technologies
to market**

Example from California study by E3.

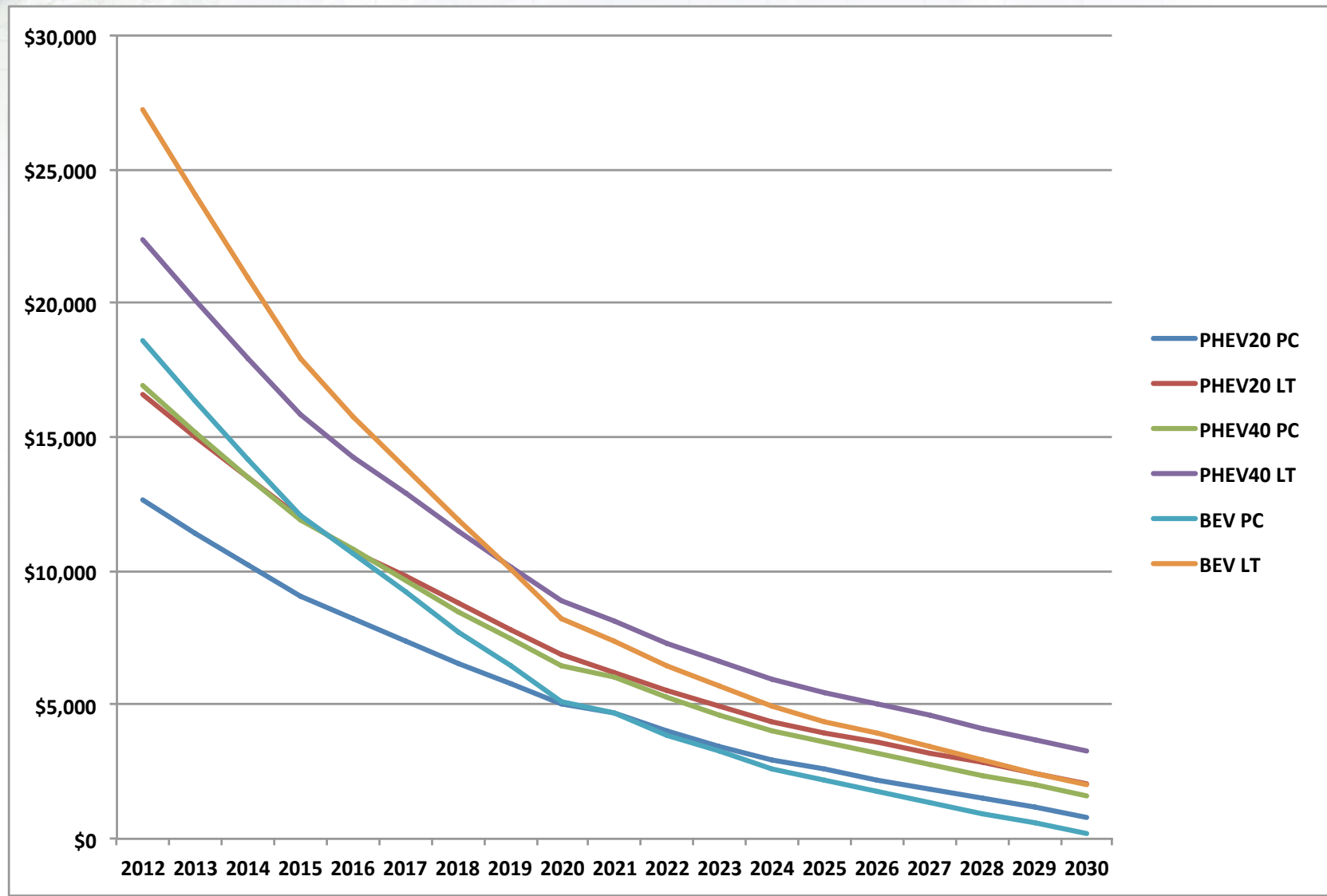
Supply curve measures are not exhaustive and do not add to exactly the emission reductions in the scenario due to interactive effects

Renewable Electricity Costs: Already Competitive and Trending Down

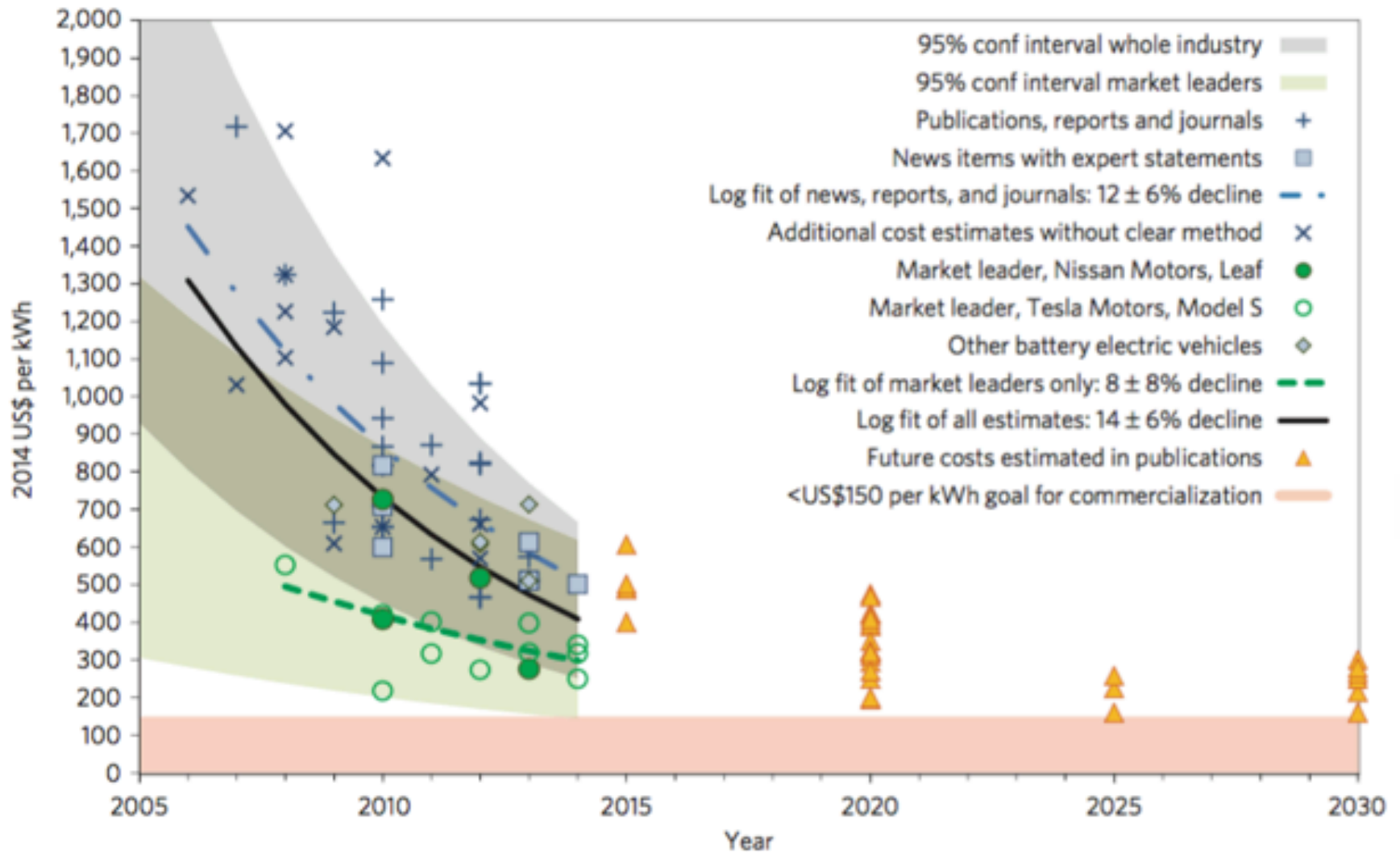


- In the US, costs have fallen over 50% for wind and 70% for solar in the last five years alone.

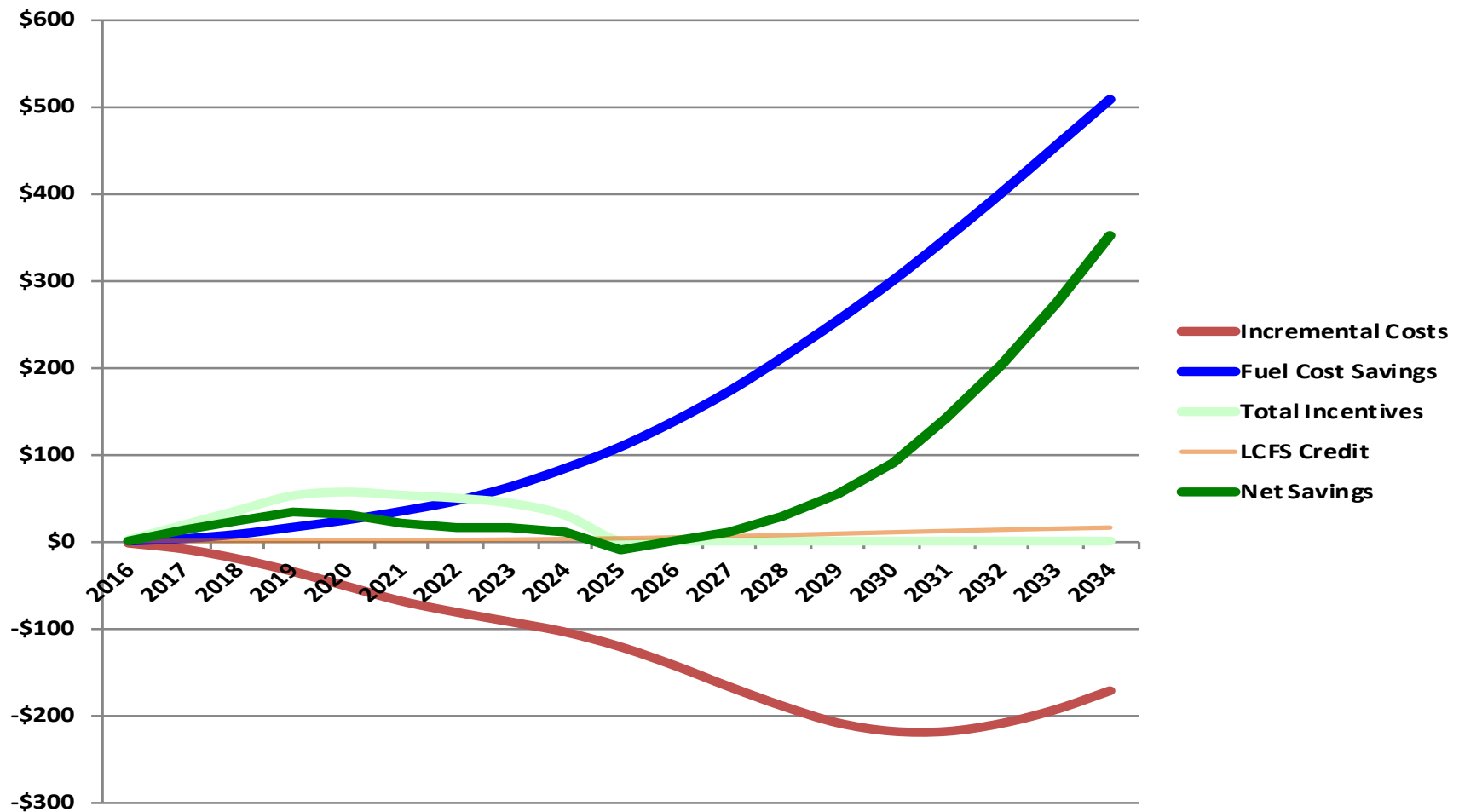
Incremental Electric Vehicle Costs



Actual EV Battery Costs

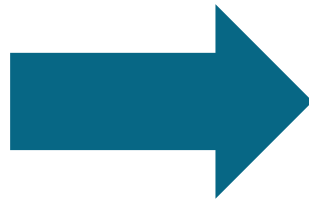


Estimated Benefits and Costs of EV Adoption (2016\$)

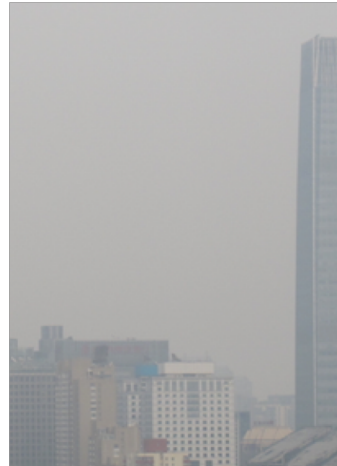


Modeling Health Costs

GHG Emissions



Criteria Pollutants
(PM2.5, ozone, etc)



Health Costs



*Model of meteorology
and air quality*

Yuqiang Zhang et al 2017 Environ. Res. Lett. "Co-benefits of global, domestic, and sectoral greenhouse gas mitigation for US air quality and human health in 2050"

*EPA's BenMAP model
for mapping exposure to health
benefits*

<https://www.epa.gov/benmap>



Economics of Health Benefits

- Emissions mitigation policy will make significant contributions to public health across Oregon
- In 2030 alone, our (conservative) exploratory estimate of the economic value health benefits from GHG reductions in the energy sector is at east \$2.0 billion annually, of which:
 - \$0.8B is due to averted premature mortality
 - \$1.2B is due to averted medical costs
- Our exploratory estimates represent health benefits associated with reductions in GHG emissions in the energy sector alone but do not quantify many of the other expected benefits that are known to be substantial (see next slide for details)



Other Benefits Not Directly Quantified in this Study

- While this study presents an exploratory analysis of the health benefits associated with reducing GHG emissions in Oregon's energy sector, other potential co-benefits not covered here include:
 - Productivity benefits from lower criteria pollutant concentrations (e.g. work and school attendance, performance, etc.)
 - Local environmental, health, and safety benefits from electrification of the vehicle fleet
 - Benefits from avoided local temperature increases due to lower GHG emissions. Higher temperatures have been found to impact many outcomes including, but not limited to, agriculture, income, education, and crime (Carleton and Hsiang 2016)
- These (and other) benefits would be additional to those estimated in this study.



Conclusions

- The state is committed to an ambitious long term program for pollution reduction, and the economic benefits for Oregonians can be significantly greater than its direct costs.
- Conservative estimates, based on investment and detailed technology cost analysis, indicate that Oregon's proposed Cap and Trade program can be a potent catalyst for income and job growth across the state.
- By accelerating adoption of currently available energy infrastructure and use technologies, enterprises and households can realize energy savings that stimulate broad based economic growth, adding
 - ✓ Over 2.5% to Oregon real GDP by 2050
 - ✓ About 50,000 additional FTE jobs by 2050
- Income and Employment growth is inclusive, extending around the state with relatively greater gains for lower income households.
- Economic benefits from improved public health are substantial.



Thank you