Recommended Policy/Action	GHG Saving $MMTCO_2e$ (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $\$/MtCO_2e$	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ $1000ft^3$	
Economy-wide program																
Cap and Trade	12.1	22.1	35.9	NQ	Cumulative net output ($ Billion) in 2020 relative to '08: (ECONorthwest). WCI scenario: $3.3 Bil; Less Effective Complementary Policy scenario: $0.7; High Energy Cost scenario: $4.4 billion (ECONorthwest).[1] Carbon-intensive industries in OR produce lower emissions than similar industries in the U.S. elsewhere. Some in OR are vulnerable to contraction or closure as a result of cost increase associated with a cap. Clean energy and other low carbon industries may experience growth and opportunities (UC Berkeley Labor Center).[2] ARB estimates that Cap and Trade program will reduce total economic output by 0.1%, from 2.4 to 2.3% (CARB).[3] The California, RGGI, and Australia programs direct revenues to programs to mitigate impacts to low-income households and ratepayers.	WCI scenario increases jobs by 19,300 by 2020 (less than 1% increase over 2008 WA employment levels). Less effective scenario: increase in 845 jobs; high energy cost scenario: increase in 25,358 jobs[4] (ECONorthwest). CO2-intensive industries are a small share of jobs in OR; 12,745 jobs are in industries that may be vulnerable to job loss, or about 0.2% of OR employment (UC Berkeley Labor Center).[5] Estimated 16,135 job years created from RGGI cap and trade (Analysis Group).[6]	At a $15/ton carbon price, the industries that will experience a cost increase >2%: cements lime, pulp & paperboard mills alkalis and chlorine, carbon black; other basic organic chemicals, nitrogenous fertilizers (UC Berkeley Labor Center).[7] "All commercial and industrial customers will have an increase in economic output over time if they have made investments in energy efficient equipment" (ECONorthwest)[8]	Most mfg. industries to have very small cost increases. Carbon-intense industries will incur costs that may result in job losses if energy efficiency investments are either not possible or not sufficient to counter costs (UC Berkeley Labor Center).[9]	No Data	"Suppliers of energy efficient equipment (contractors, construction, retail trade sectors) will benefit from increased spending on energy efficient equipment"[10] (Australian Ministry of Environment).		No Data	The Australian government estimates that during the first year of the CPM, household consumption has grown 1.7%.[11]	California ARB estimates minimal, if any, impact on household income (0 to 0.1% decrease).[12] Households in the RGGI region recognized a nearly $1.1 billion net gain from energy efficiency gains resulting from RGGI revenues (Analysis Group).[13] Res. and com. sector customers will have increase in costs from investments in EE, mitigated by energy savings; "households that have purchased energy efficient equipment will have lower energy bills and consequently more money to spend on other goods and services"[14] (ECONorthwest).	No Data	CA Cap and Trade to see avoidance of 75 million barrels of oil and 189 trillion Btus of natural gas annually (EDF).[15] EU could save an average of $26 billion (€20 billion) in fuel costs each year from 2016 to 2020 (EDF).[16] Revenues from RGGI's first compliance period have contributed to in-state energy programs and projects that have led to a direct reduction of $756 million in fuel expenditures (RGGI.org).[17]

***NOTE**: It is important to understand that the estimates provided here must be viewed carefully and considered in the context of the original research. There is a risk of oversimplification of the research and analysis, caveats and assumptions. For example, the results in this table sometimes show ranges of numbers where the upper and lower bounds come from different jurisdictions, different study parameters. Also, some dollar values are 2013 US$, whereas other data may not be directly comparable, for example if they reflect different discount rates or embody time-value-of-money differently. Important caveats, key assumptions and data sources are concisely noted in the endnotes as much as possible.*

Recommended Policy/Action	GHG Saving MMTCO$_2$e (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $/MtCO$_2$e	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ 1000ft^3	
Carbon Tax: $10 per mtCO$_2$e tax	0.4	0.6	NQ	$5 (Leidos)[18]	**Change in Tax Revenue 2020:** $563 million **Change in Tax Revenue 2035:** $571 million[19]	No Data	$1.213 billion in taxes from 2015 to 2035 (Leidos).[20]	No Data	No Data	No Data	$3.5 billion in taxes from 2015 to 2035 (Leidos).[21] $0.10 per gallon of jet fuel (Leidos).[22]	No Data	No Data	Tax of $10, $30, and $50 per ton CO2 would result in $0.09, $0.27, and $0.44, respectively, per gallon of gasoline.[23] A $30/ton tax would add about $6 per car fill-up, or $85 to a 500-gal propane tank fill-up (Leidos). BC tax of $30 yielded gasoline and diesel costs at $0.227 and $0.265 per gallon, respectively (BC MoF).[24] British Columbia directs revenues to programs to mitigate impacts to low-income households, ratepayers and reduces other provincial taxes on individuals and corporations.	Tax of $10, $30, and $50 per ton CO2 would result in $0.53, $1.59, and $2.66 per thousand cu.ft,, respectively (Leidos).[25] British Columbia tax of $30 yielded natural gas costs of $1.60 per thousand cu.ft. (MoF).[26]	British Columbia saw a reduction of fossil fuel use by 17.4% per capita from 2008 to 2012 (Elgie and McClay).[27]
Carbon Tax: $10, escalating to $30 per mtCO$_2$e tax	1.5	2.8	NQ	$15 (Leidos)[28]	**Change in Tax Revenue 2020:** $1.656 billion **Change in Tax Revenue 2035:** $1.646 billion[29] British Columbia saw 2010/11 tax revenue of $717 million with $30 tax (Ministry of Finance).[30] All revenues went toward cuts in other taxes.		$3.088 billion in taxes from 2015 to 2035 (Leidos).[31]	British Columbia saw potential negative impact to mfg. sector with $30 tax (Ministry of Finance)[32]	No Data	No Data	$9.3 billion in taxes from 2015 to 2035 (Leidos).[33] $0.29 per gallon of jet fuel (Leidos).[34]					
Carbon Tax: $10, escalating to $50 per mtCO$_2$e tax	1.7	5.0	NQ	$23 (Leidos)[35]	**Change in Tax Revenue 2020:** $1.922 billion **Change in Tax Revenue 2035:** $2.635 billion[36]		$4.255 billion in taxes from 2015 to 2035 (Leidos).[37]	No Data	No Data	No Data	$13 billion in taxes from 2015 to 2035 (Leidos).[38] $0.48 per gallon of jet fuel (Leidos).[39]					

Economic Impact Summary Significant Programs

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Recommended Policy/Action	GHG Saving MMTCO$_2$e (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $/MtCO$_2$e	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ 1000ft[3]	
Transportation Sector																
Low carbon fuel standard program[40]	1.0	3.9 (Leidos) 0.6 (ODOE)[41]	4.0	$103 to $131 (Leidos)[42] $2.42 (ODOE)[43]	$0.06[44]-11[45] billion in savings and income over a 10 year period. There is a wide range that reflects assumptions about feedstock availability and related impacts on transportation fuel prices (OR DEQ and CARB, respectively).	WSPA study of refinery impacts of CA's AB32/LCFS estimated possible job losses of 28,000-51,000 from refinery closures, far outpacing estimate of EE-job gains (BCG).[46] Increase of 800-29,000[47] jobs over 10 years based on different scenarios (ODEQ).	Affects fuel retailers & refiners. $200-400 Million investment for new ethanol plant(s) (ODOE).[48]	Investment in production facilities and AFV technologies. Potential for vehicle mfg.	Spurs market for in-state or NW ag crops, including corn, wheatstraw, canola, and cellulosic feedstocks, and ag. R&D.	$50 million in additional volume to construction sector (ODEQ).[49]	WSPA study of refinery impacts of CA's AB32 /LCFS anticipates cost increase of gas and diesel $0.14 to 0.69 per gal.[50] Program costs of $1.4 (ethanol)-$7.2 (hydrogen) /gal of gasoline equivalent. Costs include production, storage, transport and dispensing for alt.fuels (Int'l Council on Clean Transportation).[51]	N/A	No Data	WSPA study of refinery impacts of CA's AB32 /LCFS anticipates cost increase of gas and diesel $0.14 to 0.69 per gal.[52] $0-0.08 savings per gallon of gas (CARB).[53] 0-2% reduction in net fuel spending (ODOE).[54]	N/A	No Data
Zero Emission Vehicles (ZEV)	0.1	2.0	2.6	$70 (Leidos)[55]	Program costs of $1.167 million from over 15 years from 2020 to 2035. Electric vehicle industry drives $266.5Mil gross economic impact in OR, total value added of nearly $148 million (Portland State U).[56]	Increase of 80-1,000 jobs per auto plant based on actual and projected data from WA and CA (WA, CARB).[57] OR's electric vehicle cluster has created > 1,500 jobs (Portland State U).[58]	Auto industry market shift to account for ZEVs.	$2.3 billion in cost to manufacturers over 15 years from 2020 to 2035 (Leidos).[59]	No Data	Engineering, construction, installation, and maintenance of auto plants and fuel infrastructure.	**Consumers:** $(2.3) billion from 2020 to 2035 **Government:** $1.16 billion from 2020 to 2035 (Leidos)[60]	N/A	2,669 total ZEVs registered in WA in 2012.[61] Projections from Task 2 estimate that ZEVs will increase from 23,000 to 832,000 from 2020 to 2050 (Leidos).	No Data	N/A	**2020:** 14 million gallons of gas **2035:** 210 million gallons of gas **2050:** 258 million gallons of gas (Leidos)[62]
Renewable Fuel Standard (5% standard)	0.2	0.4	0.4	Under Task 1, not evaluated for economic impact.												Diesel avoided: **2020:** 34 million gallons **2035:** 43 million gallons **2050:** 52 million gallons (Leidos)[63]

Recommended Policy/Action	**GHG Saving** **$MMTCO_2e$** (Source Leidos 2013 unless otherwise noted)			**Cost Effectiveness** **$\$/MtCO_2e$**	**Sector Economic Impact**								**Household Impacts**			**Fuel Savings**
	2020	**2035**	**2050**		**Overall Economic Impact**	**Jobs**	**IND**	**MFG**	**AG**	**CONST**	**TRANS**	**Power rates**	**Consumption**	**Cost to Household**	**NG cost/ 1000ft^3**	
Transportation Land-Use		0.439 (ODOE)[64] Fehr and Peers[65]: wide range in GHG reduc-tion potential		($53) (ODOE)[66]	Under Task 1,Growth Management Act not evaluated for economic impact.											
Reductions in Vehicle Miles Traveled (VMT): Pricing Strategies	GHG Reduction Range (Fehr & Peers)[67] HOT Lanes: 0-6% Cordon Tolls: 5-25%			NQ	No Data	No Data	Potential to limit mobility for non-discretionary users (i.e., freight and trucking industry), should be mitigated. Impacts on low-income populations.	No Data	N/A	No Data	Revenue raised increases the State's ability to maintain, operate and expand the transportation system.	N/A	Consumer cost savings are case-specific, and will depend on the amount of travel, among other factors.	Toll prices are direct costs to Washington travelers.	N/A	No Data
Reductions in VMT: Public Transit		0.001-0.057 (ODOE)[68]		> $600 (ODOE)[69] On ODOE MACC results: "On a dollars per ton perspective, transit measures appear to be cost ineffective, but that is somewhat misleading […] These transit measures need to be viewed in a larger context."	No Data	No Data	Increasing public transit service may reduce the need for businesses to offer parking for employees.	No Data	N/A	No Data		N/A	No Data	Funding for state-sponsored public transit improvements would likely come from an increase in taxes (fuel, motor vehicle excise); funding from local transit authorities would come from an increase in fares (ferries and transit) or local sales taxes.	N/A	No Data

Recommended Policy/Action	GHG Saving $MMTCO_2e$ (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $\$/MtCO_2e$	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ 1000ft^3	
Energy efficiency																
Public Benefit Fund: Energy efficiency and renewable development support for utilities not covered by I-937	0.6	2.9	NQ	$(103) to $146 ODOE's MACC includes 39 cost-saving RCI measures from OR's PBF program ranging in effectiveness from $(133) to $(12). There are also 16 RCI measures in range $5 to >100 /MtCO2e (ODOE) [70]	Overall economic impact is jurisdiction-dependent. ODOE/CCS states "There are a large number of energy measures that target the industrial and commercial sectors that are highly cost-effective and that also have the potential to help make Oregon's businesses more competitive."[71]	Increase of 2,800-27,000[72] direct and indirect jobs[73] in California (CEC). Jobs will be jurisdiction-dependent, but there is potential for an expanded clean energy talent pool and job creation.		Manufacturing opportunities in the renewables sector.	N/A	Modest benefits to energy retrofitters and the renewables sector.	N/A	Electricity rates will increase. Energy efficiency and renewable energy programs funded by a PBF may reduce sales, revenue, and profit of utilities. System benefit charges range from about $0.001 (Clean Energy Finance and Investment Authority [74]) - 0.0085 (DSIRE)[75] per kWh depending on the state.	No Data	Increased bill costs may be offset by the availability of resources for energy efficiency improvements.	No Data	No Data
Public Benefit Fund: Clean energy business and economic development	0.07	NQ	NQ	NQ					N/A		N/A		No Data		No Data	Annual savings in 2020 after five years of PBF: **NG:** 570,000 mmBtu **Elec.:** 110 GWh (Leidos).[76]
Public Benefit Fund: Climate change driven energy conservation through consideration for the cost of carbon	0.44 $MMTCO_2e$ avoided per year[77]			$48 to $79 (Leidos)[78]					N/A		N/A		No Data		No Data	No Data
Property Assessed Clean Energy (PACE)	0.02	0.05	0.6	$(171) (Leidos) [79]	Overall economic impact is jurisdiction-dependent. ECONorthwest modeling estimates $10 million in gross economic output from a $4 million PACE investment across 4 U.S. cities.[80]	Increase of 60 (ECON'west)[81] to 85 (NREL)[82] jobs corresponding to $4-$13 million, respectively, in program investments.		Manufacturing opportunities in the renewables sector.	N/A	Modest benefits to energy retrofitters and the renewables sector.	N/A	No Data	Average participant savings were 1,786 kWh per year for electricity and 74.9 therms per year for NG.	$(208) per year (NREL).[83]	No Data	Dependent on size of PACE program. **NG:** 4,500 (NREL)[84]-16,000 (Opinion Dynamics Corporation)[85] mmBtu per year. **Elec.:** 1.1GWh per year (NREL).[86]

Recommended Policy/Action	GHG Saving $MMTCO_2e$ (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $\$/MtCO_2e$	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ 1000ft^3	
Appliance Standards	0.7	0.9	NQ	NQ	$1.25 billion NPV (ASAP/ACEEE)[87]	Under Task 1, not evaluated for economic impact.										Savings in 2025 and 2035, respectively (ASAP/ACEEE): 1,971 and 2,402 GWh. 2.31 and 4.32 million therms. 2 and 4 billion gal. water.
Renewable Energy																
Feed-in-Tariff	0.5	0.5	0.5	$30 to $500 (Leidos)[88]		Increase of 20,000 jobs from the Ontario program (Ontario government/Ministry of Energy).[89] Increase of 55,000 jobs in the California program (UC Berkeley).[90]	As FIT programs are still in their infancy in the US, the impact to businesses is still undetermined. In Germany, the program costs are passed on to rate payers as an EEG levy, although heavy industry customers are largely exempt. “German industrial power prices are below the EU average, Eurostat data shows.” (Business Spectator).[91]	No Data	N/A	No Data	N/A	In Germany, program costs are passed on to rate payers as an EEG levy. “Average German household prices were the second highest in the European Union behind Denmark as of November 2012”… “In contrast to household bills, German industrial power prices are below the EU average, Eurostat data shows.” The approach of calculating the EEG levy based on the gap between the wholesale power price and the higher fixed FIT has issues. (Business Spectator) [92]	No Data	Germany’s FIT cost consumers a 3% rate increase in the lifetime of the program, with a 5% increase in 2008 alone, averaging $2.66 to $8.00 per month.[93] No cost increase from solar FIT, but for wind, “an increase in electricity prices of 0.48 cents per kWh, approx. 3% of the average retail price in Germany” (Klein).[94]	N/A	As of March 2013, OPA (Ontario) had executed 1,706 micro, small and large FIT contracts for 4,541 MW in renewable energy projects, with another 882 contracts for an additional 10,577 MW in the pipeline.

Recommended Policy/Action	GHG Saving $MMTCO_2e$ (Source Leidos 2013 unless otherwise noted)			Cost Effectiveness $\$/MtCO_2e$	Sector Economic Impact								Household Impacts			Fuel Savings
	2020	2035	2050		Overall Economic Impact	Jobs	IND	MFG	AG	CONST	TRANS	Power rates	Consumption	Cost to Household	NG cost/ $1000ft^3$	
Landfill Methane Capture	NQ	0.3 (ODOE)[95]	NQ	$5.50 to $11.38 (CARB)[96] $8.77 (ODOE)[97]	$446 million total cost ($111 million implementation costs and $335 million management costs) (CARB).[98]	Jobs created in construction sector and for compliance monitoring.	Costs to fossil fuel industry in small magnitude reduction of sales (CARB).[99]	No Data	No Data	$(27) million (CARB)[100]	N/A	No Data	No Data	$0.09 per citizen month using a landfill with methane capture.[101]	No Data	Small magnitude displacement of natural gas.

[1] **WA:** ECONorthwest (2010) analysis for WA State of IMPLAN model results. WCI Policy scenario includes the following assumptions: The complementary policies are included as part of the Policy case; Banking of allowances for use in future years is allowed; Offsets are allowed up to 49 percent of emissions reductions; Carbon allowance costs are capped at $30/ton. Results are net impacts.
[2] **OR:** UC Berkeley Labor Center (2009), The Impact of Climate Change Policies on Carbon-Intensive Manufacturing Industries in Oregon.
[3] **CA:** California Air Resources Board. October 2010. Staff Report: Initial Statement of Reasons. Accessed August 2013 at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm
[4] **WA:** ECONorthwest (2010) economic analysis for WA State.
[5] **OR:** UC Berkeley Labor Center (2009), The Impact of Climate Change Policies on Carbon-Intensive Manufacturing Industries in Oregon.
[6] **RGGI:** Analysis Group Analysis Group: Economic, Financial and Strategy Consultants, November 2011 Report: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Economic_Impact_RGGI_Report.pdf
[7] **OR:** UC Berkeley Labor Center (2009), The Impact of Climate Change Policies on Carbon-Intensive Manufacturing Industries in Oregon.
[8] **WA:** ECONorthwest (2010) economic analysis for WA State.
[9] **OR:** UC Berkeley Labor Center (2009), The Impact of Climate Change Policies on Carbon-Intensive Manufacturing Industries in Oregon.
[10] **Australia:** Australian Government. How Australia's Carbon Price is Working One Year On. July 2013. http://www.cleanenergyfuture.gov.au/wp-content/uploads/2013/08/carbon-price-one-year-on.pdf
[11] **Australia:** Australian Government. How Australia's Carbon Price is Working One Year On. July 2013. http://www.cleanenergyfuture.gov.au/wp-content/uploads/2013/08/carbon-price-one-year-on.pdf
[12] **CA:** Environmental Defense Fund, Center for Resources Solutions, and Energy Independence Now. September 2010. Shockproofing Society: How California's Global Warming Solutions Act (AB 32) Reduces the Economic Pain of Energy Price Shocks. Accessed August 2013 at: http://www.resource-solutions.org/pub_pdfs/Shockproofing%20Society.pdf
[13] **RGGI:** Analysis Group Economic, Financial and Strategy Consultants November 2011 Report: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Economic_Impact_RGGI_Report.pdf
[14] **WA:** ECONorthwest (2010) economic analysis for WA State.
[15] **CA:** Environmental Defense Fund, Center for Resources Solutions, and Energy Independence Now. September 2010. Shockproofing Society: How California's Global Warming Solutions Act (AB 32) Reduces the Economic Pain of Energy Price Shocks. Accessed August 2013 at: http://www.resource-solutions.org/pub_pdfs/Shockproofing%20Society.pdf
[16] **European Union:** Environmental Defense Fund - "The EU Emissions Trading System, Results and Lessons Learned"; http://www.edf.org/sites/default/files/EU_ETS_Lessons_Learned_Report_EDF.pdf
[17] **RGGI:** RGGI Program Review News Release: RGGI States Propose Lowering Regional CO2 Emissions Cap 45%,Implementing a More Flexible Cost-Control Mechanism; http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf
[18] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.
[19] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[20] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[21] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[22] Calculated directly from CO2 Emissions Coefficients reported by EIA, http://www.eia.gov/environment/emissions/co2_vol_mass.cfm
[23] Calculated directly from CO2 Emissions Coefficients reported by EIA, http://www.eia.gov/environment/emissions/co2_vol_mass.cfm
[24] **British Columbia:** British Columbia Ministry of Finance: How the Carbon Tax Works. Accessed August 2013 at: http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm
[25] Calculated directly from CO2 Emissions Coefficients reported by EIA, http://www.eia.gov/environment/emissions/co2_vol_mass.cfm
[26] **British Columbia:** British Columbia Ministry of Finance: How the Carbon Tax Works. Accessed August 2013 at: http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm
[27] **British Columbia:** Elgie and McClay. Sustainable Prosperity BC's Carbon Tax Shift After Five Years: Results, An Environmental (and Economic) Success Story. (July 2013). Accessed August 2013 at: http://www.sustainableprosperity.ca/article3685
[28] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.
[29] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[30] British Columbia Ministry of Finance. June Budget Update – 2013/14 to 2014/15, Carbon Tax Review. 2013. Accessed August 2013 at: http://www.fin.gov.bc.ca/tbs/tp/climate/Carbon_Tax_Review_Topic_Box.pdf
[31] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[32] **British Columbia:** British Columbia Ministry of Finance. June Budget Update – 2013/14 to 2014/15, Carbon Tax Review. 2013. Accessed August 2013 at: http://www.fin.gov.bc.ca/tbs/tp/climate/Carbon_Tax_Review_Topic_Box.pdf
[33] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[34] Calculated directly from CO2 Emissions Coefficients reported by EIA, http://www.eia.gov/environment/emissions/co2_vol_mass.cfm
[35] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.

[36] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[37] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[38] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[39] Calculated directly from CO2 Emissions Coefficients reported by EIA, http://www.eia.gov/environment/emissions/co2_vol_mass.cfm
[40] **WA:** Scenario of 10 % reduction in carbon intensity over 10 years.
[41] **OR:** ODOE 10-Year Energy Action Plan Modeling (2012), based on reports and data produced by the ODEQ as part of the OR LCFS development process, 10% reduction in carbon intensity over 10 yrs. Modeling assumes market responds with a blend of ethanol and biodiesel feedstocks, both in-state, out-of-state, and imported. Also accounts for indirect land use change, "which increases the estimated carbon content of certain biofuels in order to reflect the anticipated clearing of additional land for farming."
[42] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.
[43] **OR:** Policy TLU-9-21, LCFS Program. Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Costs are cumulative from 2013 to 2035, adjusted to 2010 dollars. Source: Center for Climate Strategies for Oregon Department of Energy, 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.
[44] **OR:** Macro-economic modeling sponsored by the Oregon DEQ. LCFS increases income in Oregon between $60 and $2,630 million over 10 years.
[45] **CA:** Reduced fossil fuel use would produce an overall savings in the state of $11 billion over the 10-year period.
[46] **CA:** BCG (2012) for Western States Petroleum Association.
[47] **OR:** LCFS creates 800-29,000 jobs over 10 years, increasing income in Oregon between $60 and $2,630 million over 10 years. Overall, the six scenarios modeled in the analysis sponsored be the Oregon DEQ involving in-state production of biofuels (A through C and E through G) have fairly similar gross state product (GSP) impacts, ranging from approximately $900 million to about $1.25 billion in additional economic activity.
[48] **OR:** ODOE (2012) assumptions for macroeconomic foundational modeling.
[49] **OR:** Macro-economic modeling sponsored by the Oregon DEQ.
[50] **CA:** BCG (2012) for Western States Petroleum Association.
[51] **CA:** $1.4/GGE (cellulosic ethanol) to $7.2/GGE (hydrogen).
[52] **CA:** BCG (2012) for Western States Petroleum Association.
[53] **CA:** In its initial statement of reasons, ARB estimated that the policy would result in a net savings over the life of the policy, which would amount to a $0 - $0.08 per gallon savings if passed entirely to the consumer. ARB acknowledged that the savings are highly dependent on the future price of fossil fuels, availability of lower-carbon intensity fuels, and the economic recovery. There will be an estimated overall savings in the state of $11 billion over the 10-year period.
[54] **OR**: ODOE (2012) reports on statewide fuel expenditures (not limited to households), "Reductions in conventional fuel purchase offset increases in spending on lower-carbon fuels. All scenarios showed some reduction in fuel expenditure, though in most cases the savings is well below 1% of the baseline expenditure of $86 billion. In Scenario D, which emphasized a switch to electricity and natural gas (both of which offered significant savings per mile traveled), the fuel savings approached 2% of the baseline."
[55] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.
[56] **OR**: Portland State University 2013 study of Oregon's Electric Vehicle Industry.
[57] **WA and CA:** Washington is already benefitting with 80 jobs at the SGL/BMW Automotive Carbon Fiber plant at Port of Moses Lake, a plant that is helping to produce the new BMW i3, an all-electric vehicle. In 2011, ARB projected a Tesla manufacturing facility in Fremont, California, to create 1,000 jobs alone.
[58] **OR**: Portland State University 2013 study of Oregon's Electric Vehicle Industry.
[59] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[60] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[61] 2012 Vehicle registration data provided by WA Department of Ecology
[62] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[63] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.
[64] **OR**: Policy TLU-Land Use. Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.
[65] **WA:** Fehr and Peers 2009, for WA Dept. of Commerce, Assessment of Greenhouse Gas Analysis Tools, December 2009 accessed August 2013 at http://www.fehrandpeers.com/wp-content/uploads/2011/09/GHGAnalysisTools.pdf
[66] **OR**: Policy TLU-Land Use. Scenario 3 Costs are cumulative from 2013 to 2035, adjusted to 2010 dollars. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.
[67] **WA:** Fehr and Peers 2009, for WA Dept. of Commerce, Assessment of Greenhouse Gas Analysis Tools, December 2009 accessed August 2013 at http://www.fehrandpeers.com/wp-content/uploads/2011/09/GHGAnalysisTools.pdf
[68] **OR**: Policy TLU Transit program range (Corvallis, Salem, TriMet). Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.
[69] **OR**: ODOE reports, "On a dollars per ton perspective, transit measures appear to be cost-ineffective, but that is somewhat misleading because many of the highly cost-effective travel behavior and land use measures are motivated at least in part by having a transit system in place to provide travel options, security (e.g. carpooling), and so forth. These transit measures need to be viewed in a larger context." Scenario 3 Costs are cumulative from 2013 to 2035, adjusted to 2010 dollars. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.
[70] **OR:** Marginal Abatement Cost Curve (MACC) modeling results of cost effectiveness of RCI energy efficiency and distributed renewable energy measures in the RCI sector. Examples of measures include but are not limited to lighting, HVAC, water/wastewater efficiency, insulation, and solar PV in residential, commercial, and industrial areas. Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Costs are cumulative from 2013 to 2035, adjusted to 2010 dollars. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. Table 14. 2013-2035, July 30, 2012.
[71] **OR:** Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012. Quote from the July 29, 2013, summary "Work to data" on the Oregon GHG MACC.
[72] **CA:** Over 15 years, the California Energy Commission invested $839 million for energy RD&D projects and attracted $1.35 billion in match funding. Private rate of return on RD&D around 20-30 percent, social return is around 66 percent. In 2012, PIER projects sustained 2,800 direct and 4,500 indirect full-time jobs (27,700 direct, indirect, and induced jobs is projected long-term as a result of these projects). $0.0015/kWh surcharge on electricity rates.
[73] **CA:** California Energy Commission. 2013. Public Interest Energy Research 2012 Annual Report. Accessed August 2013 at: http://www.energy.ca.gov/2013publications/CEC-500-2013-013/CEC-500-2013-013-CMF.pdf
[74] **CT:** Clean Energy Finance and Investment Authority. 2013. Progress Through Partnerships Annual Report Fiscal Year 2012. Accessed: August 2013 at: http://www.ctcleanenergy.com/annualreport/files/assets/downloads/publication.pdf
[75] **CA**: DSIRE. 2013. California Public Benefits Funds for Renewables and Efficiency. Accessed August 2013 at: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA05R
[76] **WA:** All numbers taken from Leidos (2013) - WA Task 2 analysis.

[77] **WA:** At a savings rate of 0.44 metric tons carbon dioxide per megawatt-hour (the GHG emission rate of natural gas Combined Cycle Combustion Turbine (CCCT) technology), Washington could avoid about 440,000 metric tons of carbon dioxide per year for every one million megawatt-hours of demand met through energy conservation measures in lieu of developing new natural gas CCCT generation.

[78] **WA:** By definition, the social cost of carbon represents the emissions abatement cost under this program option. These abatement costs are $48, $63, and $79 per metric ton of carbon dioxide for 2020, 2035, and 2050, respectively.

[79] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.

[80] Research conducted by ECONorthwest in April 2011 suggests that PACE programs have the potential to generate significant economic and fiscal impacts. Specifically, modeling of hypothetical PACE programs in Columbus, Ohio, Long Island, New York, Santa Barbara, California, and San Antonio, Texas indicates that $4 million in total PACE project spending across the four cities ($1 million in spending in each city) will generate $10 million in gross economic output, $1 million in combined federal, state and local tax revenue, and 60 jobs (about $67,000 per job), on average.

[81] ECONorthwest modeling of hypothetical PACE programs in Columbus, Ohio, Long Island, New York, Santa Barbara, California, and San Antonio, Texas indicates that $4 million in total PACE project spending across the four cities could create 60 jobs at $67,000 annual salary each.

[82] **Boulder, CO:** $13 million spent in financing and program costs supported 85 jobs (57 percent were solar PV-related jobs) in Boulder County (about 6.5 jobs/$1 million of investment) and 126 jobs in the state as a whole (about 9.7 jobs/$1 million of investment).

[83] **Boulder, CO:** Reduced energy use saved participants a combined total of about $124k/yr ($208/yr per participant) during the first year on their electric and gas utility bills.

[84] **Boulder, CO:** Gross first-year electricity and NG savings of 1.1 GWh/yr and 4,500 mmBtu/yr,respectively.

[85] **ME:** Verified first-year, annual gross savings for the PACE/PowerSaver Program are 16,332 mmBtu for the 284 projects completed April 2011 through September 2012.

[86] **Boulder, CO:** Gross first-year electricity and NG savings of 1.1 GWh/yr and 4,500 mmBtu/yr,respectively.

[87] WA: Lowenberger, A., Mauer, J., deLaski, A., DiMascio, M., Amann, J., and S. Nadel. 2012. The Efficiency Boom: Cashing In on the Savings from Appliance Standards. Report # ASAP-8/ACEEE-A123. 87pp. Online at: http://www.appliance-standards.org/content/efficiency-boom.

[88] **WA:** Leidos (2013) reflects 5 percent discount rate, NPV 2013 of emission reductions through 2035.

[89] **Ontario:** With over $27 billion in private sector investment to Ontario, the program has created 20,000 jobs and is expected to create 50,000 jobs.

[90] **CA:** An economic study from University of California, Berkeley, projected 28,000 direct jobs per year, and 27,000 indirect jobs per year on average, and an increase in direct state revenue of $1.7 billion.

[91] The growing cost of Germany's feed-in tariffs. Web Article from business spectator.com, Feb, 2013. Accessed Aug. 13, 2013. http://www.businessspectator.com.au/article/2013/2/21/policy-politics/growing-cost-germanys-feed-tariffs

[92] The growing cost of Germany's feed-in tariffs. Web Article from business spectator.com, Feb, 2013. Accessed Aug. 13, 2013. http://www.businessspectator.com.au/article/2013/2/21/policy-politics/growing-cost-germanys-feed-tariffs

[93] **Germany:** NARUC. *Feed-in Tariffs: Frequently Asked Questions for State Utility Commissions*. June 2010.

[94] **Germany**: "Using 1992-2009 panel data across 20 European countries and a dynamic panel data model estimation, this paper analyzes the effect of FIT policies for electricity generated from wind and solar photovoltaic (PV) on electricity prices at the household consumer level. The analysis finds a mild association of the support level for wind energy with higher retail prices, but no price increase for solar PV support. This finding points toward the existence of a "merit-order effect" and, in particular, a strong "time-of-day" effect, where solar PV is able to replace more costly natural gas and petroleum generation because it is generated during times of peak demand, whereas electricity from wind is mostly generated at night when demand is low." … "The empirical analysis indicates "the presence of an FIT that pays exactly the mean tariff amount results in an electricity price that is 0.22 cents per kWh higher than in the absence of the FIT, approximately 2 percent of the average retail rate. **For countries with successful FIT programs, such as Germany**, that paid an average tariff of approximately 8 cents over the period of the panel, this corresponds to **an increase in electricity prices of 0.48 cents per kWh, approximately 3 percent of the average retail price in Germany**." Source: C. A. Klein, "Renewable Energy at What Cost? Assessing the Effect of Feed-In Tariff Policies on Consumer Electricity Prices in the European Union" *The Georgetown Public Policy Review*. (2013), http://gppreviewdotcom.files.wordpress.com/2013/02/klein-thesis-ed.pdf

[95] **OR:** Policy AFW-5, Landfill Gas Collection & Use. Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.

[96] **CA:** The overall cost-effectiveness estimates inclusive of private and public costs of the measure range from a low of $5.50 per mtCO2e to a high of $11.38 per mt$CO_2$e over the measure's expected life of 2010-2033, with an average of $8.64 per mt$CO_2$e.

[97] **OR:** Policy AFW-5, Landfill Gas Collection & Use. Reflects Scenario 3, which represents a moderate increase in both Federal and State programs. Costs are cumulative from 2013 to 2035, adjusted to 2010 dollars. Source: Center for Climate Strategies for Oregon Department of Energy (ODOE), 10-Year Energy Action Plan Modeling. Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon. 2013-2035, July 30, 2012.

[98] **CA:** California ARB estimated the $111 million in costs to affect businesses and $335 million to impact state government agencies over the life of the measure. The California ARB estimates a necessary capital investment of over $27 million to design, construct, and install required landfill GCCS, and an additional $6.4-$14 million annually in recurring costs. Thus, total costs for technology, operation, monitoring and maintenance are estimated at approximately $335 million. Values in 2008 US Dollars.

[99] There may be costs to fossil fuel industry due to modest displacement of fossil fuels. Landfill gas can be converted for use in vehicles as liquefied natural gas (LNG), or upgraded to pipeline quality methane. Additionally, if sufficient gas quantities exist the methane can be combusted for electricity generation.

[100] **CA:** The California ARB estimates a necessary capital investment of over $27 million to design, construct, and install required landfill gas collection and control systems. Values in 2008 US Dollars.

[101] **CA:** Costs associated with the Landfill Methane Control Measure are borne directly by landfill operators and regulating agencies. However, some costs will be passed to consumers in the form of increased waste disposal costs. Over the life of the measure, California ARB calculated that the measure will cost each California approximately $0.09 per month. Values in 2008 US Dollars.