



THE CENTER FOR
CLIMATE STRATEGIES

Minnesota Climate Strategies
and Economic Opportunities
(CSEO) Project
Economic Impact Analysis
Component

REMI Webinar - March 31, 2016

About CCS

Better Safer World



Non profit, non advocacy 501(c)3 since 2004

Working Together

Activities

Leadership commitments, partnership formation, information and education, consensus building, action planning and analysis, policy and mechanism design, implementation authority and financing, training and capacity building, in kind and donor support

United States

Alaska, Arizona, Arkansas, Colorado, Connecticut*, Florida, Kentucky, Iowa, Maine*, Maryland, Michigan, Minnesota, Montana, Oregon, Pennsylvania, New Mexico, North Carolina, New York, South Carolina, Southern California, Vermont, Washington

Global

BC Canada, Bhutan, China, DR Congo, Eastern Europe, European Union, Guatemala, Macedonia, Mexico States, Panama, Philippines, Ukraine



MN CSEO Goals

- Improve the state's economic, energy, and environmental conditions in all sectors
- Expand the knowledge, planning, and implementing capacities of its agencies
- Contribute to state and federal goals across all sectors and agencies
- Update and improve upon policy options in the 2008 Minnesota Climate Change Advisory Group Final Report; expand the analysis to include several new strategies
- Full final report available at www.climatestrategies.us



Participants

- February 4, 2014 MOU between CCS, COMM, MPCA
 - EQB provided agency coordination
- 12 Minnesota agencies, 60+ staff
 - Review, input, conferral: policy selection, design, analysis
- 15 member CCS team
 - Training, exchange, conferral, coordination, sector policy option design, technical analysis, report development
- CCS supported by private foundations
 - Rockefeller Brothers Fund, Merck Family Fund, McKnight Foundation, Energy Foundation



Successful Outcomes

- 20 Policies Selected & Custom-Designed for MN
 - Energy Supply, Buildings, Industrial Use, Transportation, Agro, Forestry & Waste
- Reduce greenhouse gas (GHG) emissions related to state and federal goals
 - 34 percent reduction below BAU forecasted emissions in 2030
 - 33 percent reduction in comparison to 2015 base year emissions by 2030
 - Exceeds Clean Power Plan Section 111(d) anticipated requirements for Minnesota
- ***Expand Minnesota's Economy and Create Jobs***
 - 24,630 newly created jobs per year
 - 369,440 additional years of employment through 2030
 - GSP grows \$35.7 billion from 2015-2030
 - \$2.38 billion in additional economic activity per year (a 0.5 percent annual increase)
 - Personal income expands by an annual average of \$2.3 billion, or 0.6 percent per year
- Improved energy & resource efficiency, sustainability, and risk resiliency
- Returns on investment are strong

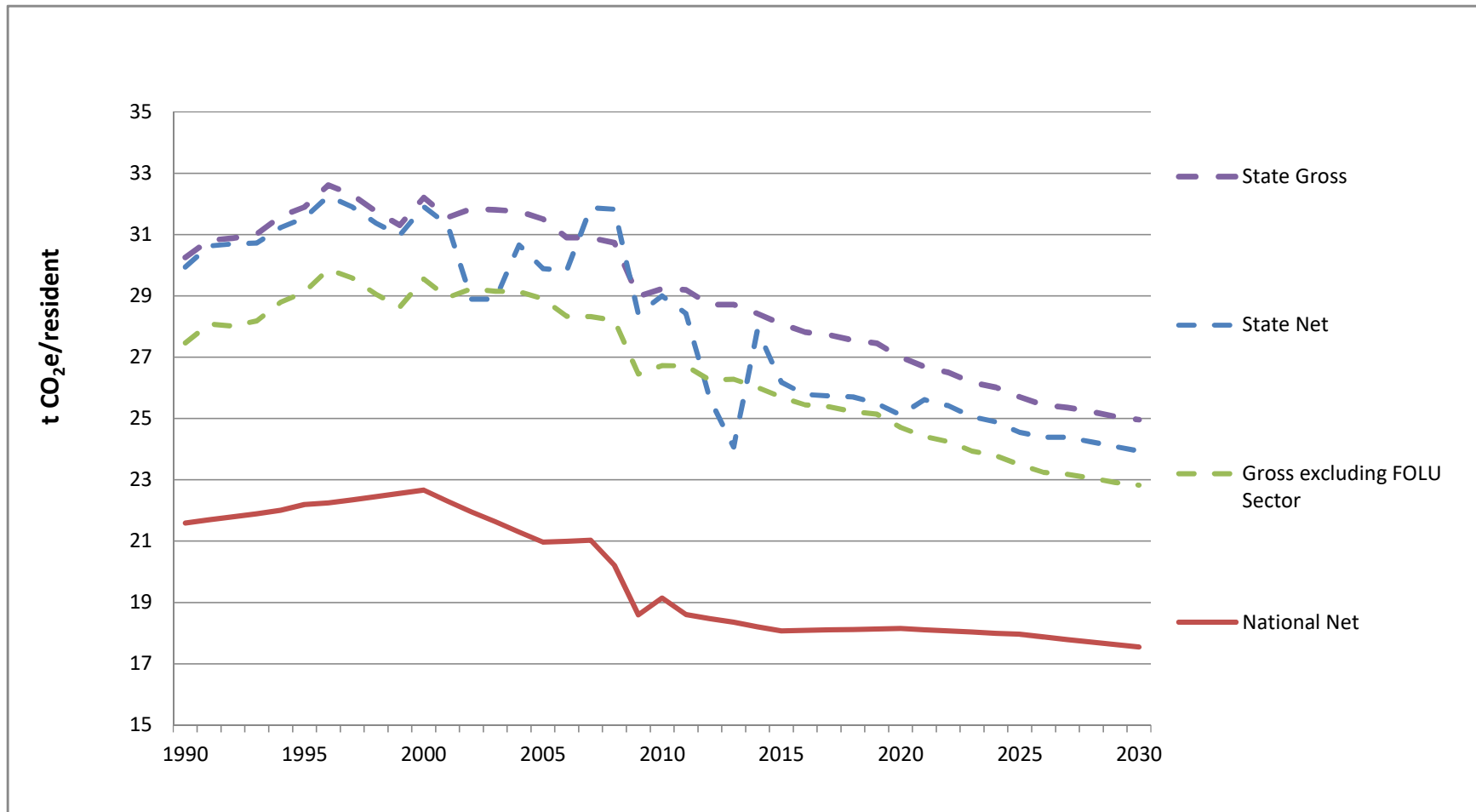




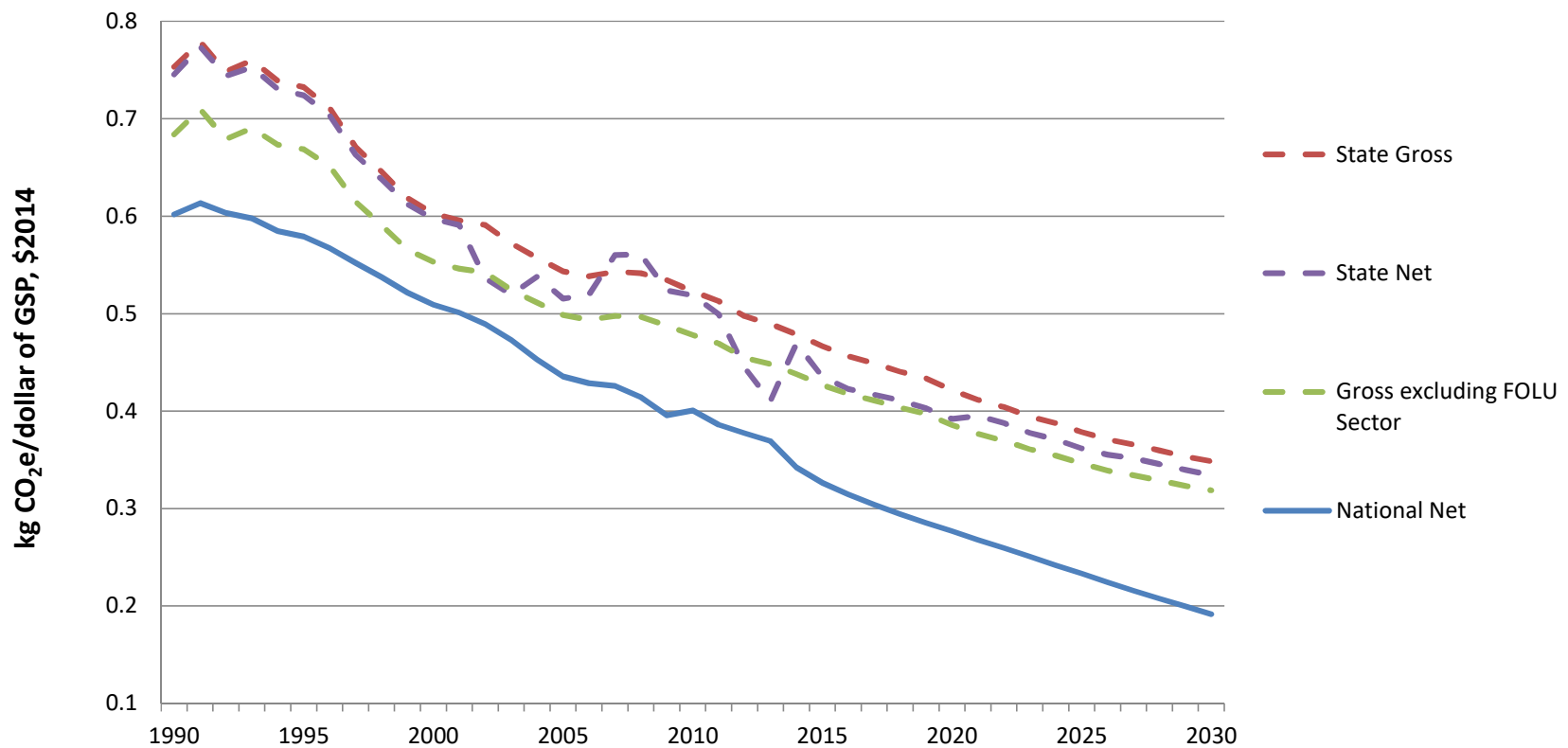
State Agencies

- Agriculture Department
- Board of Water and Soil Resources
- Environmental Quality Board
- Department of Commerce
- Department of Employment and Economic Development
- Environmental Health Department
- Forest Resources Council
- Metropolitan Council
- Natural Resources Department
- Office of Energy Security
- Pollution Control Agency
- Public Utilities Commission
- Transportation Department

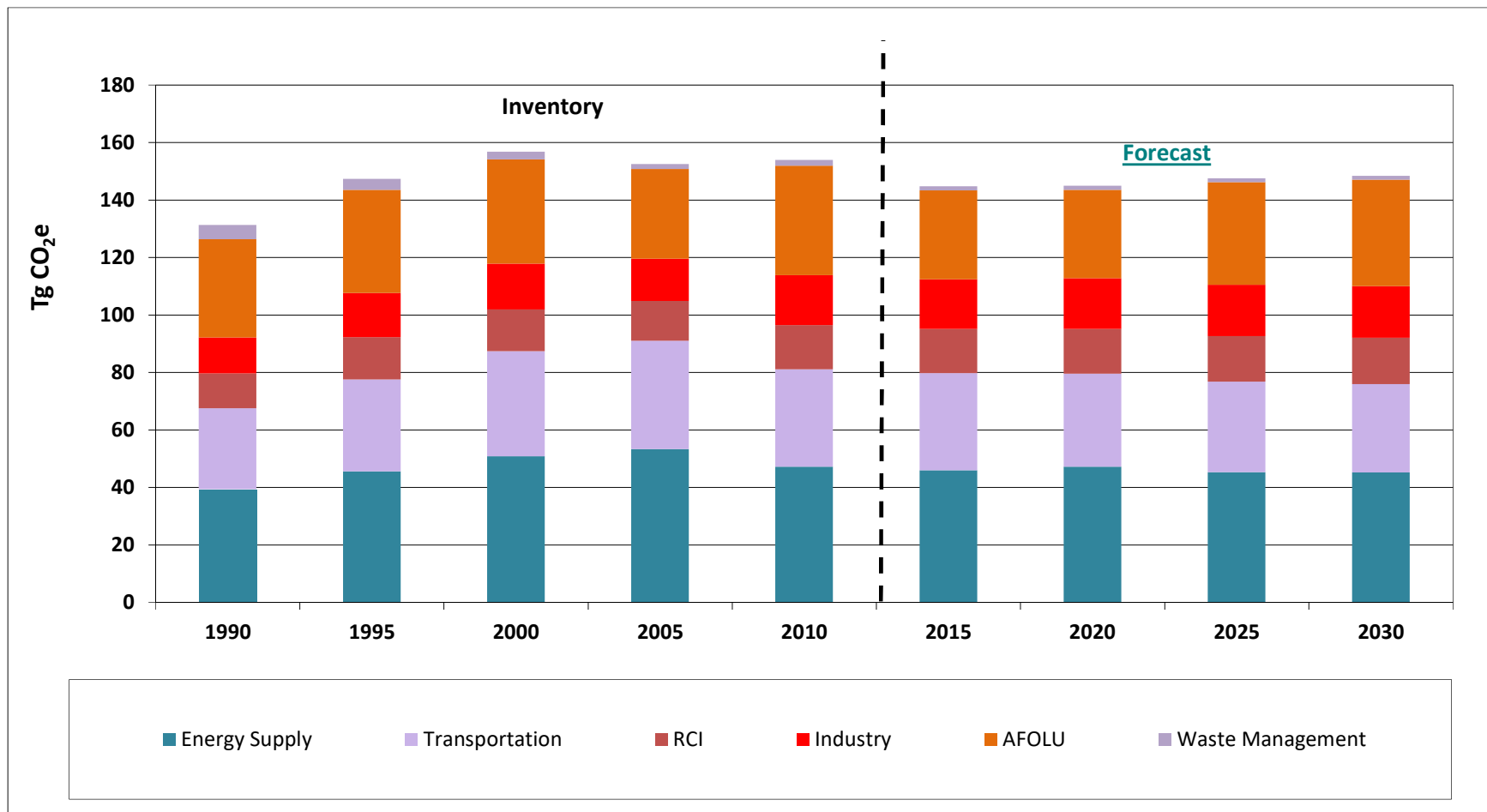
Starting Point: Projected Carbon Intensity Per Capita



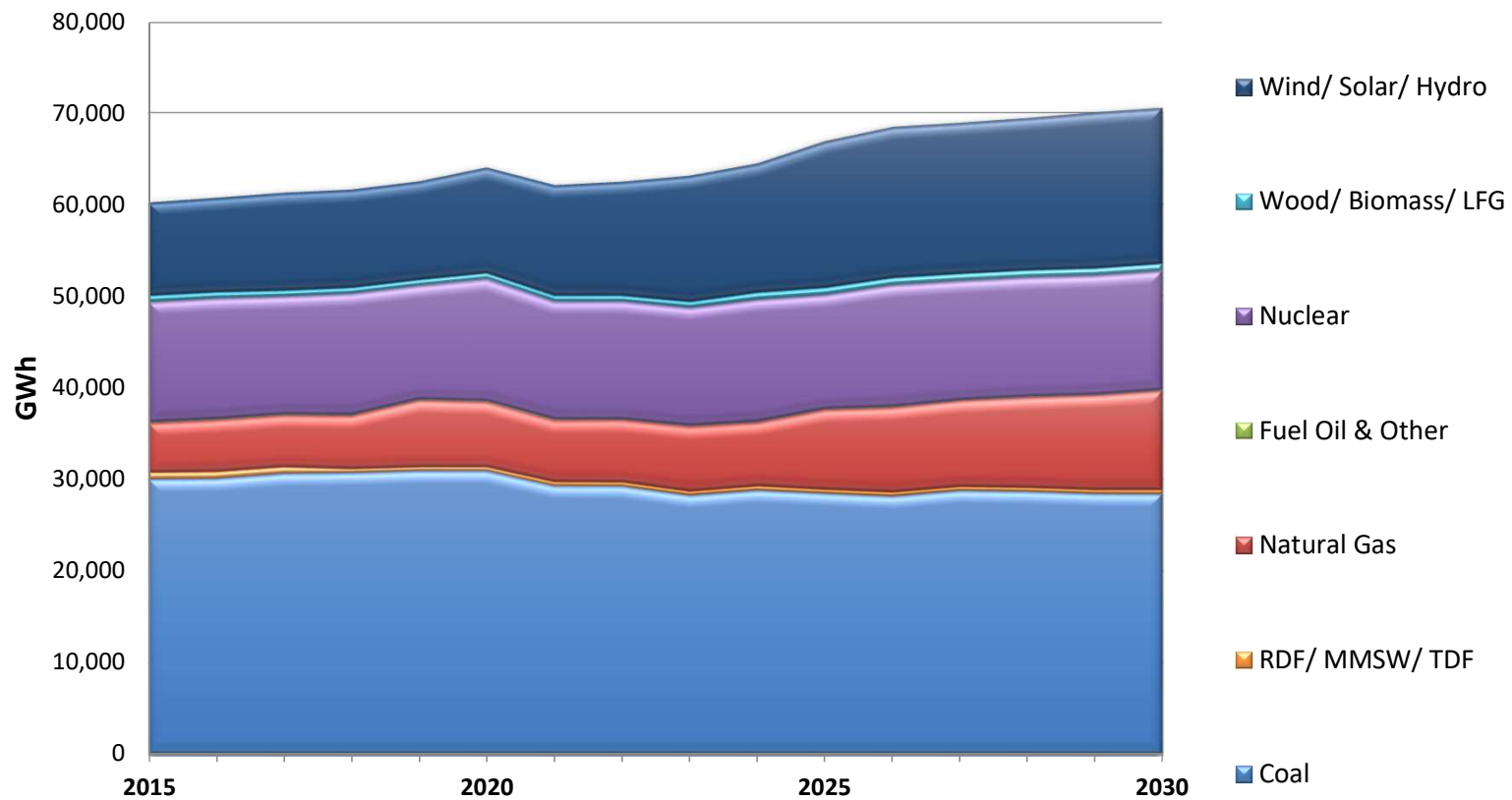
Projected Carbon Intensity & GSP



GHG Baselines



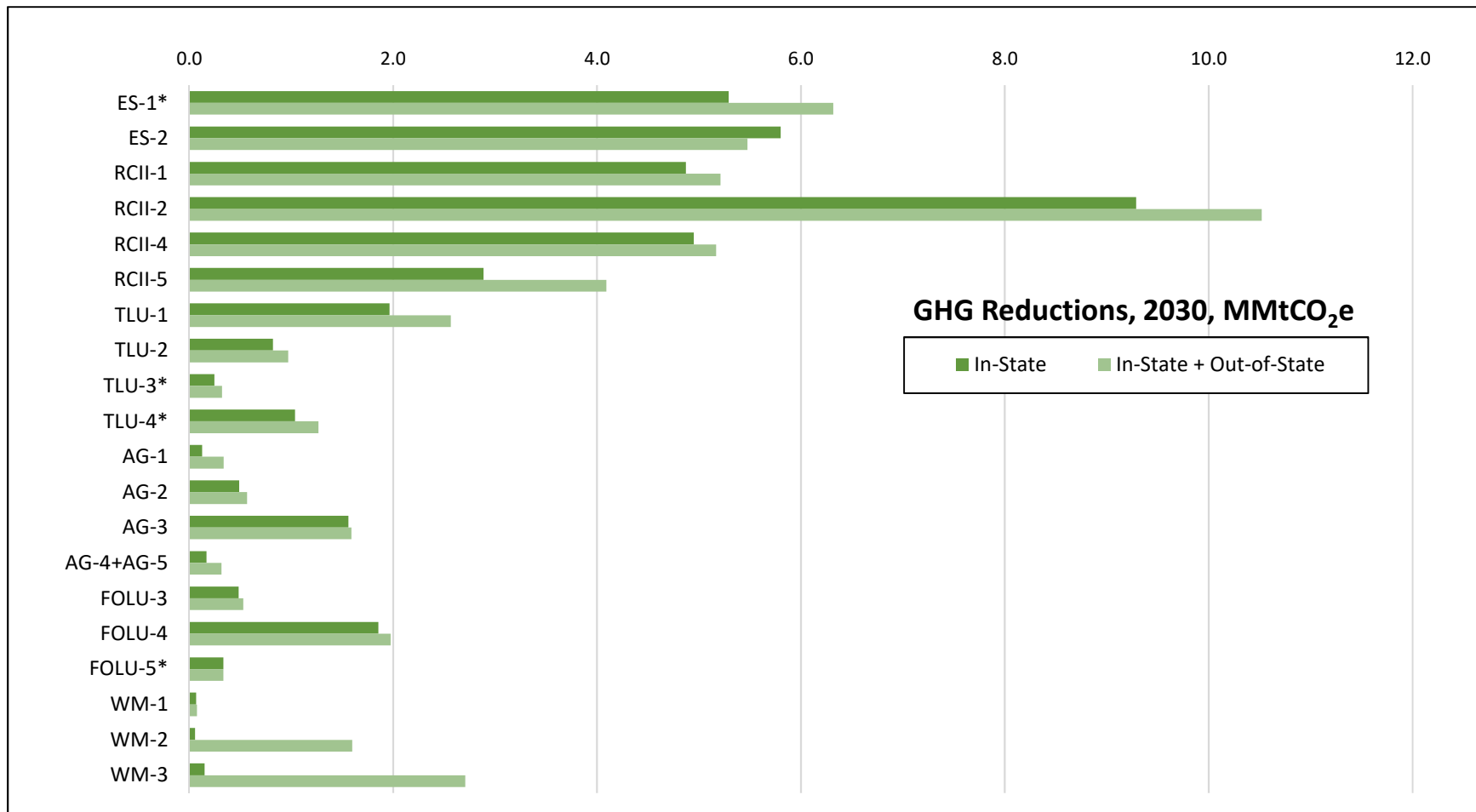
Power Generation Forecast



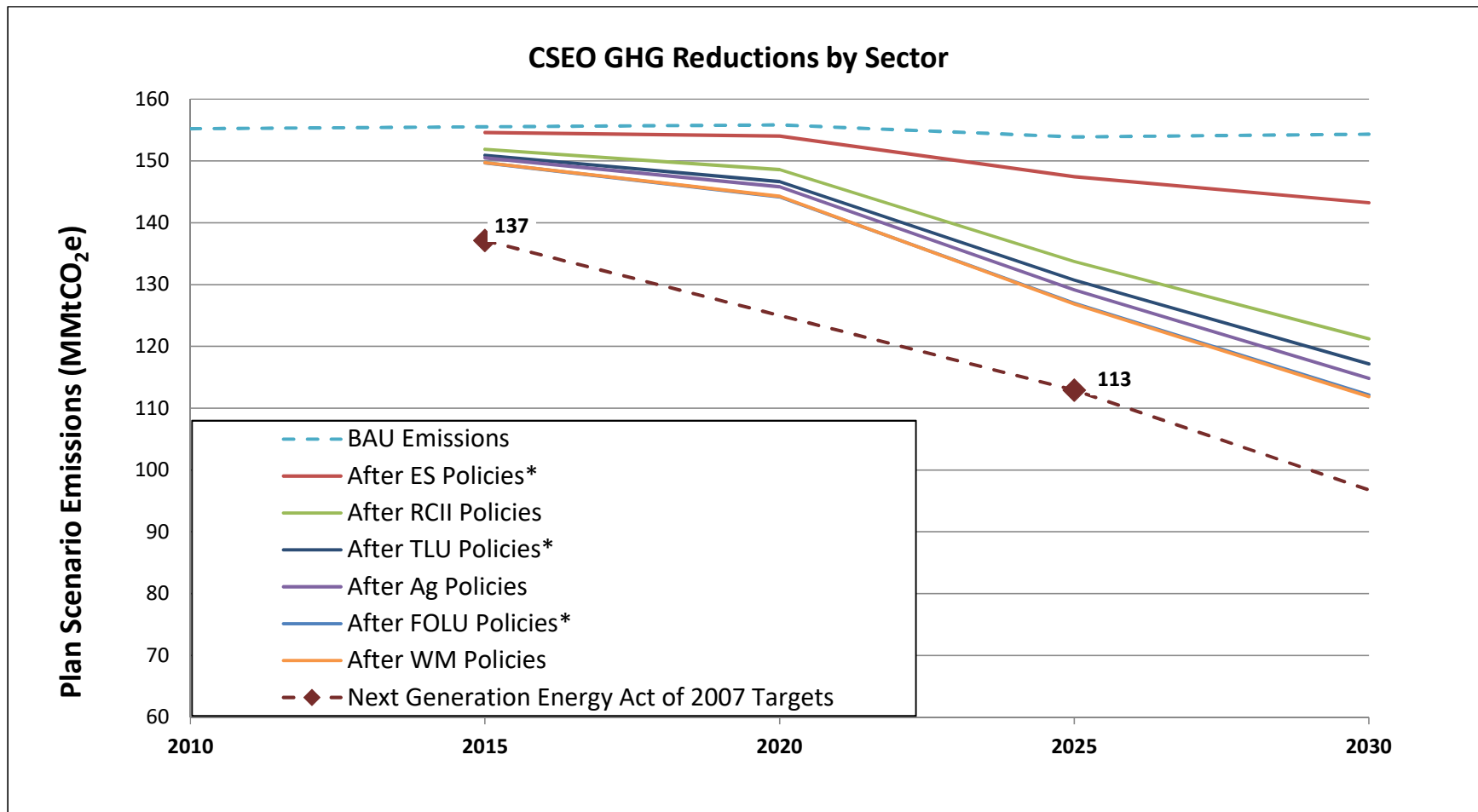
Policy Options

Policy ID	Policy Title	Policy ID	Policy Title
ES-1	Increase the Minnesota Renewable Energy Standard	A-2	Soil Carbon Management: Cover Crops
ES-2	Efficiency Improvements, Repowering, Retirement, and Upgrades to Existing Plants	A-3	Soil Carbon Management: Row to Perennial Crops Conversion
RCII-1	Incentives and Resources for Combined Heat & Power for Biomass and Natural Gas	A-4	Advanced Biofuels Production
RCII-2	Zero Energy Transition/Codes (SB2030)	A-5	Biofuels Consumption (Existing Biofuels Statute)
RCII-4	Increase Energy Efficiency Requirements	FOLU-3	Community Forests
RCII-5	Incentives and Resources to Promote Thermal Renewables	FOLU-4	Tree Planting: Forest Ecosystems
TLU-1	Transportation Pricing	FOLU-5	Conservation on Private Lands
TLU-2	Improve Land Development and Urban Form	WM-1	Wastewater Treatment: Energy Efficiency
TLU-3	Metropolitan Council Transportation Policy Plan	WM-2	Front-End Waste Management: Source Reduction
TLU-4	Zero Emission Vehicle Standard	WM-3	Front-End Waste Management: Re-Use, Recycling & Composting
A-1	Nutrient Management	CPP	Comprehensive Effects of CSEO Policy options on Section 111(d) Anticipated Requirements

GHG Emissions Reductions

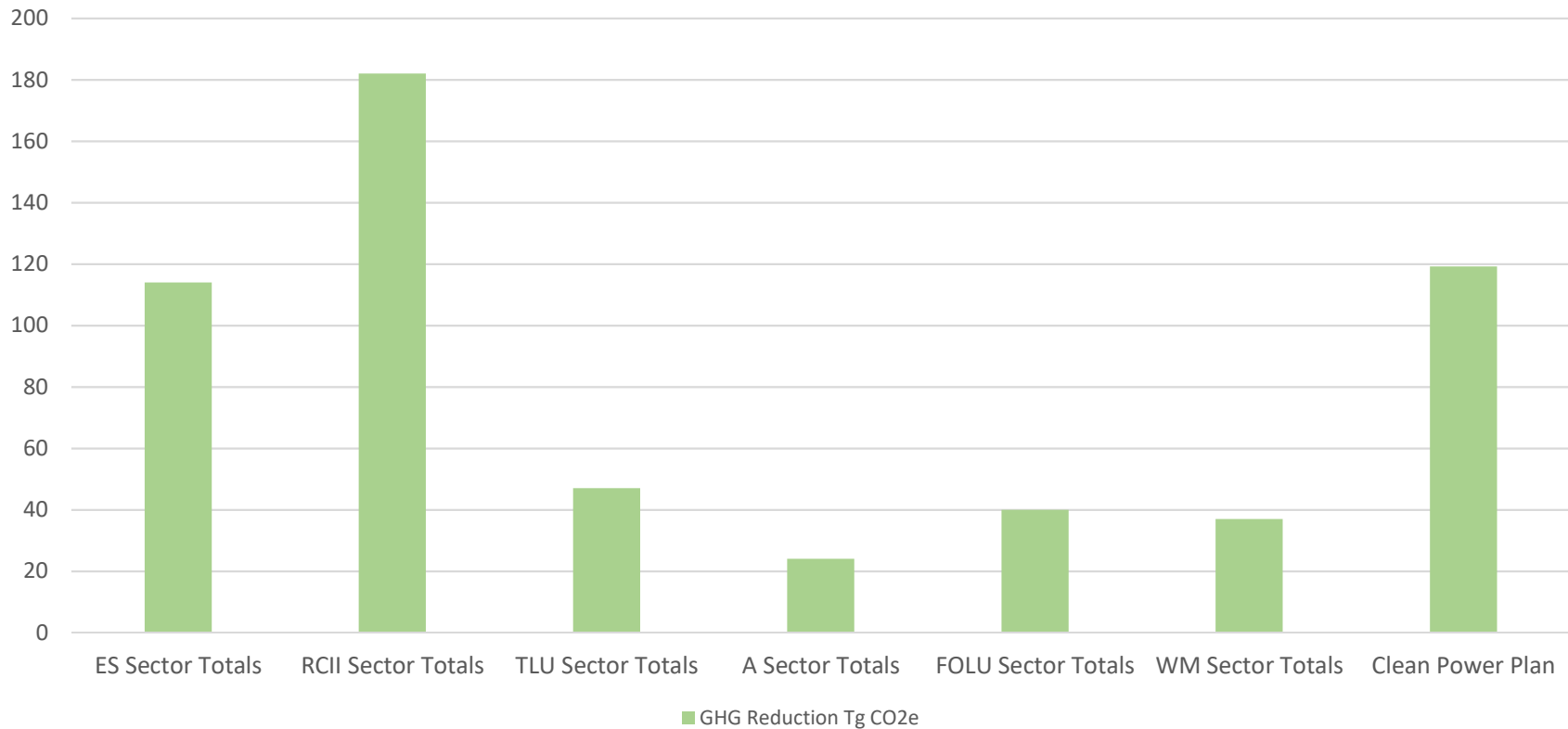


GHG Emissions Reductions

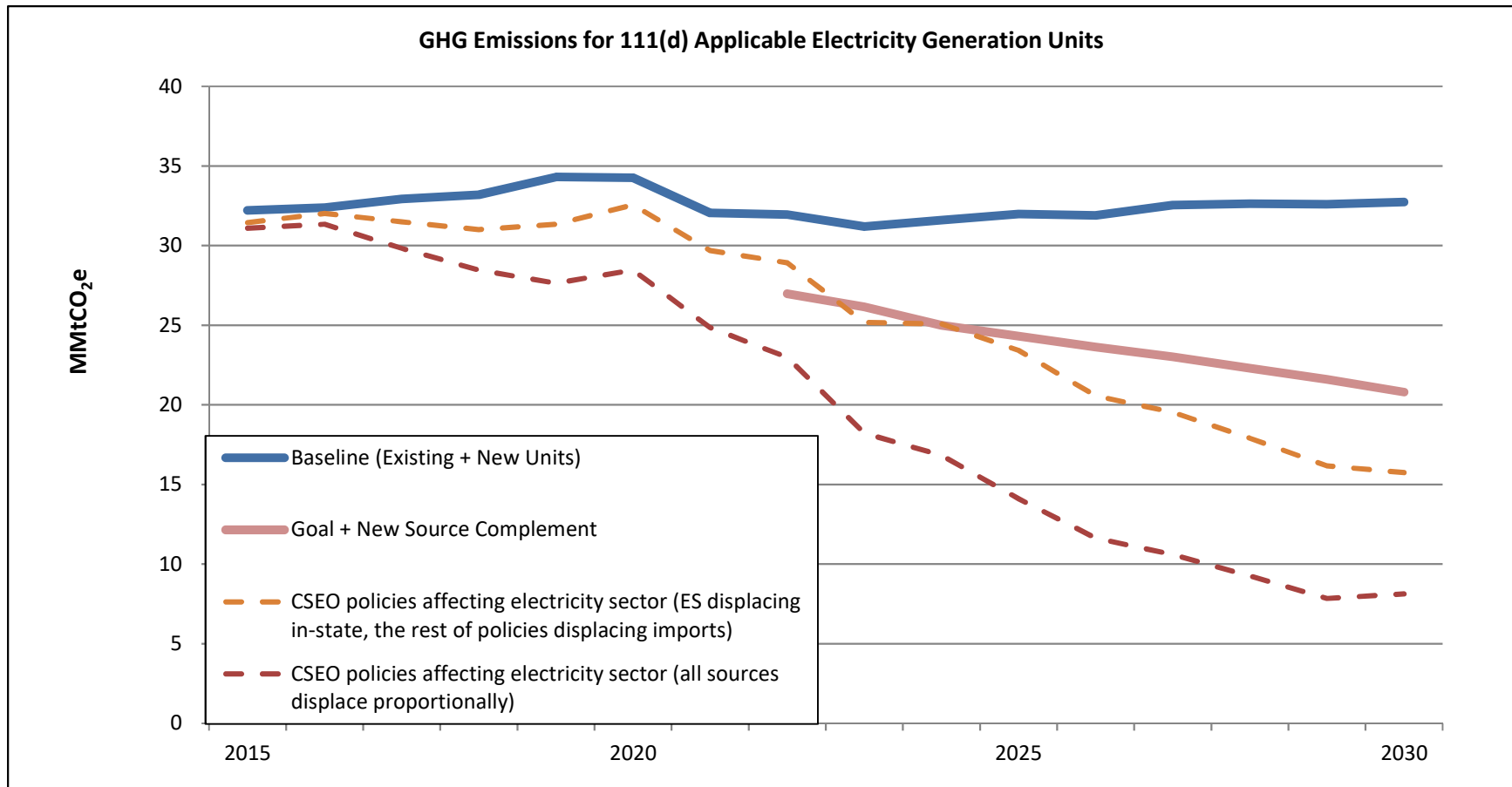


GHG Impacts by Sector

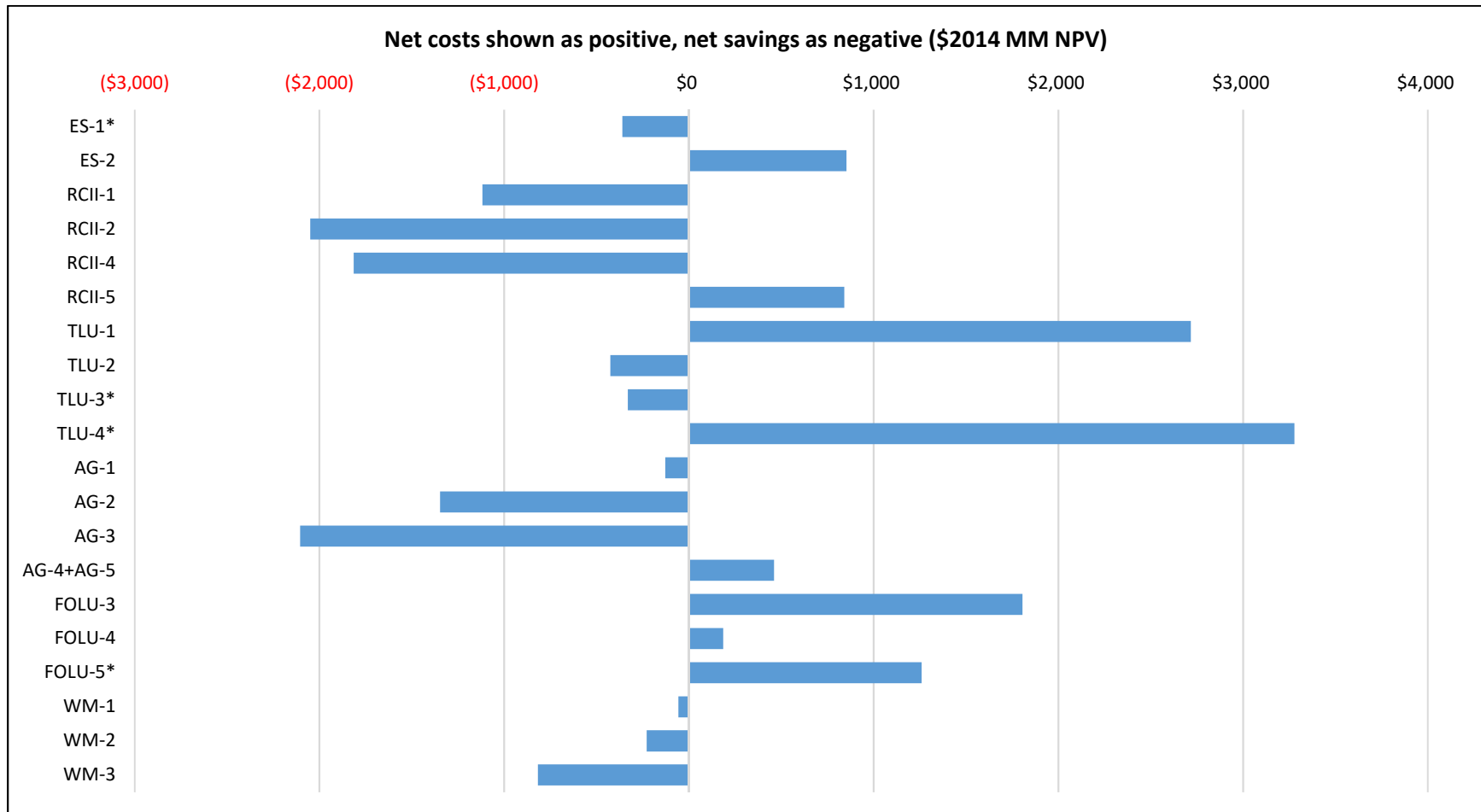
GHG Reduction (Millions of Metric Tons of CO₂e), Total – over Entire Planning Period (2015-2030)



GHG Emissions Reductions Compared to Anticipated EPA Goal

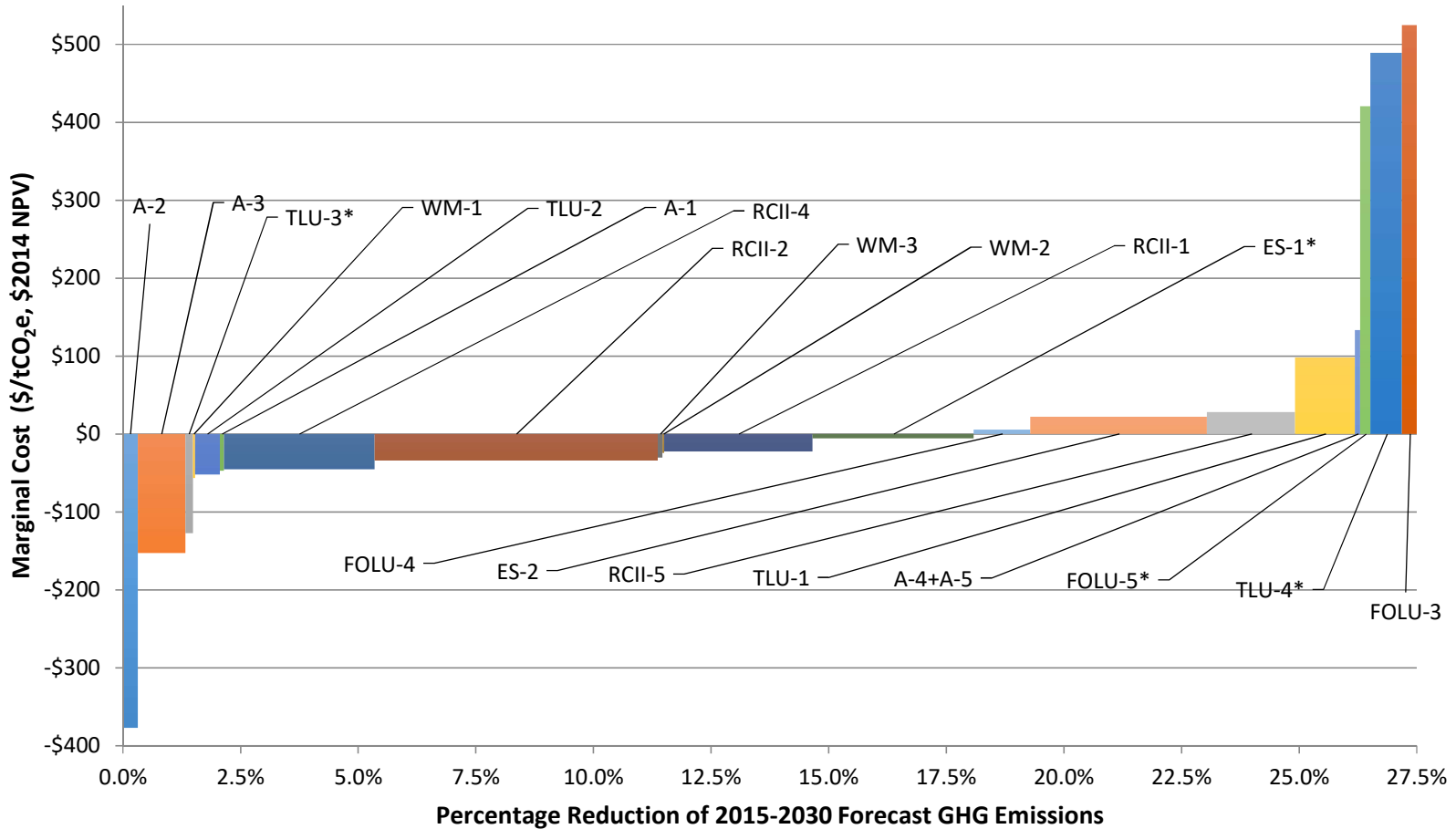


Net Direct Costs/Savings (Cumulative 2015-2030, Net Present Value)



Cost Effectiveness of Emissions Reduction

Marginal Abatement Cost Curve (MACC) of CEO Policy options, Cumulative, 2015-2030





Macroeconomic Strategies

1. Cost effective actions increase economic efficiency and expansion

2. Energy savings actions cut energy costs, stimulate labor investment

3. Shifts to indigenous vs. imported energy and resources cut capital outflows

4. Actions supported by local vs. distant supply chains cut job outflows

5. New investment from outside sources stimulates labor investment at home

6. Labor intensive activities create more jobs, even if at higher cost (up to a point)

From “Summary of Key Factors Contributing to Macroeconomic Impacts of GHG Mitigation Options”
Dan Wei, Adam Rose, and Noah Dormady, CCS/USC 2011



Macroeconomic Analysis

Begin with direct costs & savings developed in policy analyses

- Macro analysis consistent with micro, and with scenarios developed in baselines, policy design

Identify relevant sectors/actors for each cost & savings stream

Identify induced changes

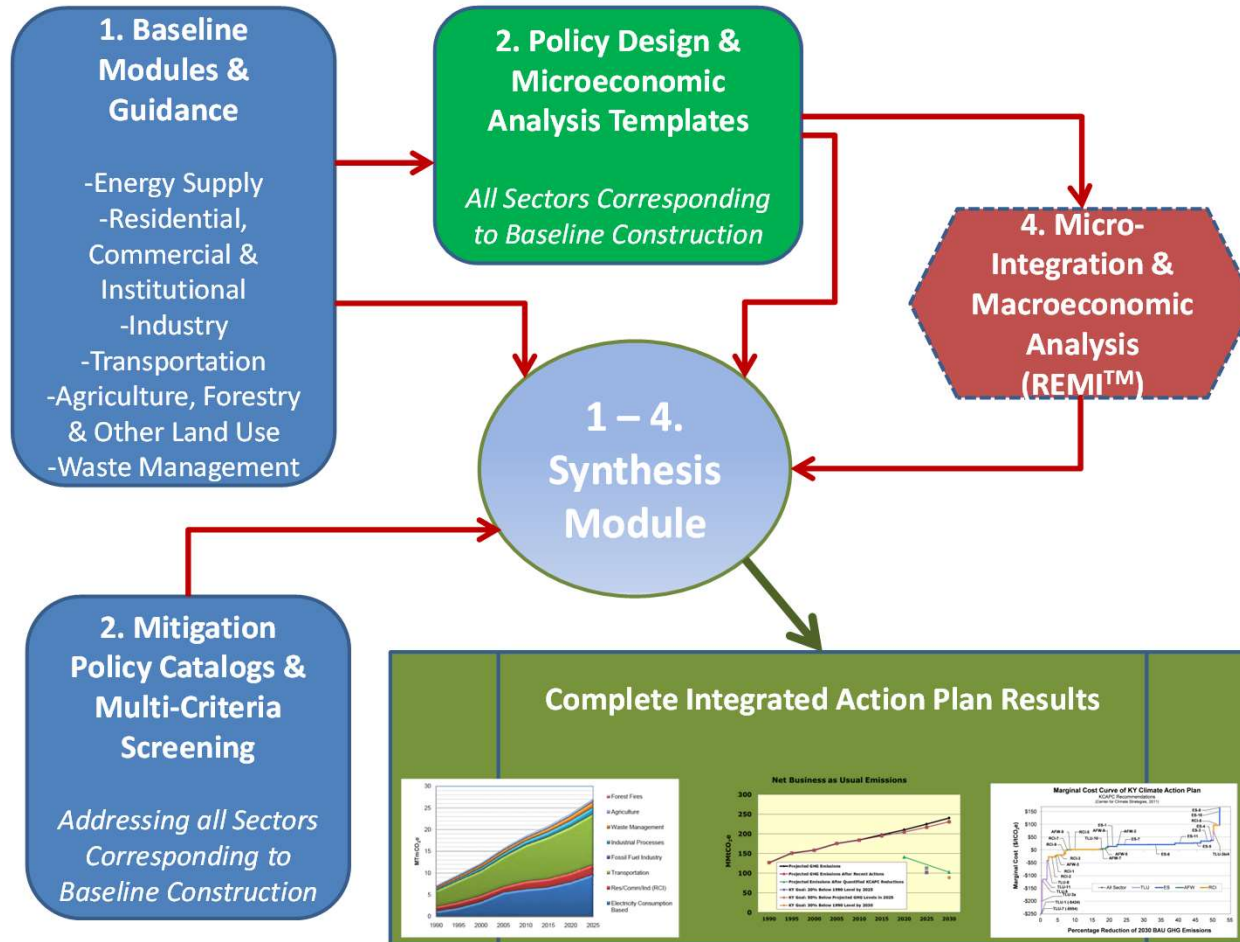
Identify other variables affecting Macro analysis

- Type of effect (consumption, price, demand, sales...)
- Boundary issues (export/import)

Generate granular, dynamic outputs

- Jobs, income, employment, prices, productivity...

CCS Linked Modeling System

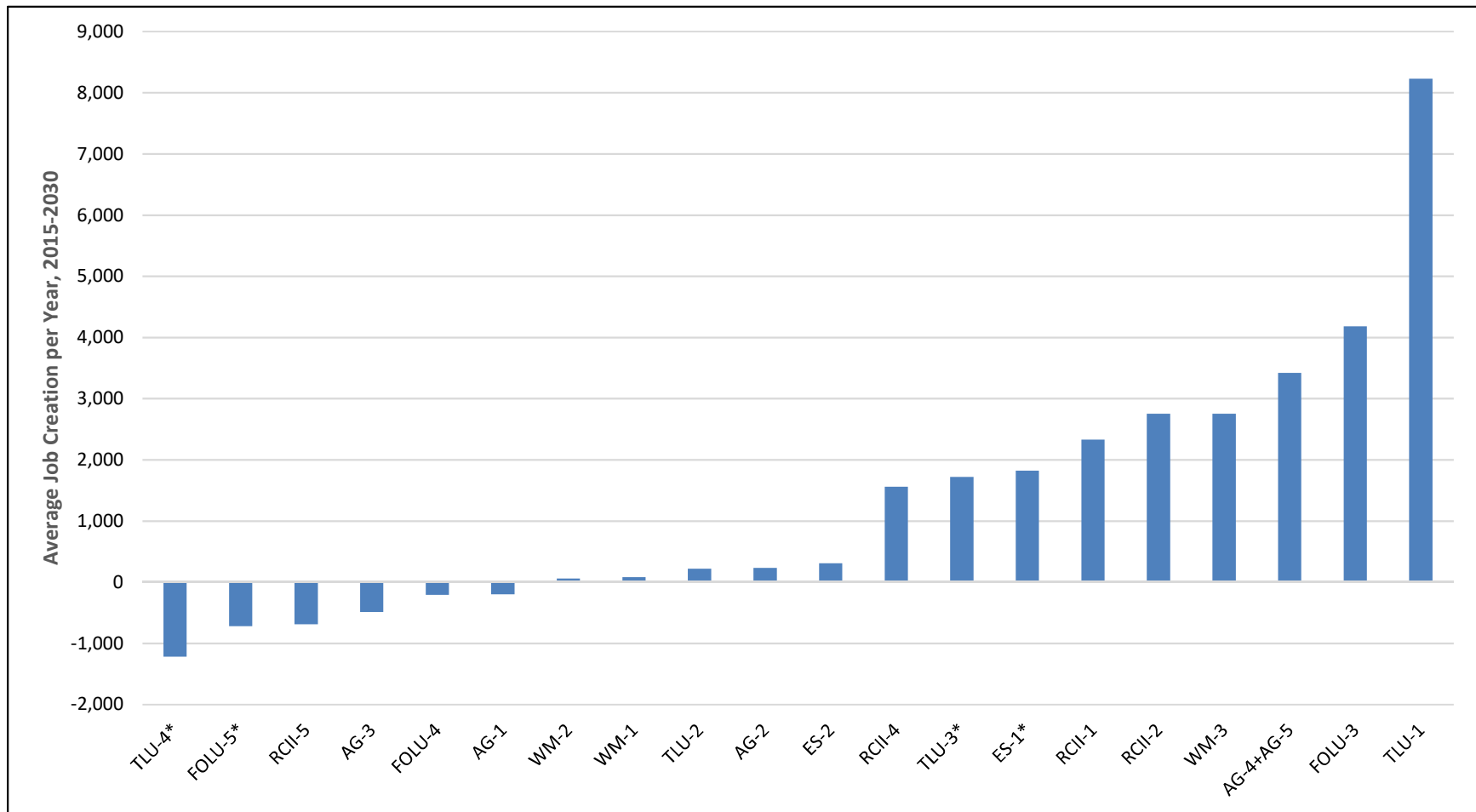


Direct and Indirect Impacts

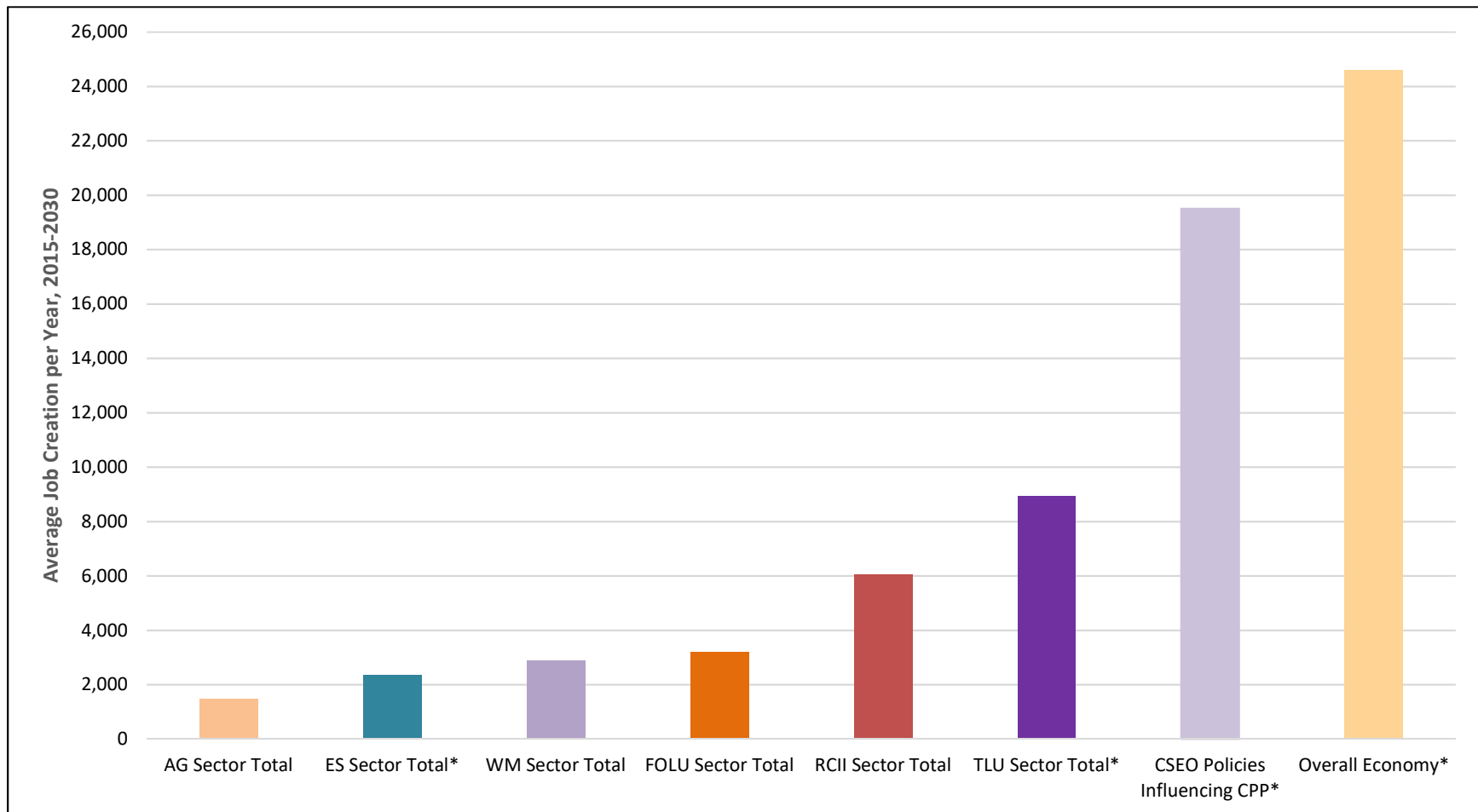
Direct Impacts of CSEO Policy Recommendations						
Policy Option	2030 Annual In-State	Cumulative In-State 2015-2030	2030 Annual Total	Cumulative Total 2015-2030	NPV Costs/Savings 2015-2030	Cost Effectiveness
	GHG Reductions (TgCO ₂ e)				(\$2014MM)	(\$2014/tCO ₂ e)
ES-1	5.3	53	6.3	62	(\$360)	(\$5.8)
ES-2	5.8	41	5.5	38	\$854	\$22
ES Sector Totals	11	94	12	100	\$494	\$4.9
RCII-1	4.9	46	5.2	49	(\$1,117)	(\$23)
RCII-2	9.3	54	11	60	(\$2,050)	(\$34)
RCII-4	4.9	34	5.2	40	(\$1,814)	(\$45)
RCII-5	2.9	22	4.1	30	\$842	\$28
RCII Sector Totals	22	156	25	180	(\$4,140)	\$23
TLU-1	2.0	21	2.6	28	\$2,718	\$98
TLU-2	0.82	7.0	0.97	8.2	(\$425)	(\$52)
TLU-3	0.25	2.0	0.32	2.6	(\$330)	(\$127)
TLU-4	1.0	5.5	1.3	6.7	\$3,278	\$489
TLU Sector Totals	4.1	36	5.1	45	5,241	\$116
A-1	0.13	1.0	0.34	2.7	(\$127)	(\$47)
A-2	0.49	3.1	0.57	3.6	(\$1,346)	(\$377)
A-3	1.6	14	1.6	14	(\$2,104)	(\$153)
A-4+A-5	0.17	1.76	0.32	3.5	\$462	\$133
Agriculture Totals	2.4	19	2.8	23	(\$3,115)	\$133
FOLU-3	0.49	3.2	0.53	3.4	\$1,806	\$525
FOLU-4	1.9	30	2.0	34	\$187	\$5.59
FOLU-5	0.34	3.0	0.34	3.0	\$1,261	\$421
FOLU Sector Totals	2.7	36	2.8	40	\$3,254	\$81
WM-1	0.068	0.89	0.076	0.99	(\$56)	(\$56)
WM-2	0.057	0.073	1.6	9.4	(\$228)	(\$24)
WM-3	0.15	(0.45)	2.7	27	(\$817)	(\$30)
WM Sector Totals	0.28	0.52	4.4	37	(\$1,101)	(\$29)
Total Integrated Plan Results	42	342	52	426	\$634	\$1.5

Macroeconomic Impacts of Policy Recommendations									
Policy	GSP			Employment			Income		
	Year 2030	Average	Cumulative (2016-2030)	Year 2030	Average	Cumulative (2016-2030)	Year 2030	Average	Cumulative (2016-2030)
ES-1	\$538	\$228	\$3,416	3,690	1,820	27,290	\$434	\$180	\$2,695
ES-2	-\$73	-\$39	-\$309	170	310	2,470	-\$16	-\$3	-\$22
ES Sector Total	\$542	\$239	\$3,579	4,720	2,380	35,650	\$485	\$204	\$3,058
RCII-1	\$508	\$202	\$3,026	3,840	2,330	35,020	\$434	\$213	\$3,191
RCII-2	-\$69	-\$6	-\$91	6,020	2,750	41,190	\$336	\$134	\$2,011
RCII-4	\$137	\$141	\$2,111	1,430	1,560	23,340	\$163	\$143	\$2,140
RCII-5	-\$345	-\$149	-\$2,081	-1,680	-690	-9,610	-\$154	-\$58	-\$809
RCII Sector Total	\$262	\$210	\$3,149	9,820	6,080	91,270	\$801	\$444	\$6,658
TLU-1	\$711	\$688	\$10,319	8,140	8,230	123,400	\$781	\$659	\$9,885
TLU-2	\$4	-\$2	-\$31	500	220	3,290	\$29	\$10	\$151
TLU-3	\$125	\$165	\$2,477	1,330	1,720	25,860	\$78	\$138	\$2,068
TLU-4	\$140	-\$65	-\$969	-810	-1,220	-18,300	-\$56	-\$108	-\$1,622
TLU Sector Total	\$981	\$787	\$11,799	9,170	8,950	134,270	\$833	\$699	\$10,485
AG-1	-\$9	-\$5	-\$73	-360	-200	-2,960	-\$22	-\$8	-\$125
AG-2	-\$2	\$8	\$113	70	230	3,380	\$21	\$20	\$299
AG-3	\$23	-\$35	-\$529	1,170	-490	-7,420	\$56	-\$32	-\$486
AG-4+AG-5	\$1,132	\$819	\$11,469	3,610	3,420	47,820	\$539	\$398	\$5,576
AG Sector Total	\$980	\$680	\$10,203	810	1,490	22,300	\$349	\$277	\$4,148
FOLU-3	\$382	\$366	\$5,495	4,420	4,180	62,670	\$463	\$361	\$5,409
FOLU-4	-\$10	-\$15	-\$232	-130	-210	-3,160	-\$14	-\$19	-\$283
FOLU-5	-\$75	-\$59	-\$883	-920	-720	-10,750	\$117	\$144	\$2,157
FOLU Sector Total	\$294	\$290	\$4,345	3,340	3,220	48,340	\$567	\$486	\$7,292
WM-1	\$2	\$2	\$31	90	80	1,130	\$8	\$6	\$86
WM-2	\$6	\$2	\$31	150	60	930	\$13	\$5	\$72
WM-3	\$240	\$203	\$3,039	3,290	2,750	41,210	\$319	\$223	\$3,338
WM Sector Total	\$248	\$207	\$3,101	3,530	2,890	43,280	\$340	\$233	\$3,496
ES+RCII	\$776	\$440	\$6,601	14,340	8,390	125,880	\$1,263	\$641	\$9,614
Overall Economy	\$3,246	\$2,378	\$35,677	30,820	24,630	369,440	\$3,235	\$2,261	\$33,908

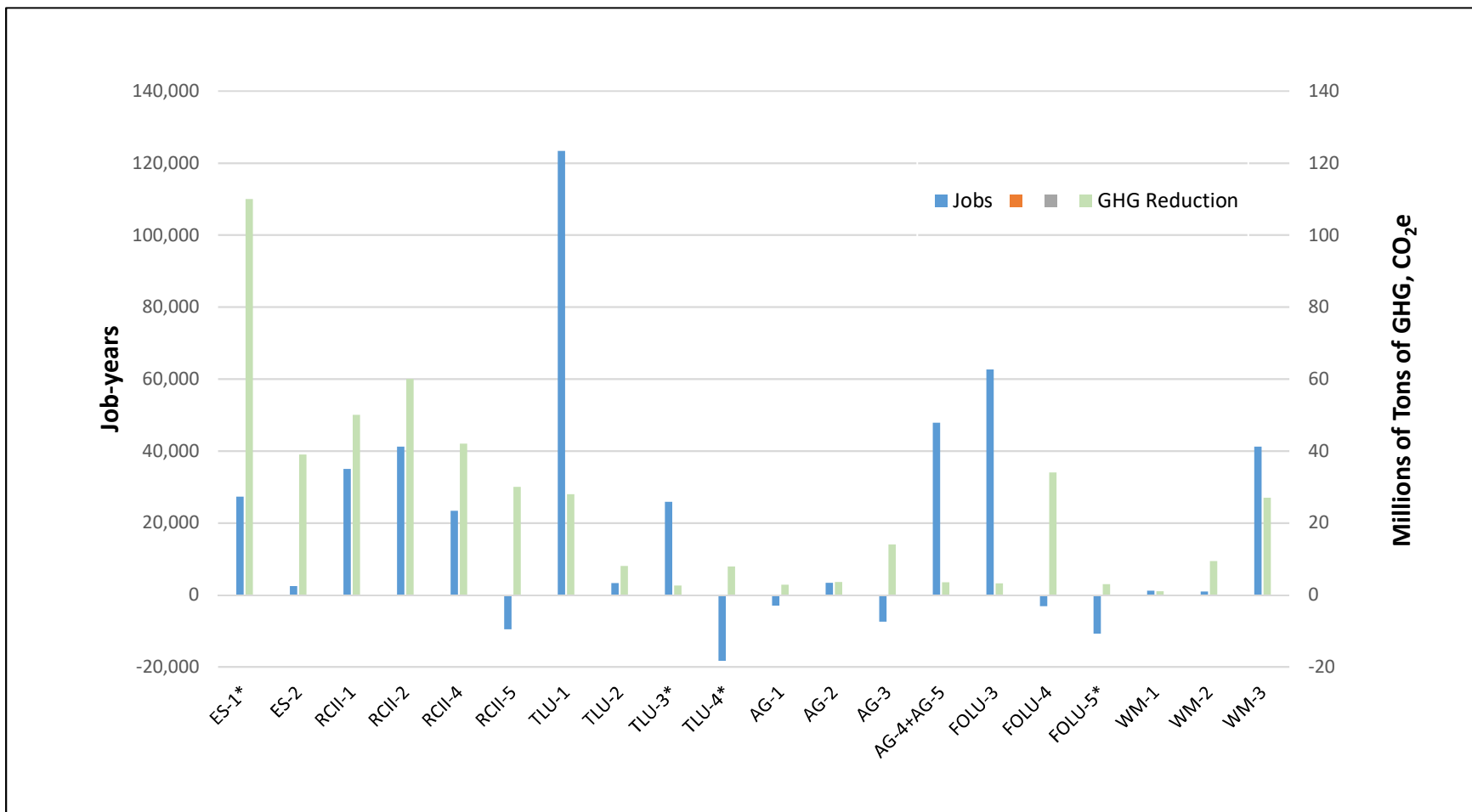
Jobs by Policy Option



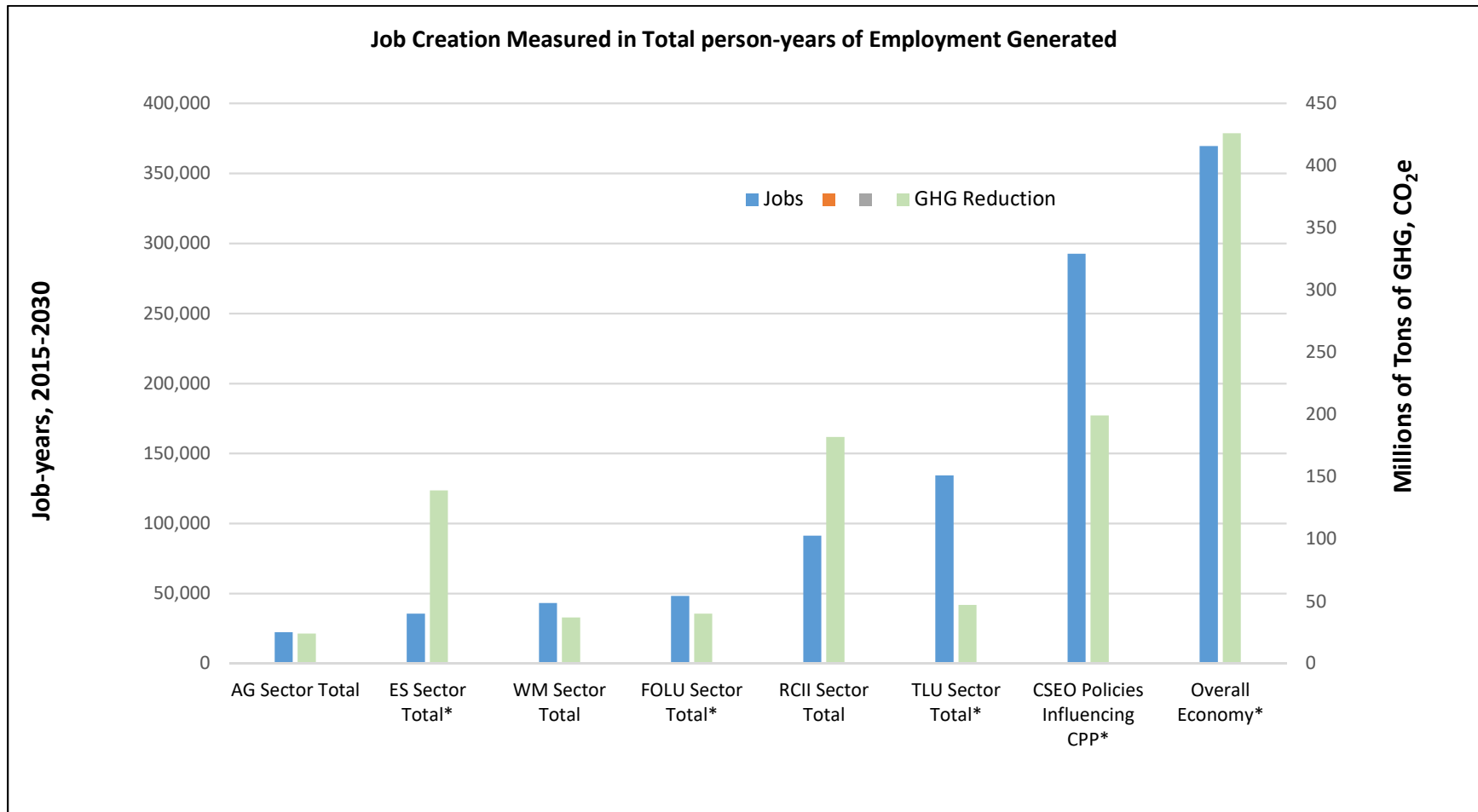
Jobs by Sector



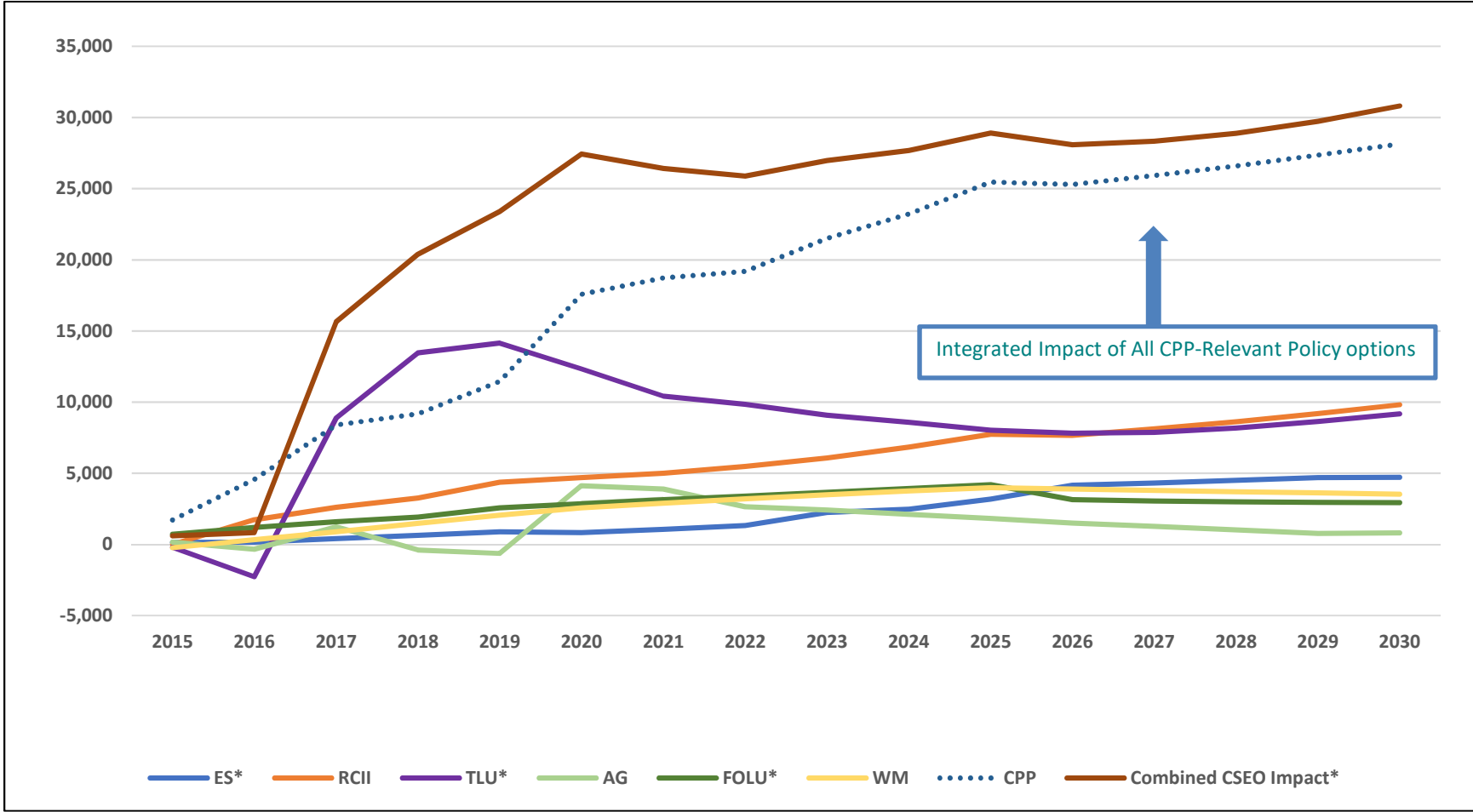
Jobs & GHGs



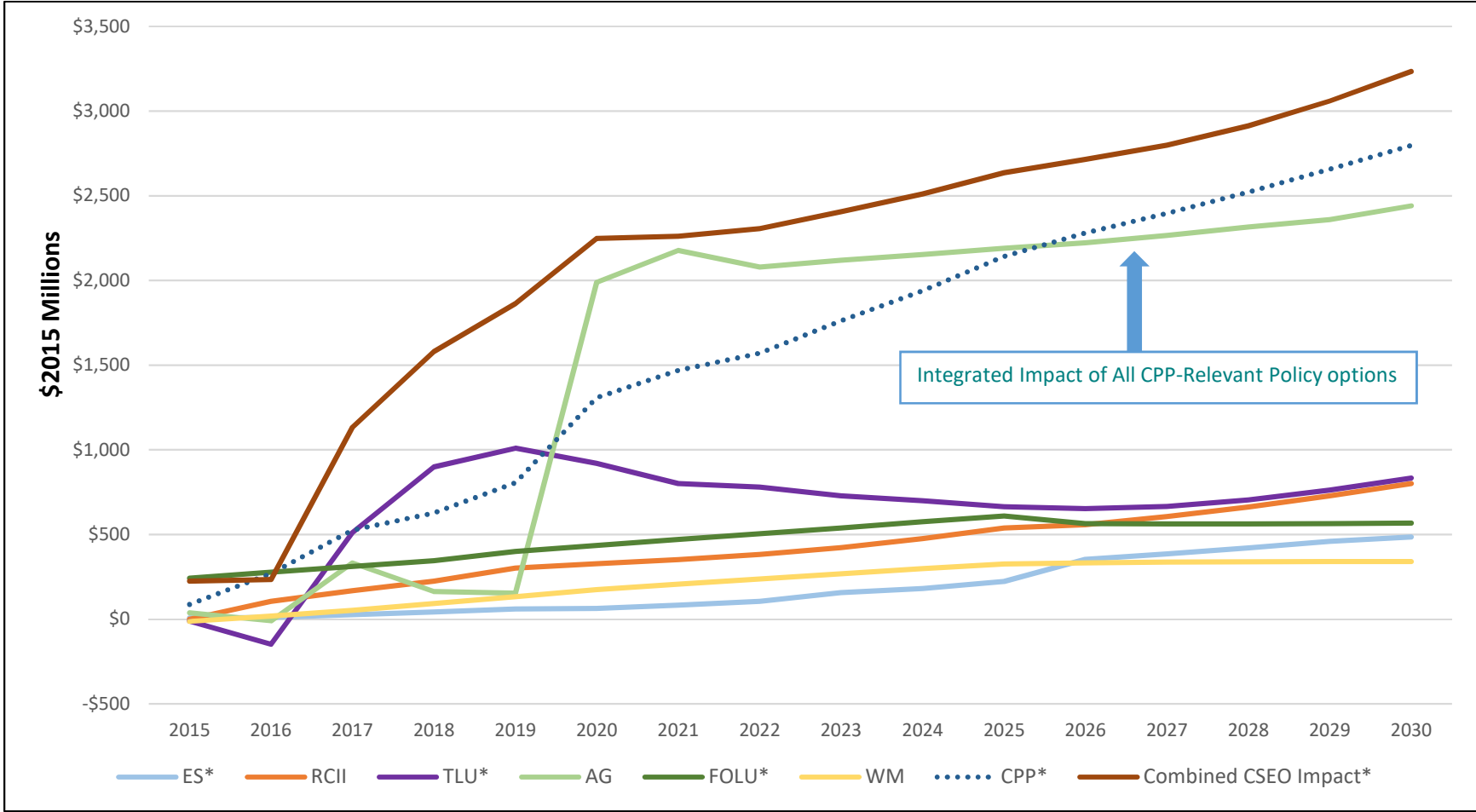
Jobs & GHGs



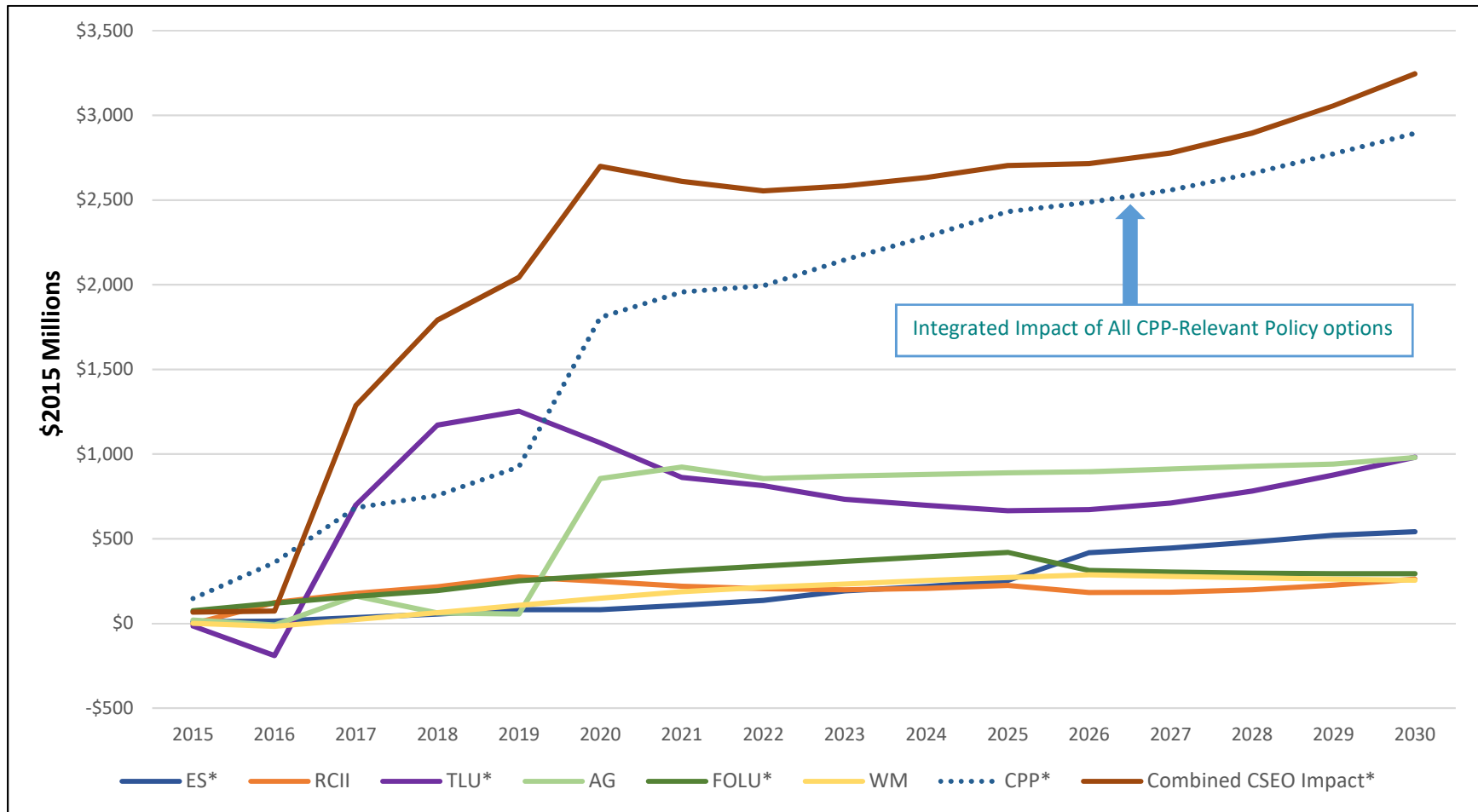
Jobs



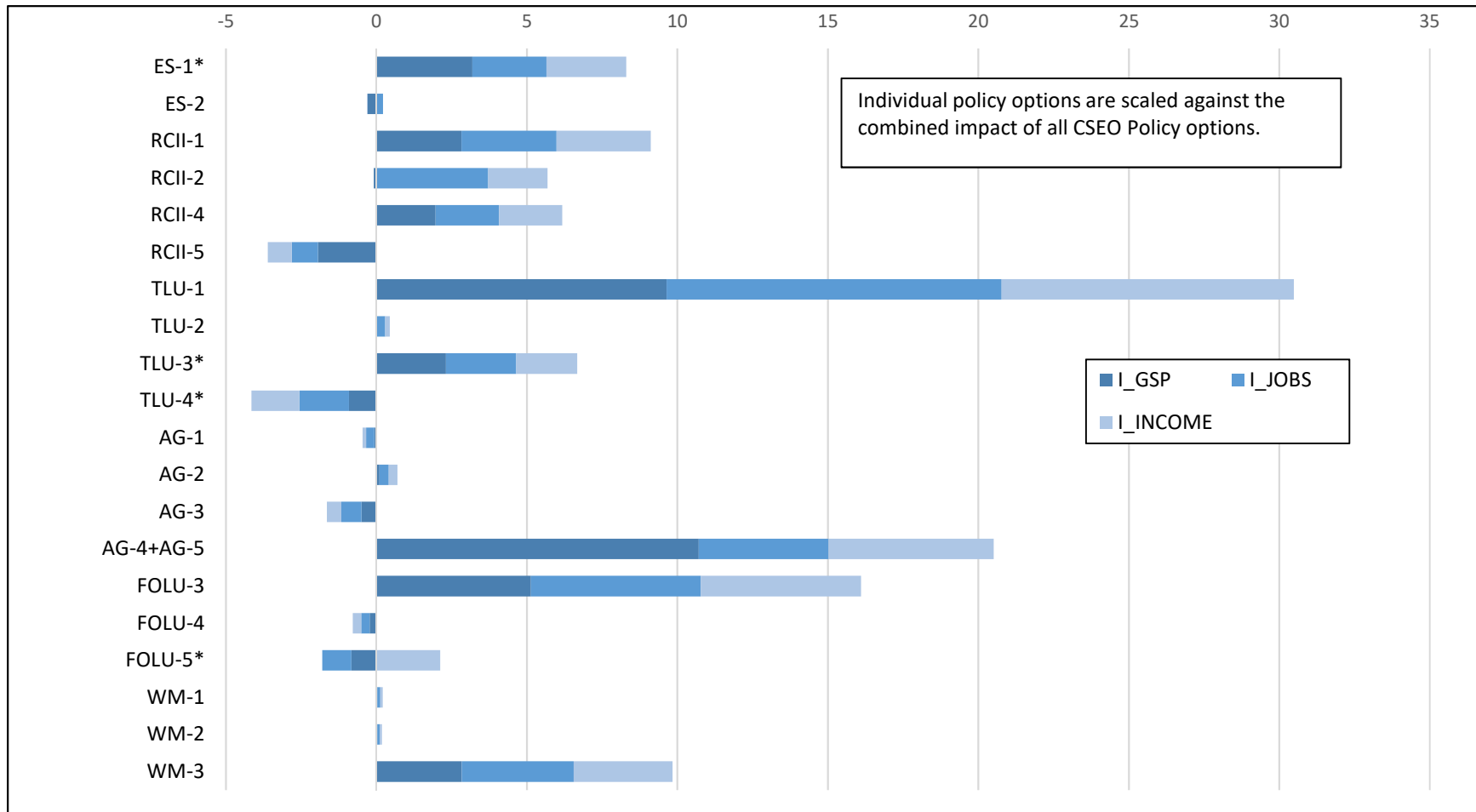
Personal Income



GSP (Economic Growth)

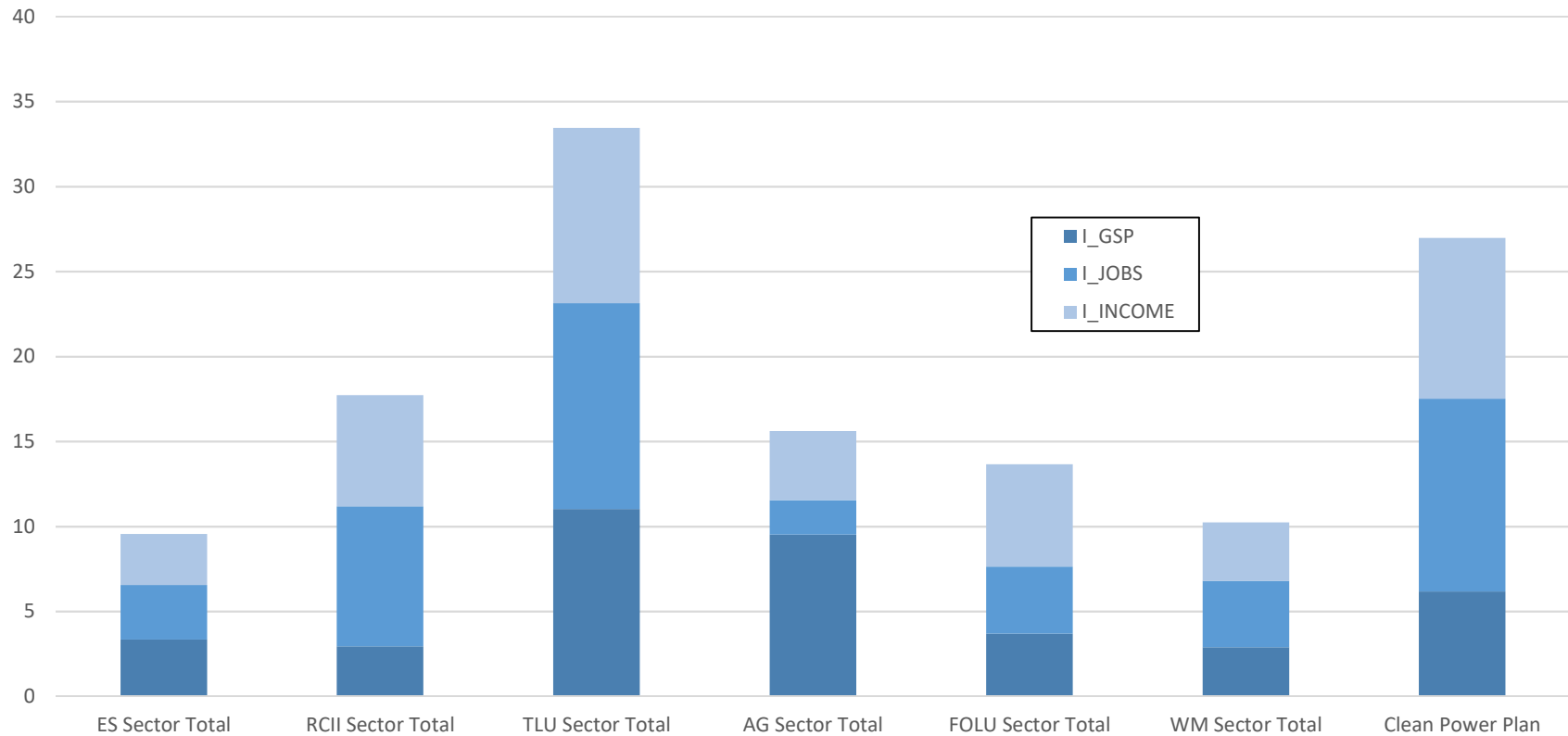


Macroeconomic Indicators



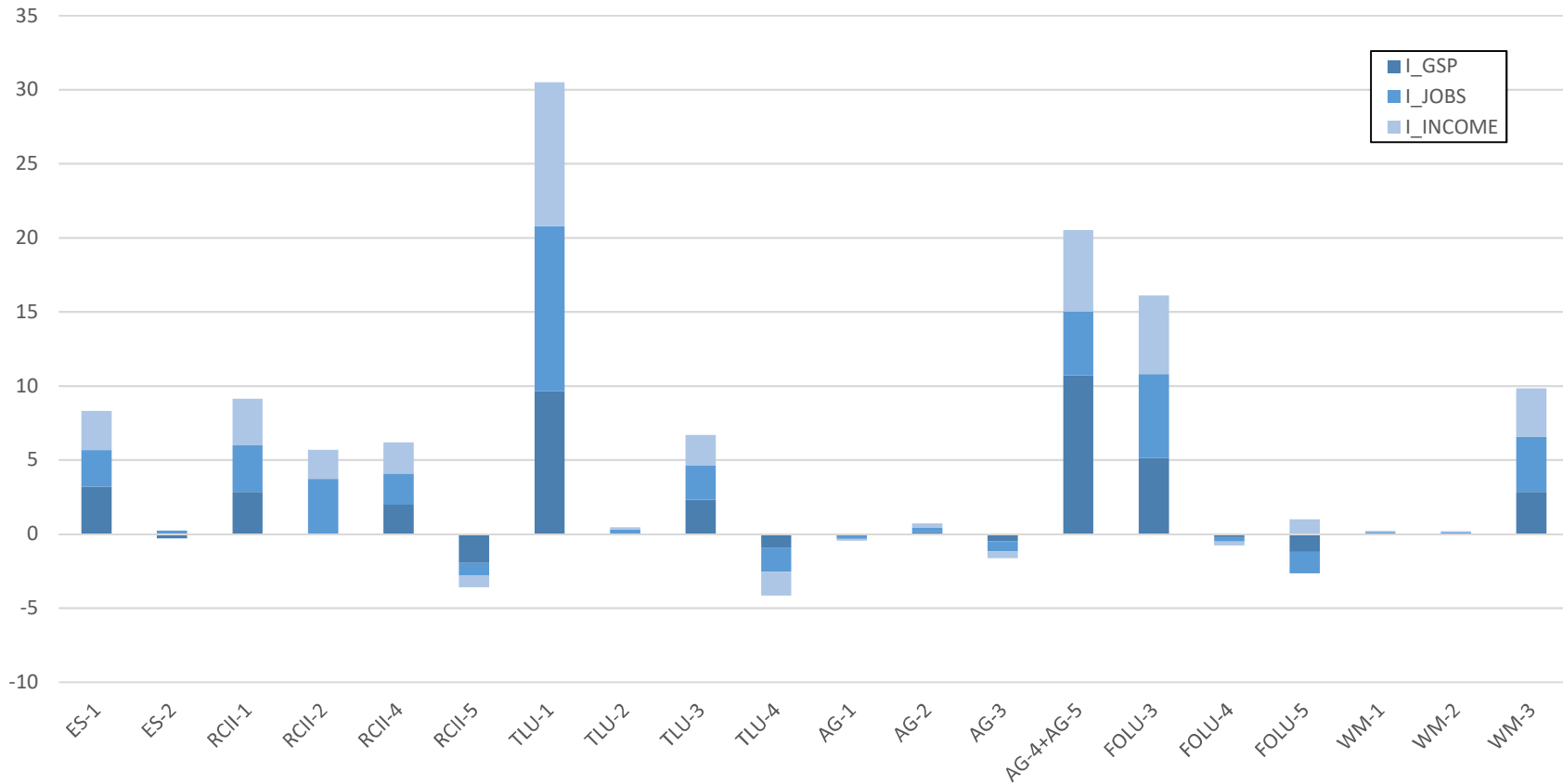
Macroeconomic Impacts by Sector

Macroeconomic Impact, 2016-2030, Cumulative

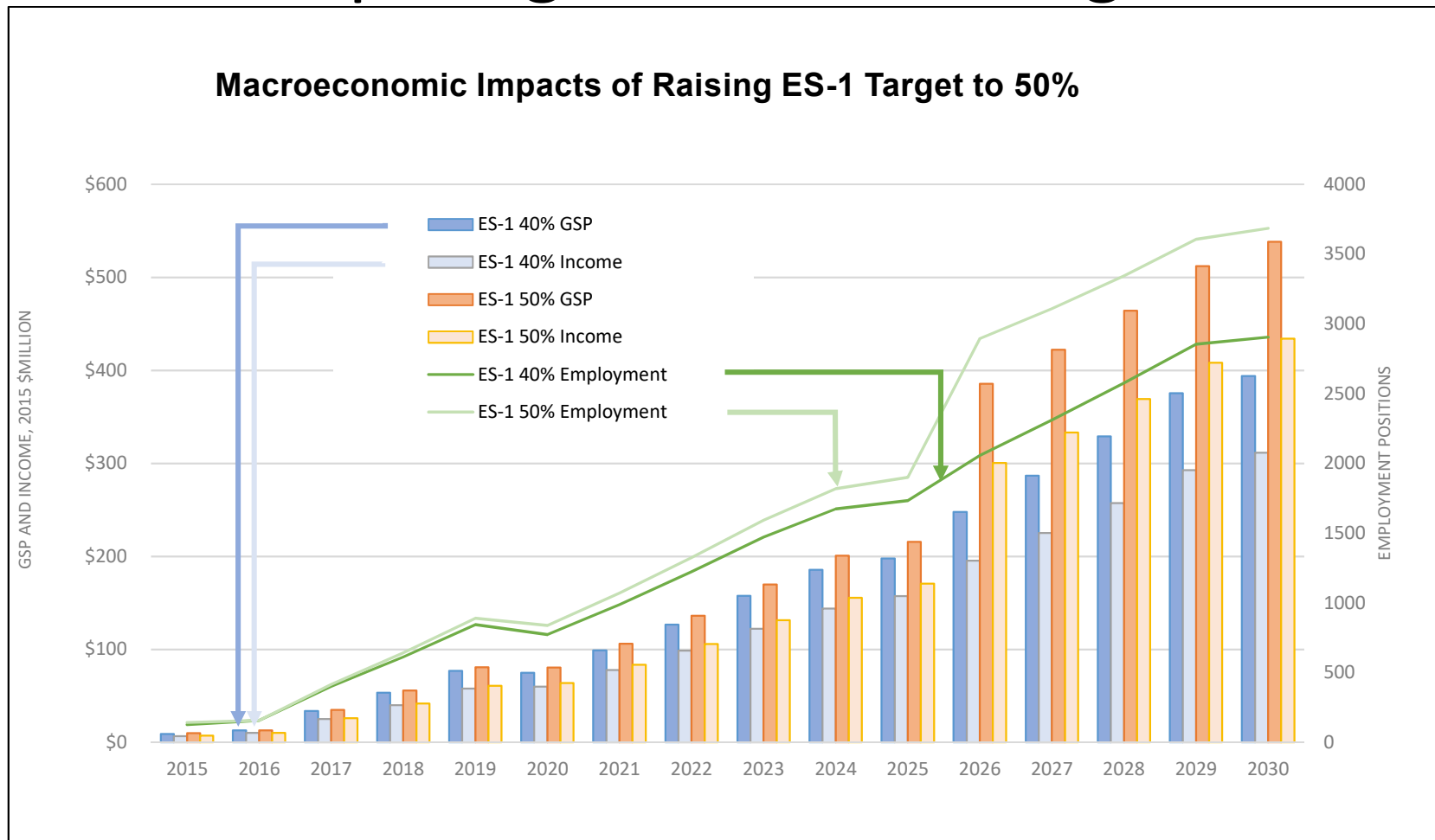


Macro Impacts by Policy Option

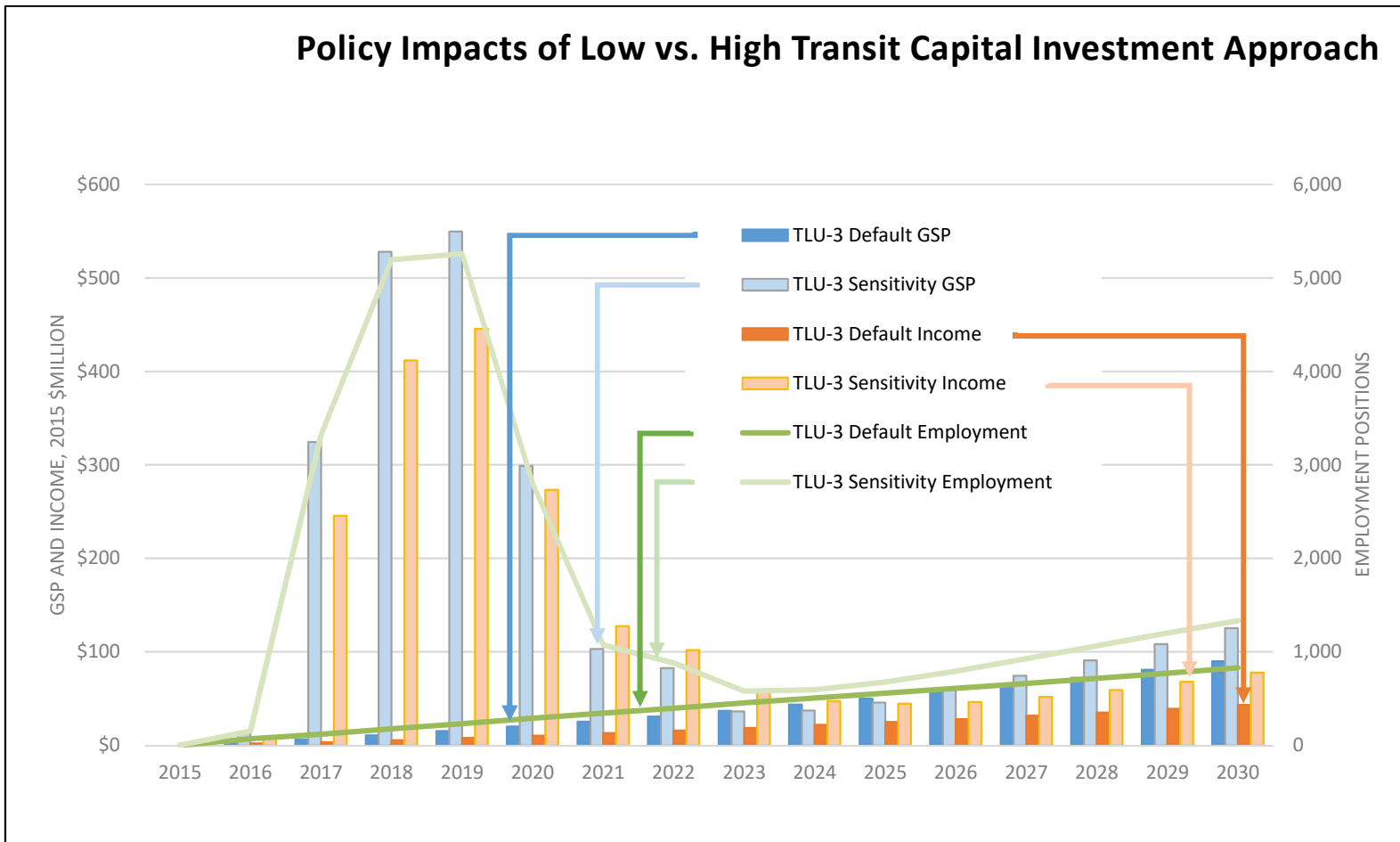
Macroeconomic Impact, 2016-2030, Cumulative



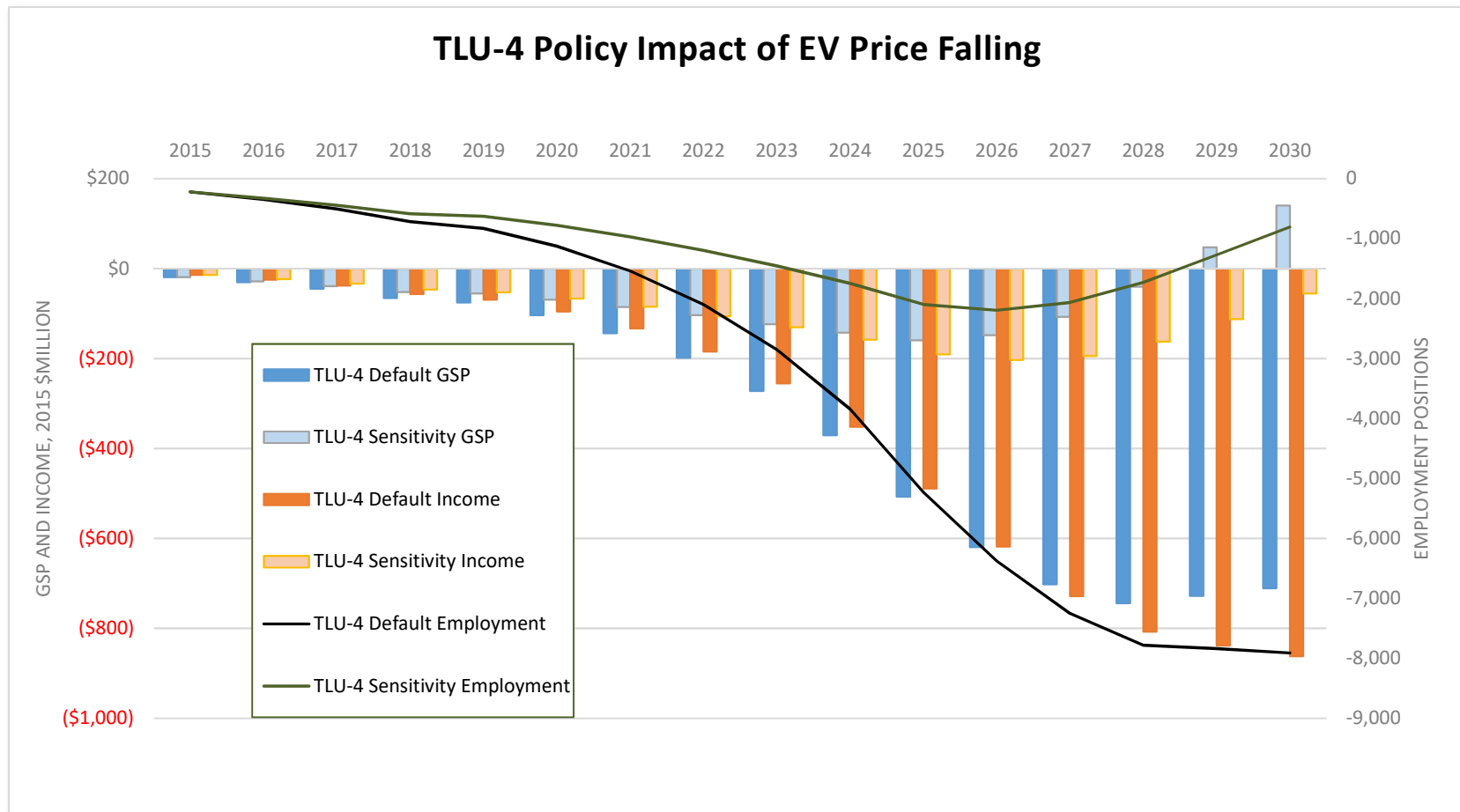
ES-1 Renewable-Energy Goals: Comparing 40% & 50% Targets



Transit Expansion: Comparing Capital-Cost Assumptions



Electric Vehicles: Comparing High vs. Low Vehicle Price Assumptions



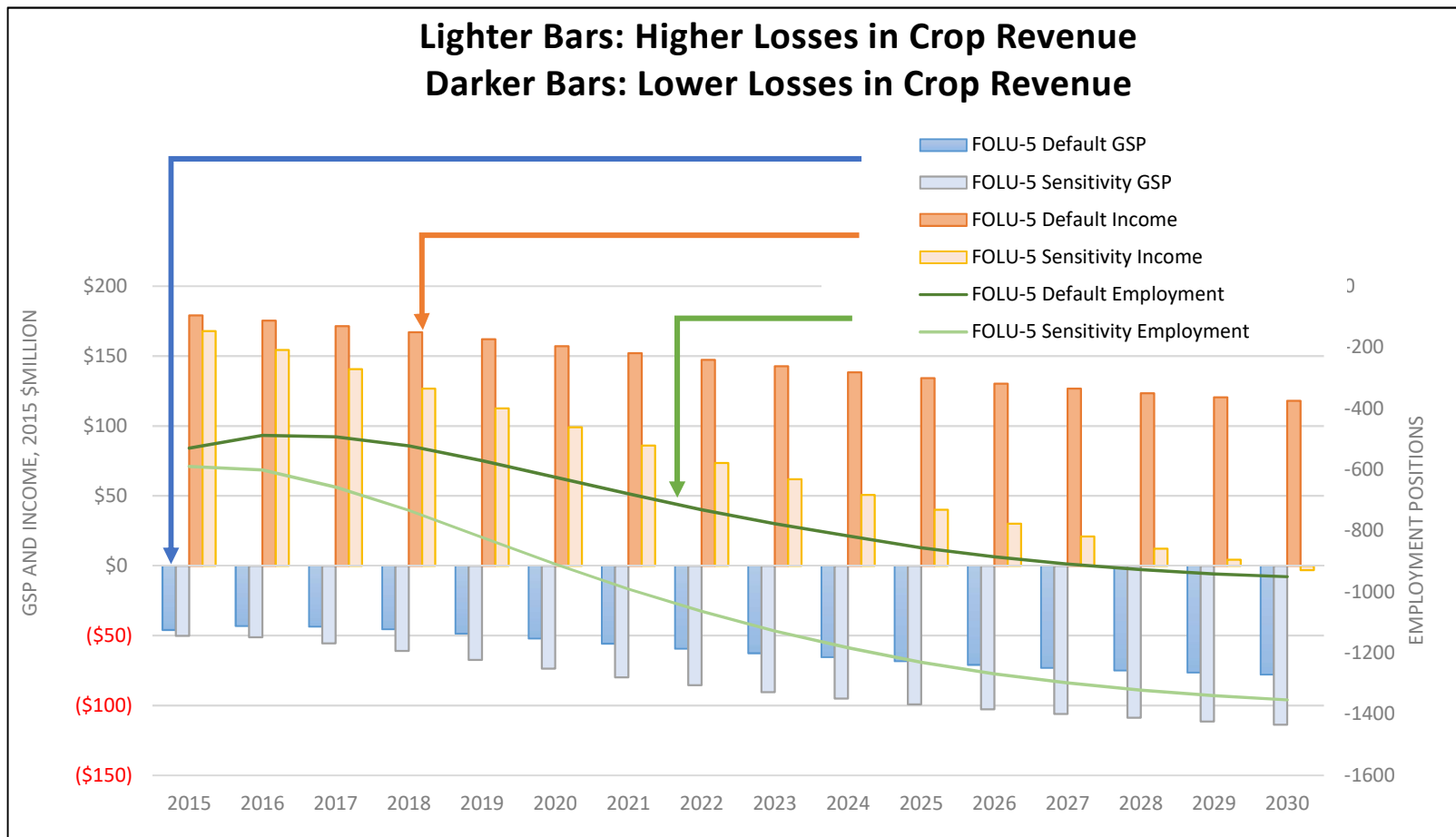
Slide 34

y2

Error in this slide - the two GDPs should not be equal.

yttocs37, 3/30/2016

Conservation Easements





Many Thanks!

swilliamson@climatestrategies.us

www.climatestrategies.us

1800 K Street, NW, Suite 714

Washington, DC 20006

202-293-4591

202-560-4962

(Additional Resource Slides Following)



MN CSEO Policy Options

Policy ID	Policy Title	Description
ES-1	Increase the Minnesota Renewable Energy Standard	Expands Minnesota's Renewable Portfolio Standard to 40% or 50% of renewable electricity generation as a share of retail sales in the state by 2030
ES-2	Efficiency Improvements, Repowering, Retirement, and Upgrades to Existing Plants	Repowers or retires two of the largest coal-fired boilers in Minnesota (Sherco plants 1 and 2)
RCII-1	Incentives and Resources for Combined Heat & Power for Biomass and Natural Gas	Implements 800 MW of gas-fired CHP and 300 MW of biomass-fired CHP by 2030
RCII-2	Zero Energy Transition/Codes (SB2030)	Provide incentives for or mandates construction of highly energy efficient buildings and phasing in the use of renewable energy sources
RCII-3	Reduce High Global Warming Potential GHGs	Reduces emissions; postponed due to data limitations
RCII-4	Increase Energy Efficiency Requirements	Increase the requirements of the existing EERS for electric and gas utilities while allowing them to count energy savings from infrastructure improvements, end-use efficiency and CHP
RCII-5	Incentives and Resources to Promote Thermal Renewables	Establish new thermal goal of switching 5% of the future heat load that is fueled with non-electric sources by 2020 and 20% by 2030

MN CSEO Policy Options

Policy ID	Policy Title	Description
TLU-1	Transportation Pricing	Use transportation pricing method to reduce GHG and provide more reliable funding for roads and bridges, including incentives to institute insurance pricing, carbon tax on fuels with rebates, and a 6.5% state wholesale fuel tax
TLU-2	Improve Land Development and Urban Form	Implement urban planning and development practices in the seven-county metropolitan area that result in greater concentration of development, more compact urban form, more locally diverse uses, and shorter trip distances, thus mitigating VMT and GHG from transportation
TLU-3	Metropolitan Council Draft 2040 Plan	Expansion and operation of the MnPASS System, the Transit System and the Bicycle/Pedestrian System
TLU-4	Zero Emission Vehicle Standard	Require automobile manufacturers, through their dealerships, to have a percentage of the total light and medium duty vehicle sales in Minnesota, designated as electric vehicle sales

MN CSEO Policy Options

Policy ID	Policy Title	Description
A-1	Nutrient Management	Achieves gains in nitrogen use efficiency with precision agricultural techniques and nitrification inhibitors
A-2	Soil Carbon Management: Cover Crops	Improves soil carbon management through cover crop adoption for cropping systems
A-3	Soil Carbon Management: Row to Perennial Crops Conversion	Sequesters carbon and reduced fuel and fertilizer consumption
A-4	Advanced Biofuels Production	Expands ethanol production through cellulosic and energy beet production methods
A-5	Biofuels Consumption (Existing Biofuels Statute)	Supports programs to replace gasoline with 14% biofuels by 2015, 18% by 2017, 25% by 2020, and 30% by 2025

MN CSEO Policy Options

Policy ID	Policy Title	Description
FOLU-2	Manage for Highly Productive Forests	Thins commercial forests to increase carbon sequestration; postponed due to data limitations
FOLU-3	Community Forests	Strengthens community forests across the state by increasing and maintaining the overall tree canopy cover of community forests to 40% by 2050
FOLU-4	Tree Planting: Forest Ecosystems	Dedicates resources to ensure timely restoration of carbon sequestration following large disturbances on state, county, and private lands
FOLU-5	Conservation on Private Lands	Protects forests and their ability to annually sequester carbon while preventing large one-time emissions associated with forest loss
WM-1	Wastewater Treatment: Energy Efficiency	Calls for a statewide reduction in energy usage from WWTPs of 25% by 2025
WM-2	Front-End Waste Management: Source Reduction	Avoids disposal emissions, reduces upstream product energy-cycle emissions from the manufacture and transport of new products and packaging