

*Final Draft Results*

***Secondary ECONOMIC IMPACT ANALYSIS OF VARIOUS  
CLIMATE MITIGATION OPTIONS FOR NORTH CAROLINA***

**PREPARED FOR THE CENTER FOR CLIMATE STRATEGIES**

**N.C. Legislative Commission on Global Climate Change**

**David W. Ponder**

**April 22, 2008**

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# N.C. Energy Scenario Economic Impact Model

❖ Developed in 2005 for the N.C. Energy Policy Council

❖ Skip Laitner, U.S. Environmental Protection Agency

❖ Doug Arent, National Renewable Energy Laboratory

❖ Christopher Larsen, ABB Group

❖ Jeffry Tiller, Appalachian State University Energy Center

❖ Peer reviewed by Adam Rose, PhD. Univ. of Southern California

❖ Served as basis for similar analysis in Arizona, Colorado, Florida, Iowa, Michigan, Ohio, and Texas

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# Input-Output Modeling

- ❖ Conceptualized by Nobel laureate Wassily Leontief
  - ❖ Describes relationship among sectors of economy
  - ❖ Outputs for one sector are inputs for another
  - ❖ Changes in consumption catalyze chain reaction of production
  - ❖ Multipliers measure ripple effect due to changes in demand
  - ❖ Derived from IMPLAN 2004
- ❖ Core of NCESEIM
  - ❖ 39 x 39 Economic Sector Matrix

# Impact Analysis

- ❖ Impact model captures direct, indirect, induced effects
- ❖ Employment
  - ❖ Full time equivalents
- ❖ Income
  - ❖ Employee compensation & proprietor income
- ❖ Total Value Added
  - ❖ Income
  - ❖ Rents, royalties, dividends & profits
  - ❖ Indirect business taxes

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# Key I-O Assumptions

- ❖ Static Production Functions
- ❖ Constant Returns to Scale
- ❖ Homogenous Personal Consumption Functions
- ❖ No Supply-Side Constraints
- ❖ Endogenous

# Policy selection and bundling

- ❖ 22 bundles representing 30 policy options
  - ❖ 6 Energy Supply
  - ❖ 10 Residential, Commercial, Industrial
  - ❖ 11 Agriculture, Forestry, Waste
  - ❖ 3 Transportation & Land Use
  
- ❖ Represent more than 90% of greenhouse gas emissions reductions

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##### Energy Supply Options

ES-1, ES-2 & AFW-5: Renewable Energy Production Subsidy, Renewable Portfolio Standard, & Biomass Production Subsidy  
ES-3 & ES-9: Combined Heat and Power  
ES- 6a & 6b: Advanced Coal Technologies

ES-8: Municipal Biogas

##### Residential, Commercial, & Industrial Options

RCI-1, RCI-2 & RCI-11: Energy Efficiency Funding & Energy Audits  
RCI-4 & RCI-5: Market Transformation & Appliance Standards  
RCI-6: Energy Codes  
RCI-7 & RCI-3: High Performance Buildings  
RCI-9: Bulk Purchasing for Energy Efficient Appliances  
RCI-10: Solar Water Heating Only

##### Agriculture, Forestry, & Waste Management Options

AFW-1: Manure Digesters  
AFW-2: Biodiesel Production Subsidy  
AFW-4a & AFW-4b: Conservation Easements  
AFW-6: Cellulosic Ethanol Production Subsidy  
AFW-8: Afforestation  
AFW-9 & AFW-10: Forest Management  
AFW-11: Landfill Gas  
AFW-12: Recycling  
AFW-13: Urban Forestry

##### Transportation & Land Use Options

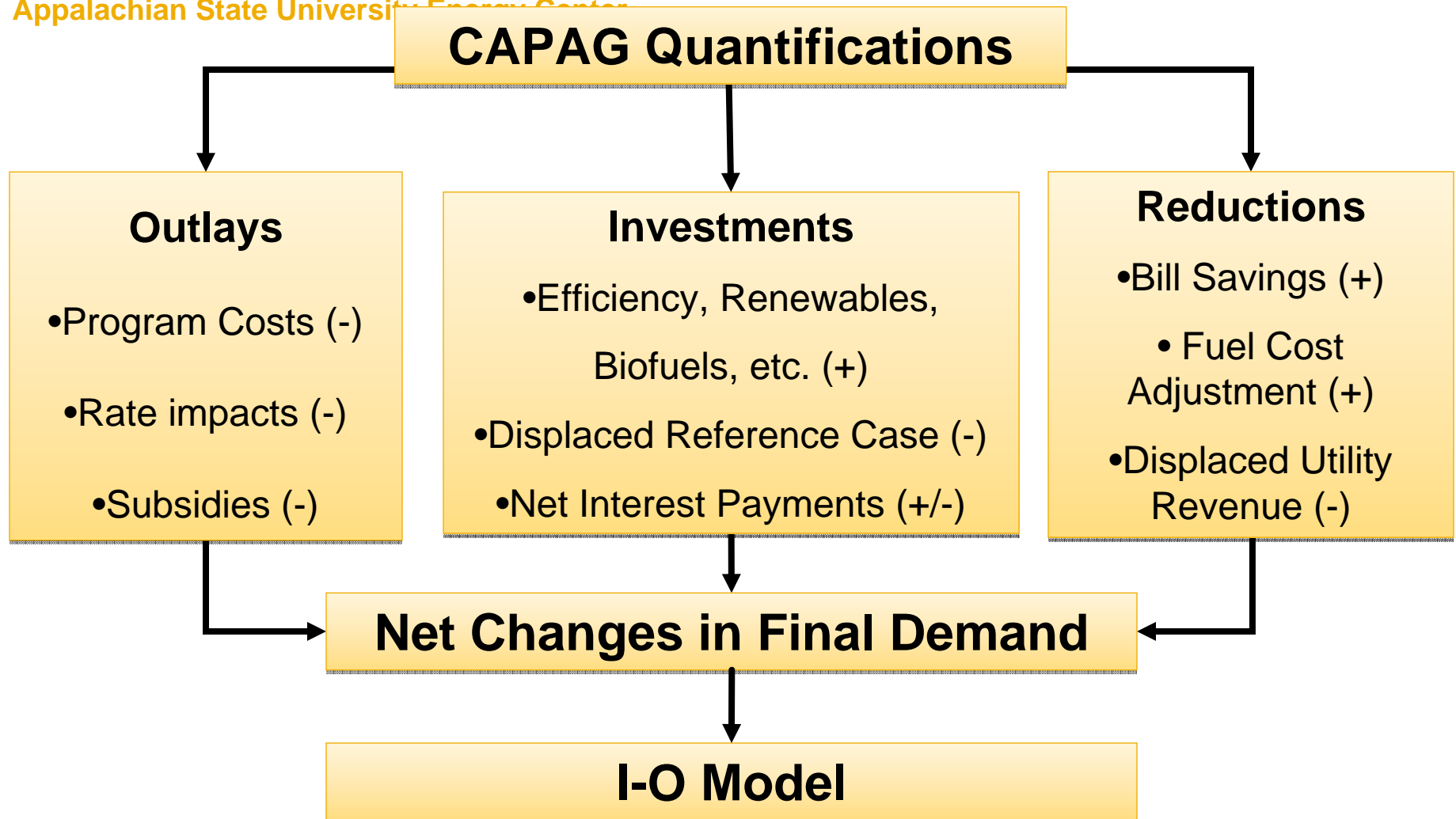
TLU-1b: Multi-modal Transportation and Promotion  
TLU-3a: Vehicle Registration Surcharge to Fund Multi-modal Transportation  
TLU-5: Tailpipe Greenhouse Gas Emissions Standards

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# Summary Results for All Options

	Net Annual Employment (FTE)			Net Income (\$2004, million)				Total Value Added (\$2004, million)			
	2010	2015	2020	2010	2015	2020	2007-2020 NPV	2010	2015	2020	2007-2020 NPV
<b>Energy Supply Resiliency Options</b>	(3,707)	(6,311)	(3,099)	(170)	(296)	(129)	(1,901)	(329)	(584)	(361)	(3,840)
<b>Commercial &amp; Industrial Options</b>	6,611	11,703	13,934	285	519	638	3,761	375	560	521	4,123
<b>Agriculture, Forestry &amp; Waste Management Options</b>	4,183	7,692	15,500	189	386	866	3,232	340	691	1,527	5,792
<b>Transportation &amp; Land Use Options</b>	2,061	1,993	6,090	62	63	288	706	133	151	567	1,523
<b>All Options</b>	9,149	15,077	32,424	366	673	1,663	5,799	520	817	2,254	7,598

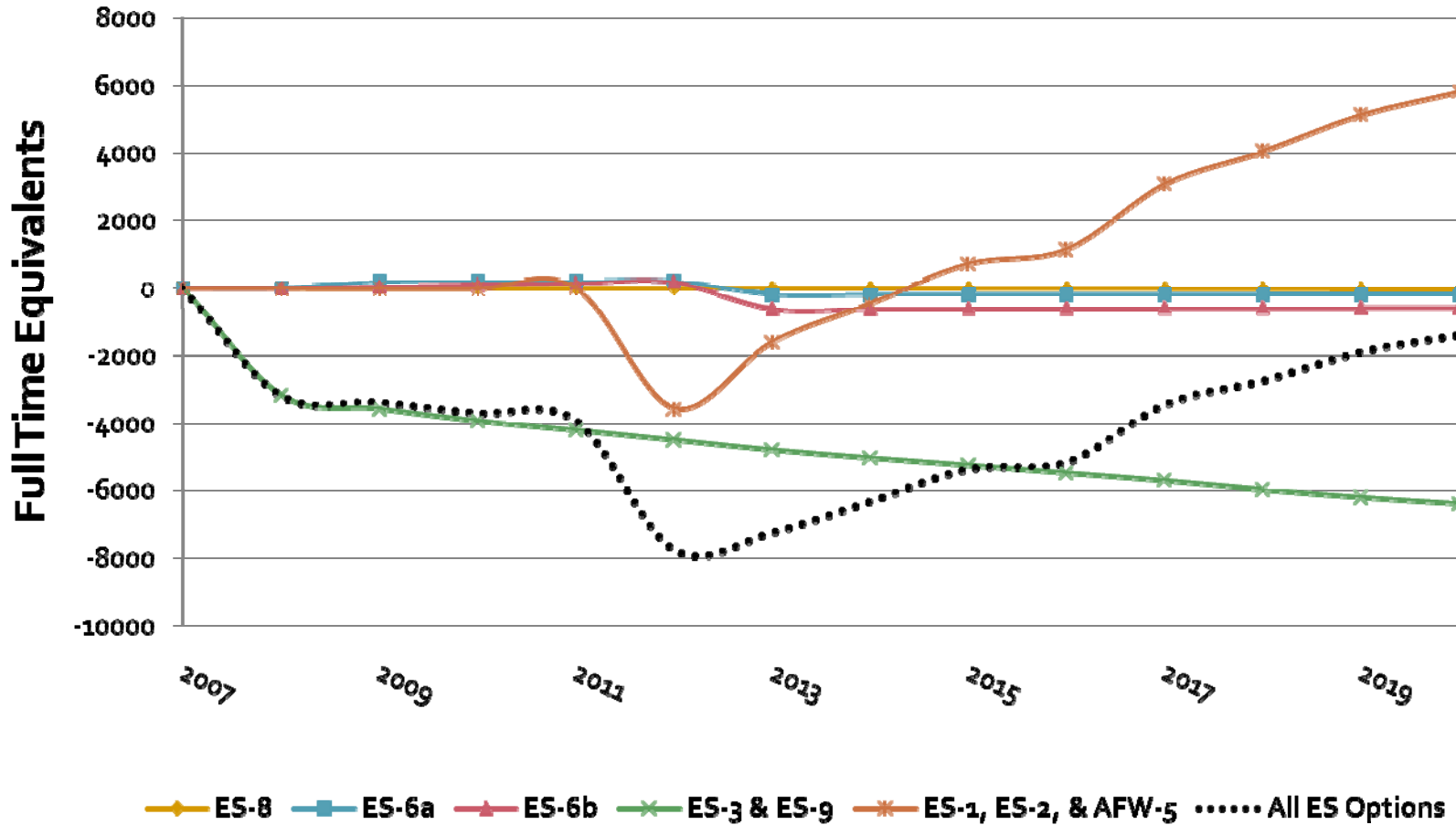
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# Net Employment Impact of Energy Supply Options



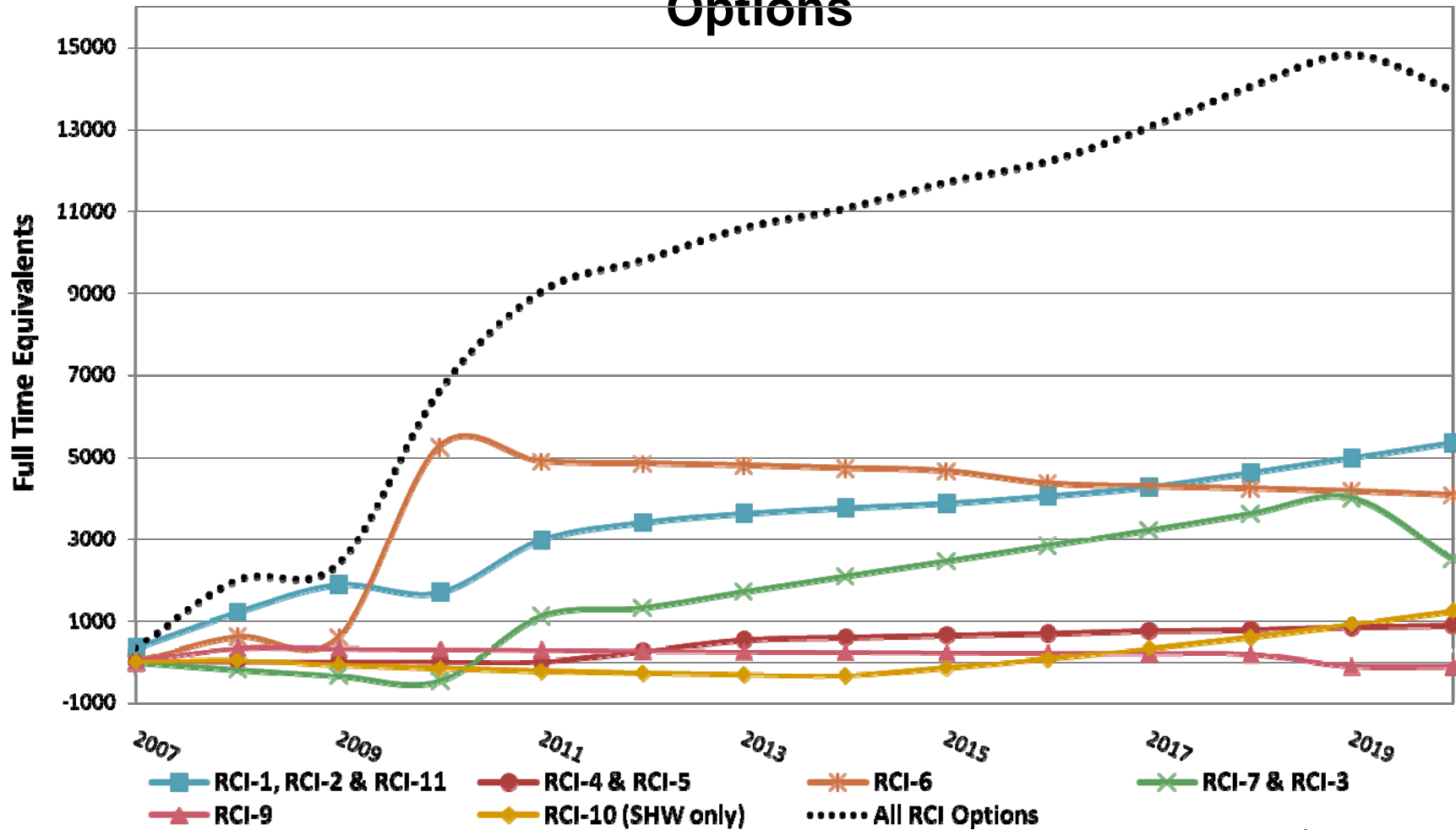
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# Net Employment Impact of Residential, Commercial & Industrial Options



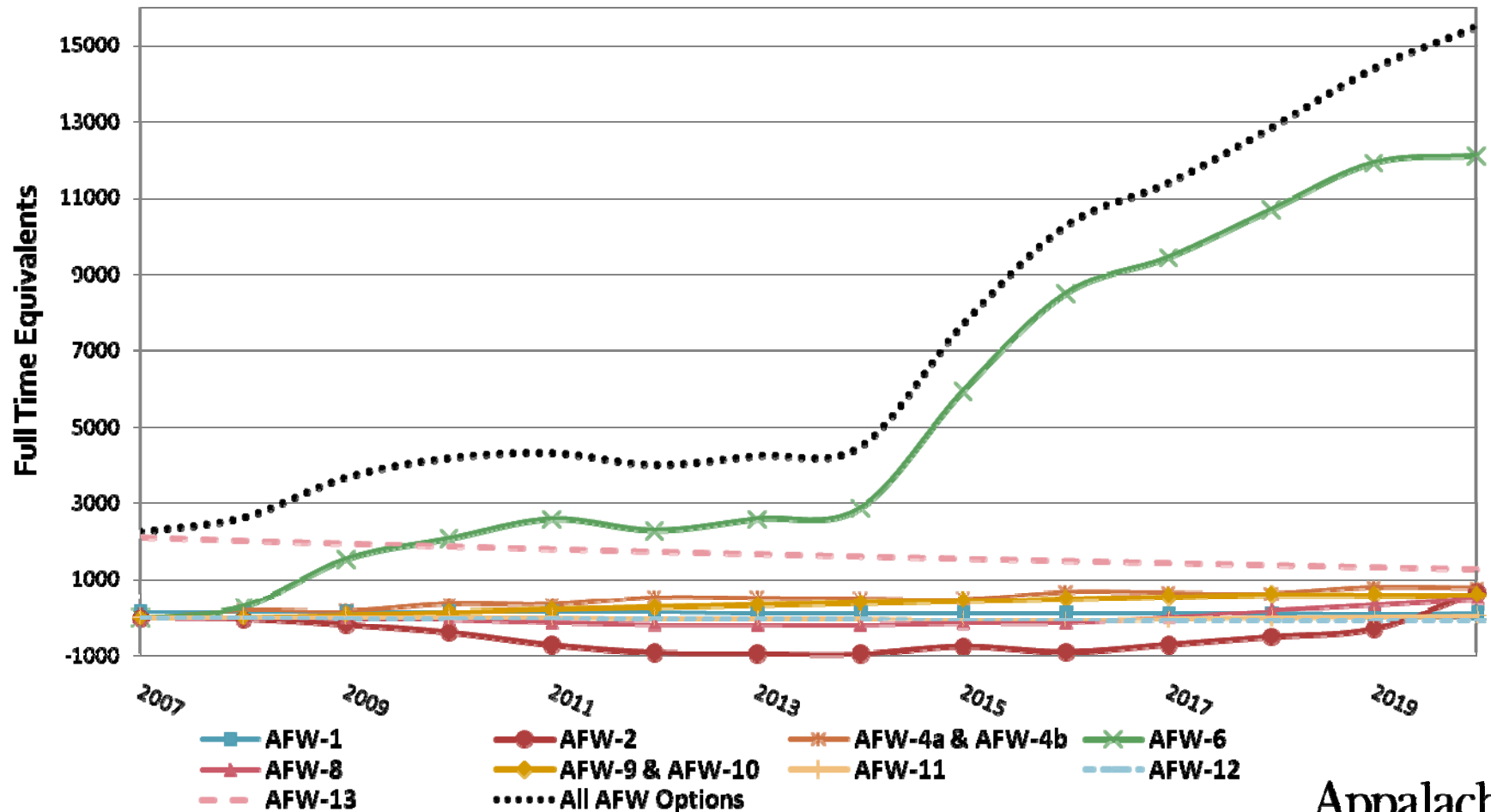
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# Net Employment Impact of Agricultural, Forestry & Waste Options



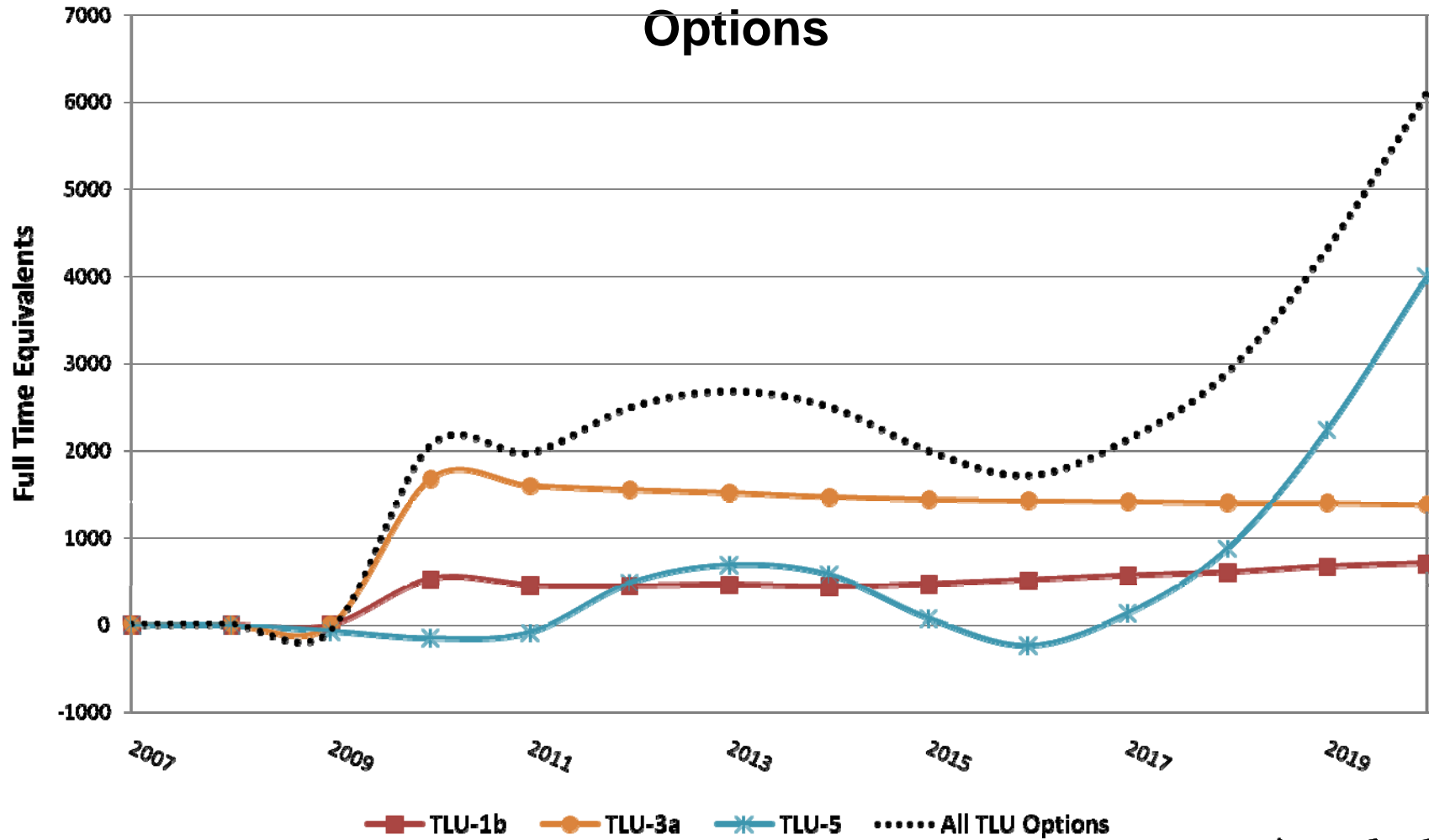
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# Net Employment Impacts of Transportation & Land Use Options



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# Sensitivity Analysis

- ❖ RCI-1: Energy Efficiency Funding
  - ❖ Program Effectiveness (energy savings realized)
  - ❖ Local Investment
  - ❖ Multipliers
  
- ❖ TLU-5: GHG Standards for Automobiles
  - ❖ Fuel Prices
  - ❖ Compliance Costs
  
- ❖ AFW-6: Subsidies for Cellulosic Ethanol
  - ❖ Feedstock Price Sensitivities

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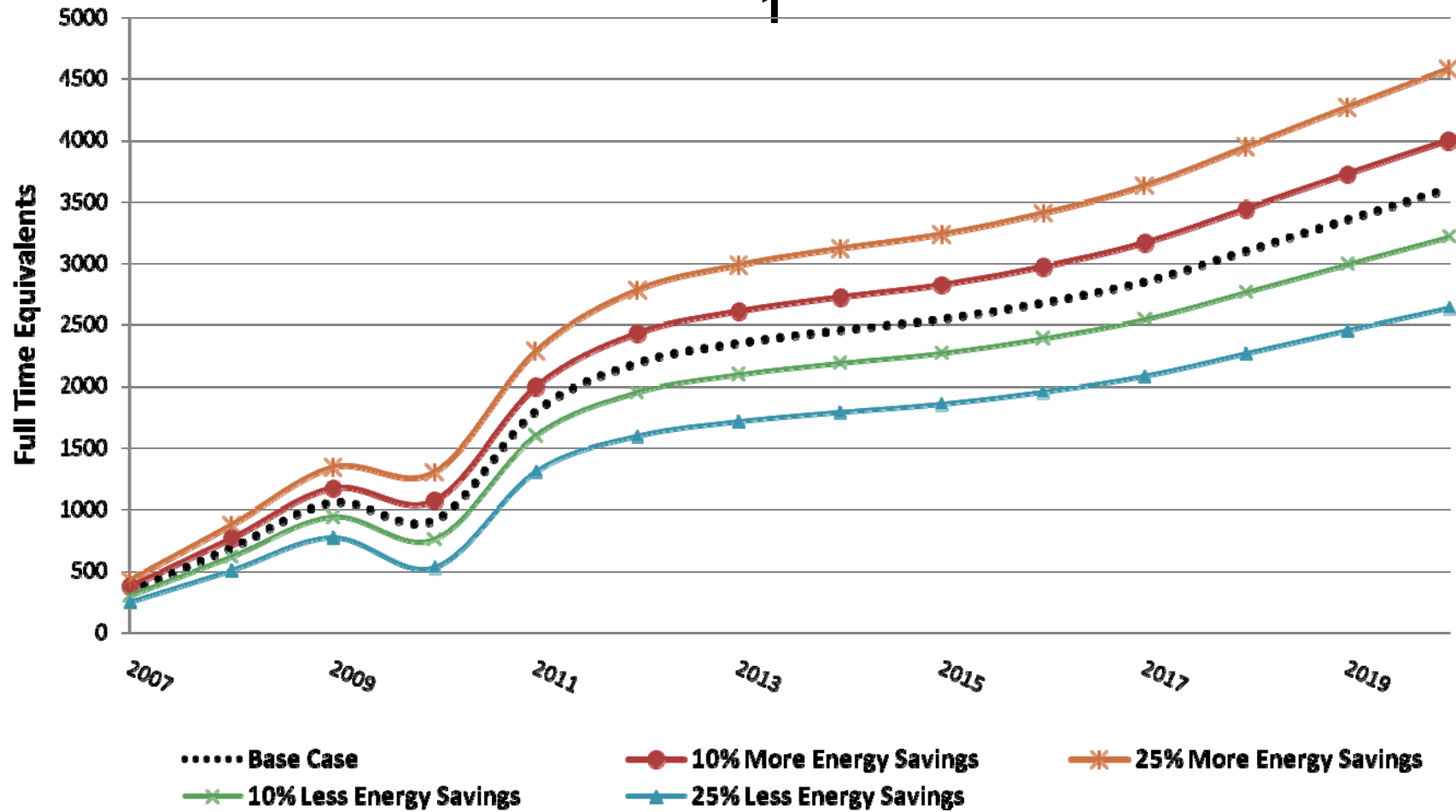
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# Effect of Program Effectiveness on Employment Impacts of RCI

1



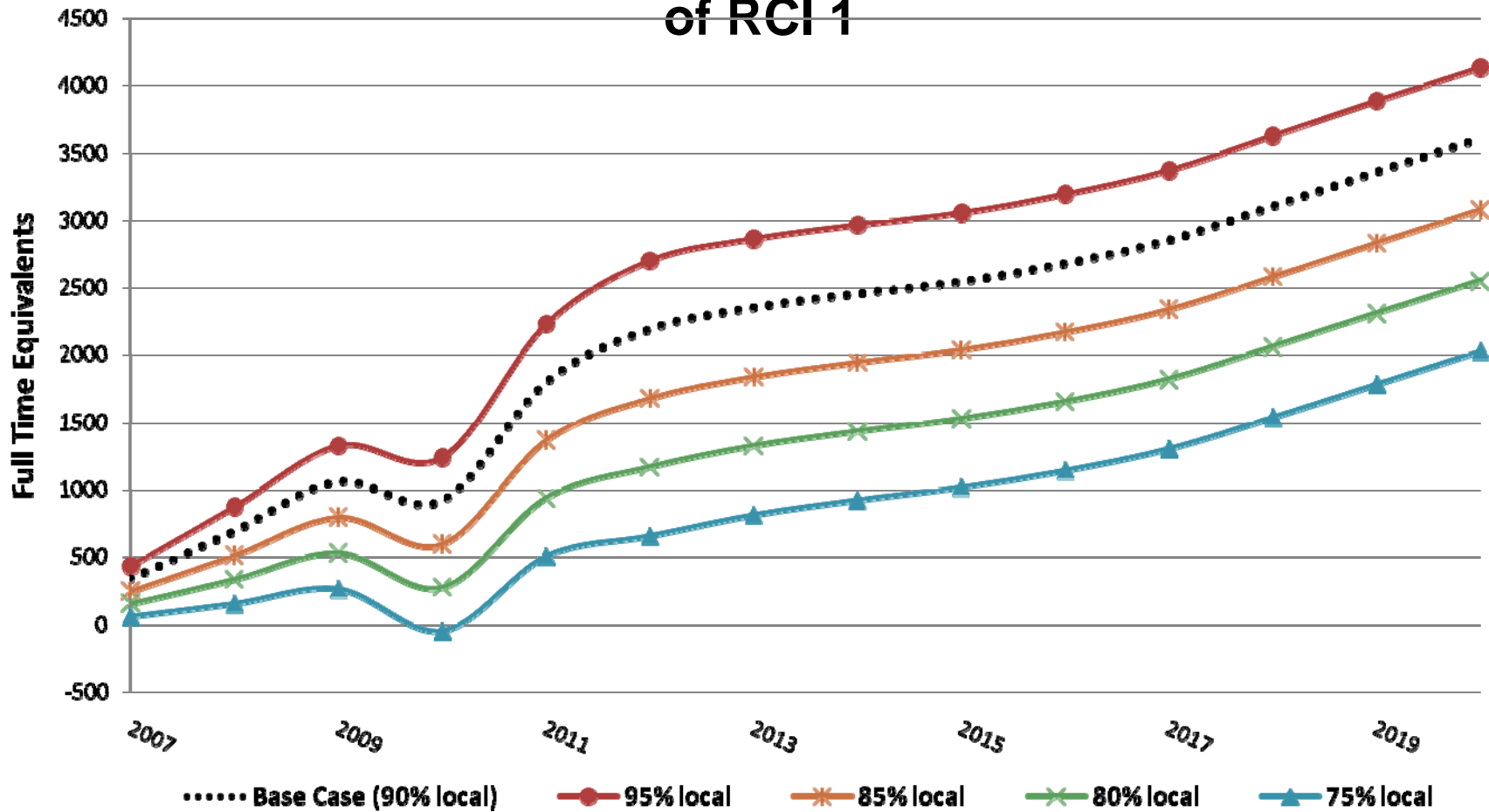
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# Effect of Local Investment Sensitivities on Employment Impacts of RCI 1



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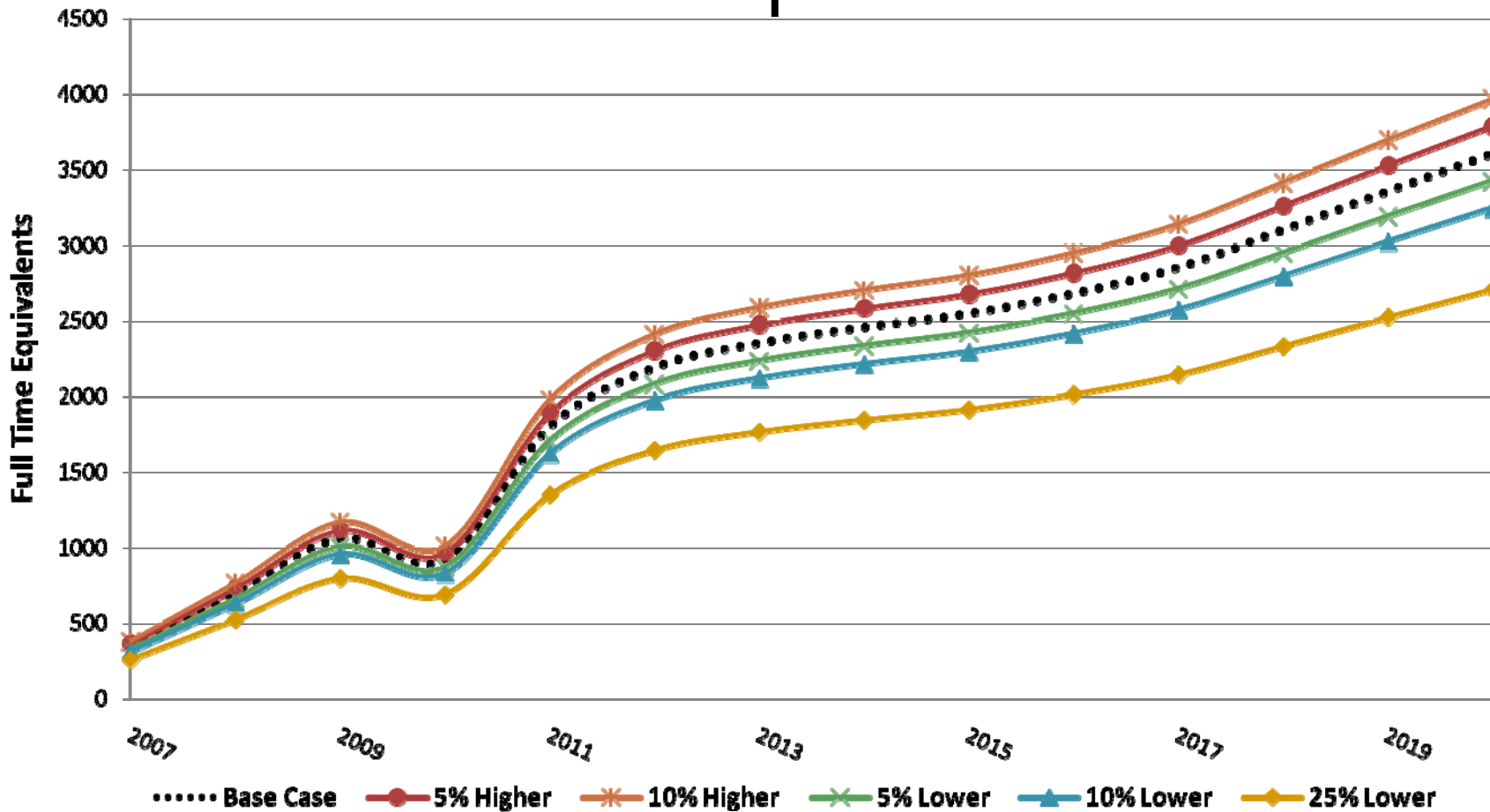
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# Effect of Multiplier Sensitivities on Employment Impacts of RCI

1



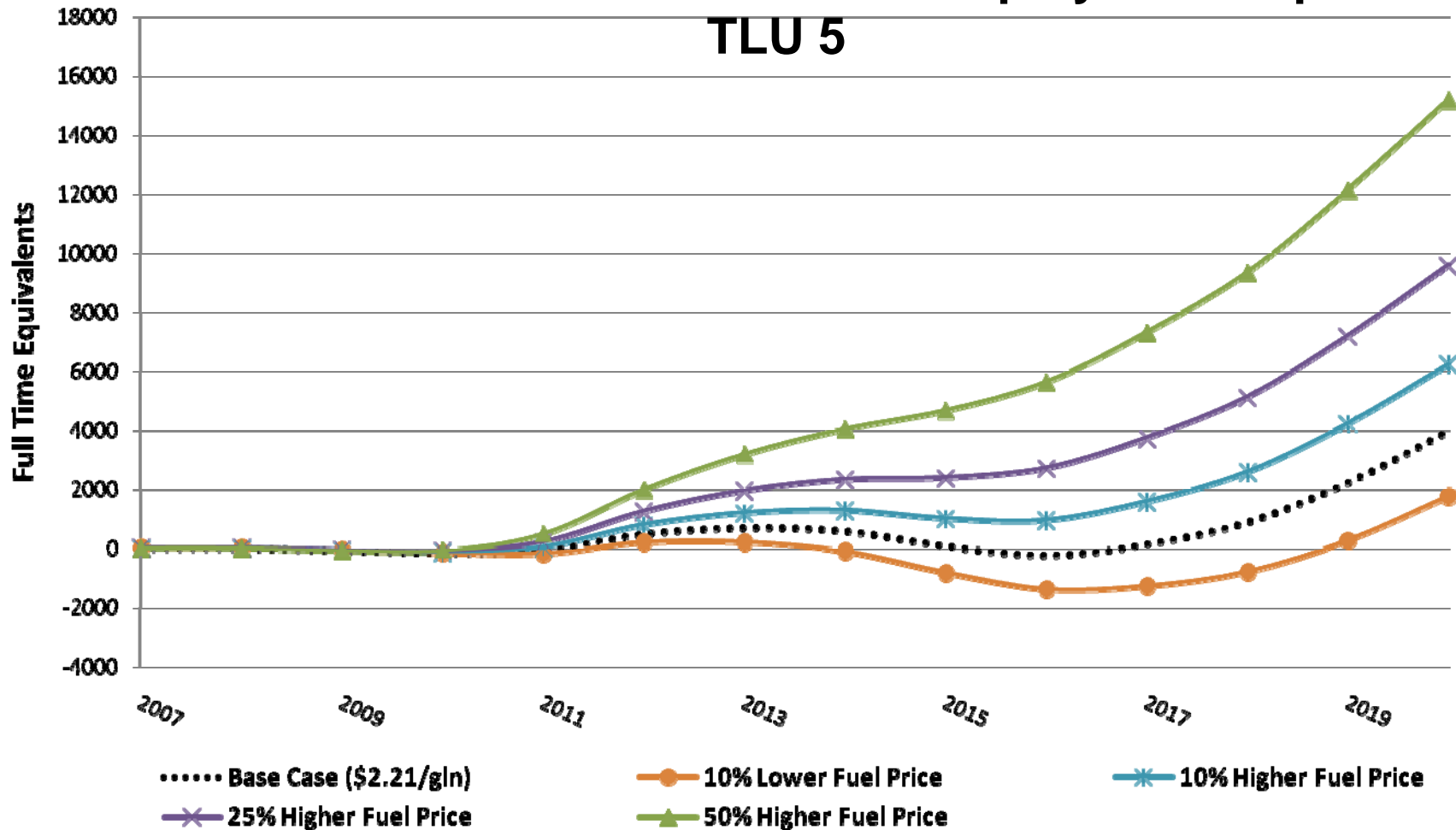
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# Effect of Fuel Price Sensitivities on Employment Impacts of TLU 5



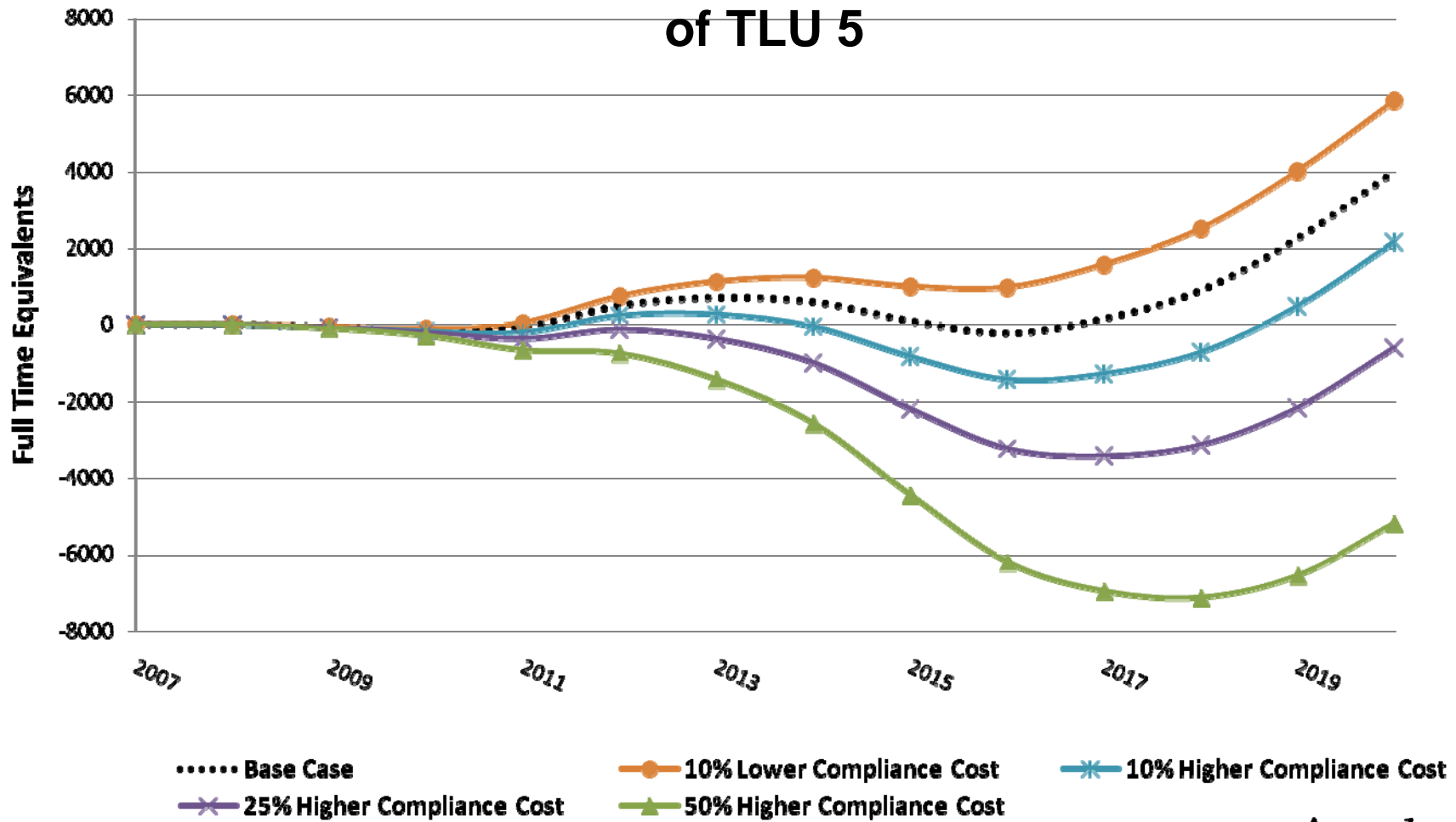
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# Effect of Compliance Cost Sensitivities on Employment Impacts of TLU 5



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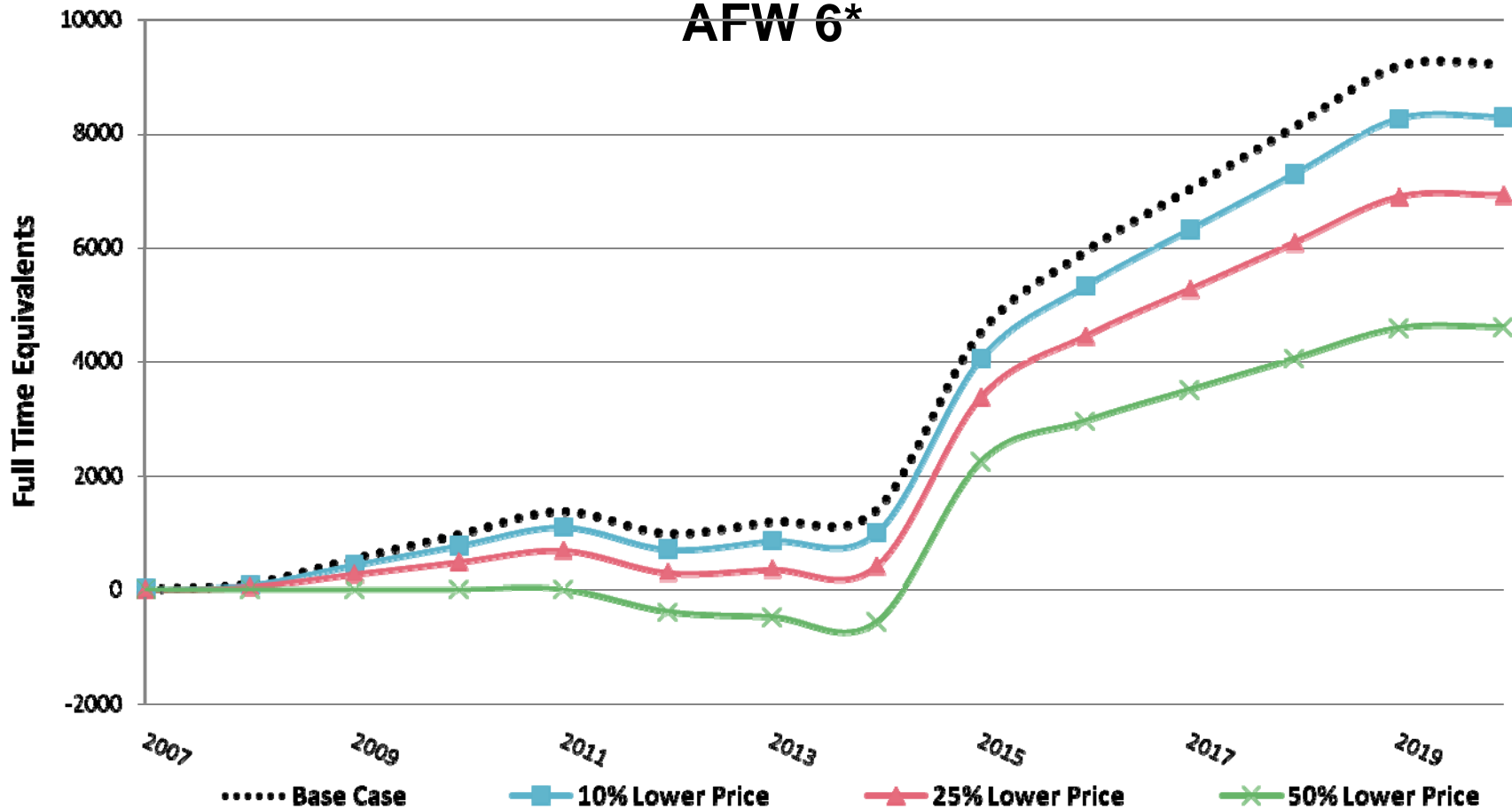
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# Effect of Feedstock Price Sensitivities on Employment Impacts of

## AFW 6\*



\*Excludes Capital and O&M Investments

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# Acknowledgements

## ❖ CCS Team

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