

**Comparing the economic impact of an expansion of regulatory CO<sub>2</sub> controls to a revenue-neutral, emissions-equivalent carbon tax**

Brandon Pizzola, EY  
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# Overview

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- } United States relies primarily on rules/regulations to reduce CO<sub>2</sub> emissions
- } Rules/regulations typically target specific sectors or types of activities and mandate the use of different technologies and processes or otherwise place restrictions on the choices of consumers and producers
- } Contrasts to the market-based approach of a carbon tax, which would place a uniform price on emitting CO<sub>2</sub> across the entire US economy
- } Uniform CO<sub>2</sub> price would leverage the knowledge and behavior of consumers and producers to find where it is least costly to reduce emissions

## Overview (cont.)

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- } Between 2013 and 2016 the Federal government expanded this set of rules/regulations to further control CO<sub>2</sub> emissions
  
- } It is this expansion of regulatory CO<sub>2</sub> controls, not the pre-2013 baseline regulations, for which this analysis estimates the economic and emissions impacts
  - } Expansion of Corporate Average Fuel Economy (CAFE) standards
  - } New Clean Power Plan (CPP)
  - } Expansion of Renewable Fuel Standards (RFS)
  - } Expansion of appliance and equipment efficiency standards (AEES)
  
- } Compared to economy-wide, revenue-neutral, emissions-equivalent carbon tax

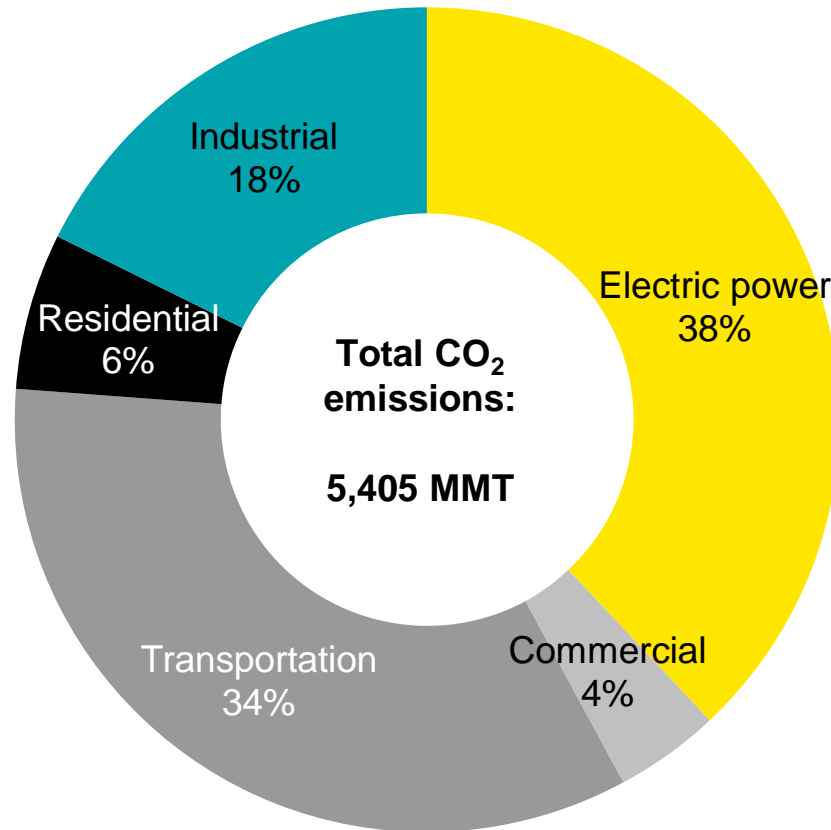
# Recent (2013-2016) introduction/expansion of regulatory CO<sub>2</sub> controls

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- } **CAFE standards.** Manufacturer's model year of vehicles meet a fleet-wide average fuel efficiency level. CAFE standards apply to light-duty, medium-duty, and heavy-duty vehicles.
  
- } **CPP.** The CPP aims to reduce CO<sub>2</sub> emissions in the power sector. The CPP is intended to be implemented at the state level (starting in 2022), and each state is required to choose one of three approaches:
  1. National emissions rate for each electricity-generating unit (EGU) (in CO<sub>2</sub>/MWh)
  2. State-specific emissions rate for the state's overall electricity portfolio (in CO<sub>2</sub>/MWh), or
  3. State-specific mass-based limits (in CO<sub>2</sub>/year).
  
- } **RFS.** RFS require that fuel distributors include a specific percentage of renewable fuels in their total sales.
  
- } **AEES.** AEES regulate more than 60 categories of appliances and equipment in both the residential and commercial sectors. The program sets energy efficiency standards for appliances and equipment to reduce energy consumption.

# US energy-related CO<sub>2</sub> emissions, by major type of economic activity (2013)

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Note: The transportation sector includes own-use vehicles. Figures are rounded.

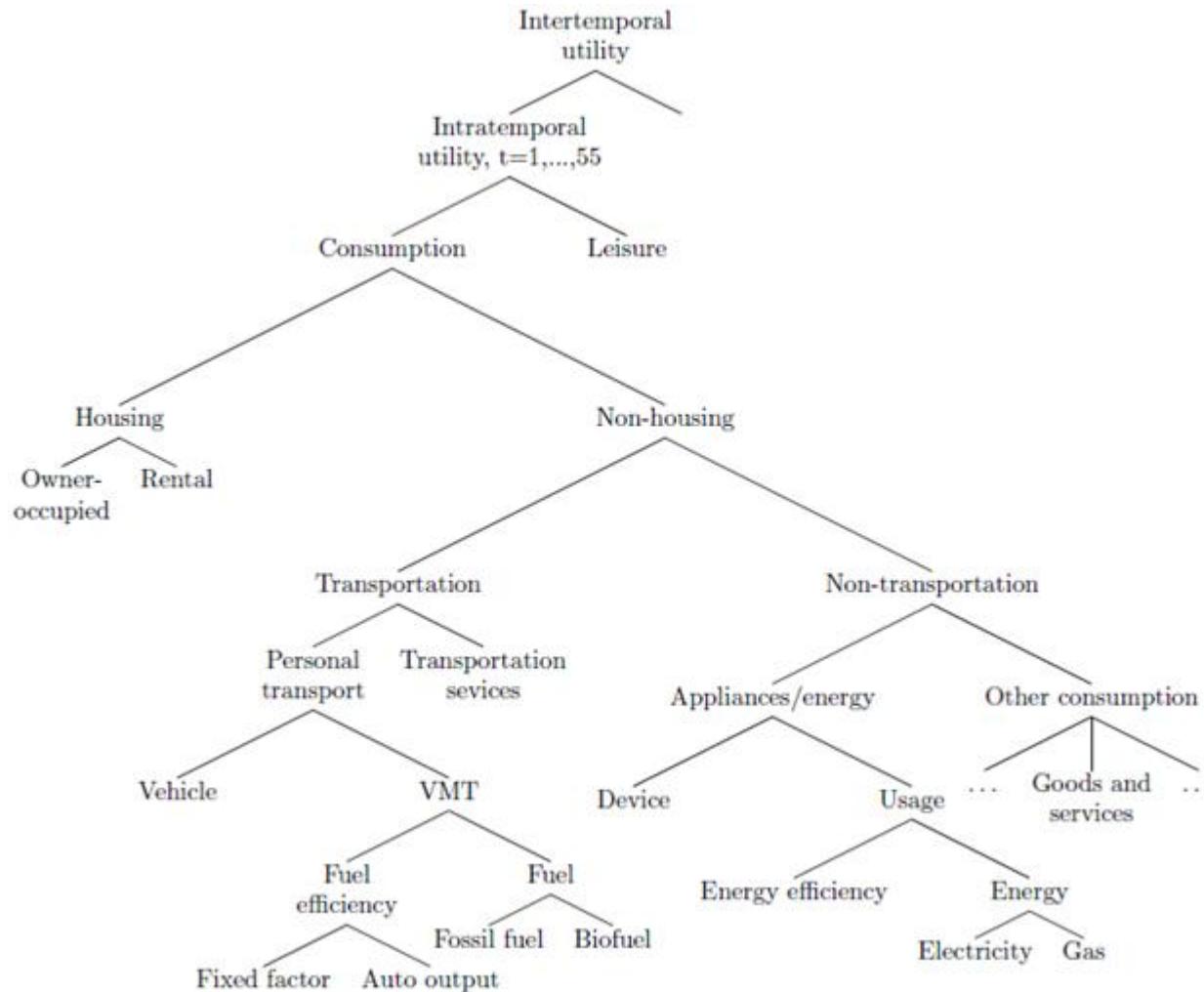
Source: US Energy Information Administration.

# EY Overlapping Generations Computable General Equilibrium Model

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- } 55 generational cohorts. In any one year the model includes a representative household optimizing lifetime consumption and savings decisions for each age 21 through 75 (i.e., 55 representative cohorts)
- } For each generational cohort the endowment of human capital exogenously changes with age – growing early in life and declining later in life
- } Households – with perfect foresight – optimize their lifetime consumption (borrowing/saving decision), consumption of goods versus leisure (labor/leisure decision), and mix of consumption goods
- } Household and producer (45 industries) behavior through a series of nested constant elasticity of substitution (CES) functions is used

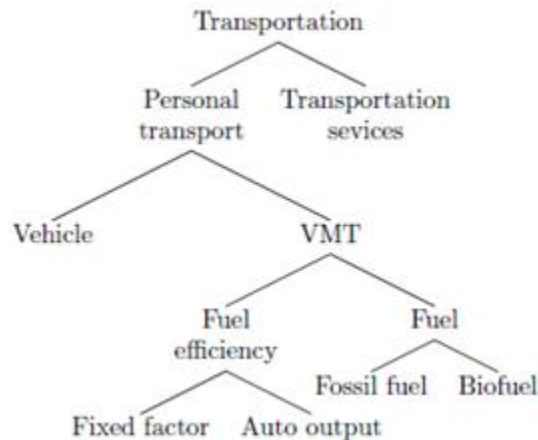
# Modeling rules/regulations – an example



# Modeling rules/regulations – an example

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- } Car consists of “Fuel efficiency” piece and “Vehicle” (i.e., all non-fuel efficiency) components



- } Vehicle miles traveled (VMT) is a combination of fuel efficiency (MPG) and fuel (gallons)

- } Fixed factor allows modeling of increasing marginal costs for fuel efficiency

- } CAFE standards mandate average fuel efficiency level (MPG)



# Modeling choices

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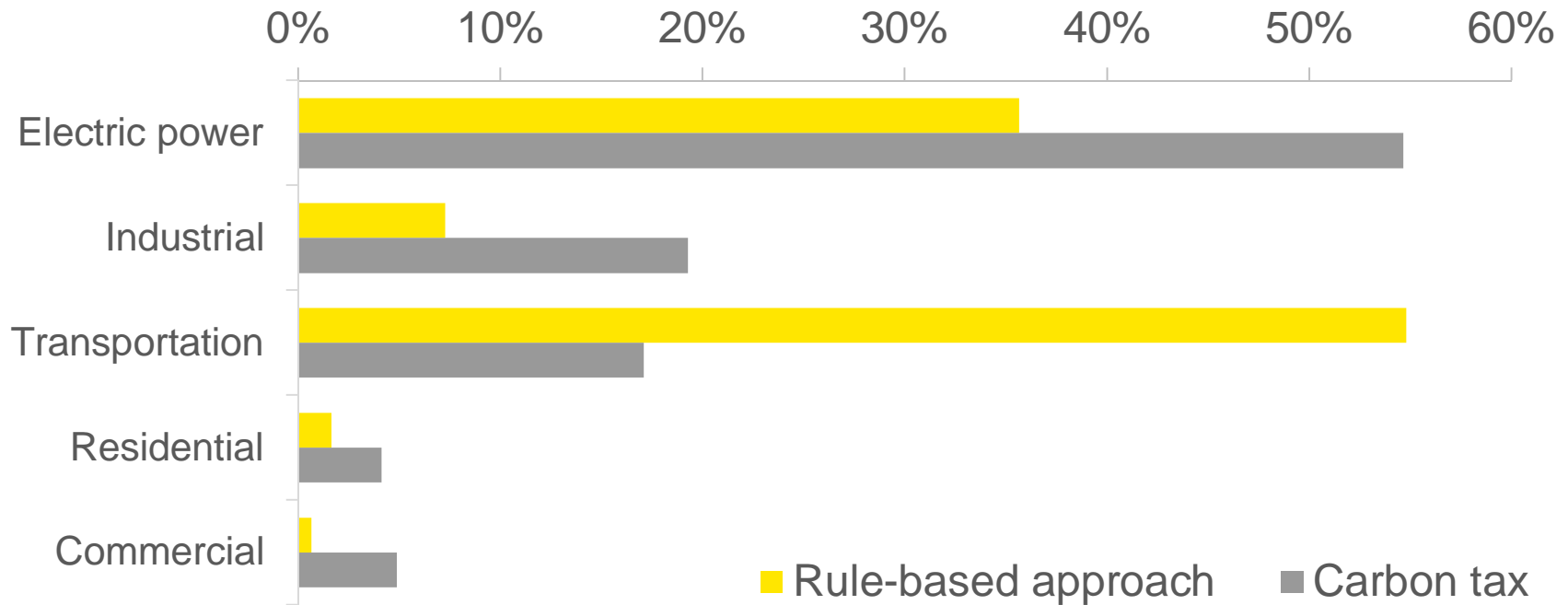
- } To highlight the difference between the two approaches rather than their timing, this report assumes that the expansion of regulatory controls goes into effect immediately
  
- } Because the CPP has not yet been implemented, there is considerable uncertainty around how states will choose to comply. Assume 50-50 split between “relatively efficient” and “relatively inefficient” implementations:
  - } all states cooperate in creating a single, multi-state cap-and-trade program (relatively efficient),
  - } all states choose to adopt the national emissions rate option without inter-industry trading (relatively inefficient)

## Modeling choices (cont.)

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- } To contrast the potential benefits associated with the use of revenue from the revenue-neutral, emissions-equivalent carbon tax analyzed, three alternative uses for the revenue are considered:
  - } Lower corporate income tax rate
  - } Across-the-board, proportional reduction in individual income tax rates (wages, pass-through income, dividends, capital gains, and interest income)
  - } Rebate to households

# Distribution of CO<sub>2</sub> emission reductions



Note: Carbon tax scenario in which revenues are rebated to households is displayed. The transportation sector includes own-use vehicles. Each set of bars sum to 100%.

# Results: Repeal rules/regulations

## Economic impacts of the expansion of regulatory CO2 controls relative to the pre-2013 regulatory baseline

	2016-20	2021-25	2026-30	2031-35	Long run
<i>Overall CO<sub>2</sub> emissions reduction</i>	-16.0%	-19.0%	-19.6%	-19.7%	-19.6%
GDP, total	-0.4%	-0.7%	-0.9%	-0.9%	-0.9%
Consumption	-0.2%	-0.4%	-0.5%	-0.6%	-0.8%
Investment	-1.7%	-3.0%	-3.3%	-3.1%	-2.6%
<i>Equivalent dollar measures (2016 \$)</i>					
GDP change per household (\$)	-550	-1,030	-1,210	-1,250	-1,310
GDP change per ton carbon reduction (\$)	-80	-130	-150	-150	-160

# Results: Replace rules/regulations

	2016-20	2021-25	2026-30	2031-35	Long-run
<b><i>Corporate income tax rate reduction</i></b>					
Carbon price (\$/ton)	28	34	36	37	37
Corporate income tax rate	19.9%	17.5%	16.8%	16.6%	16.2%
GDP	0.7%	1.5%	1.8%	1.9%	2.1%
<b><i>Across-the-board, proportional individual income tax rate reduction</i></b>					
Carbon price (\$/ton)	27	32	34	34	34
Top individual income tax rate	37.6%	37.2%	37.1%	37.1%	37.1%
GDP	0.5%	1.0%	1.2%	1.3%	1.4%
<b><i>Household rebate</i></b>					
Carbon price (\$/ton)	27	32	33	33	33
Rebate per household (\$)	1,130	1,340	1,380	1,390	1,380
GDP	0.2%	0.4%	0.5%	0.5%	0.6%

# Conclusion

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- } Comparing the economic impact of an expansion of regulatory CO2 controls to a revenue-neutral, emissions-equivalent carbon tax – Long-run impact

