Should an Economy-Wide Carbon Policy be Combined with a Vehicle Fuel Economy Standard?

Implications for Vehicles, Fuels, the Economy, and Environment

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Motivation

Carbon Policy: GHG emissions reduction (at lowest cost)

Fuel Economy Policy: Oil use reduction (originally), GHG emissions (since 2009 NHTSA Rule for MY2011)

Outcomes of interest:

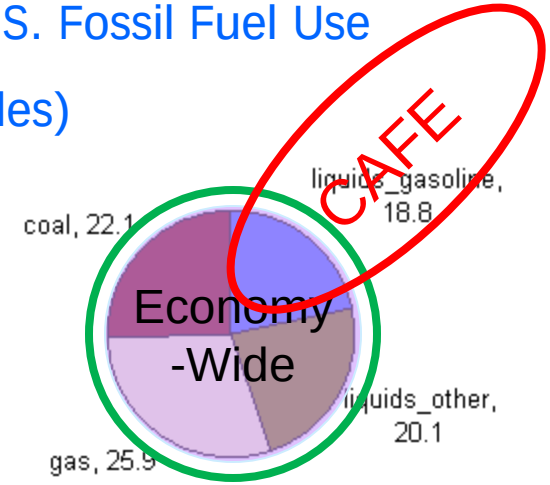
- GHG emissions
- Fuel use
- Economic cost
- Vehicle technology

Impact of individual policies and combinations on their goals (emissions and fuel use).

Motivation

2010 U.S. Fossil Fuel Use

(exajoules)



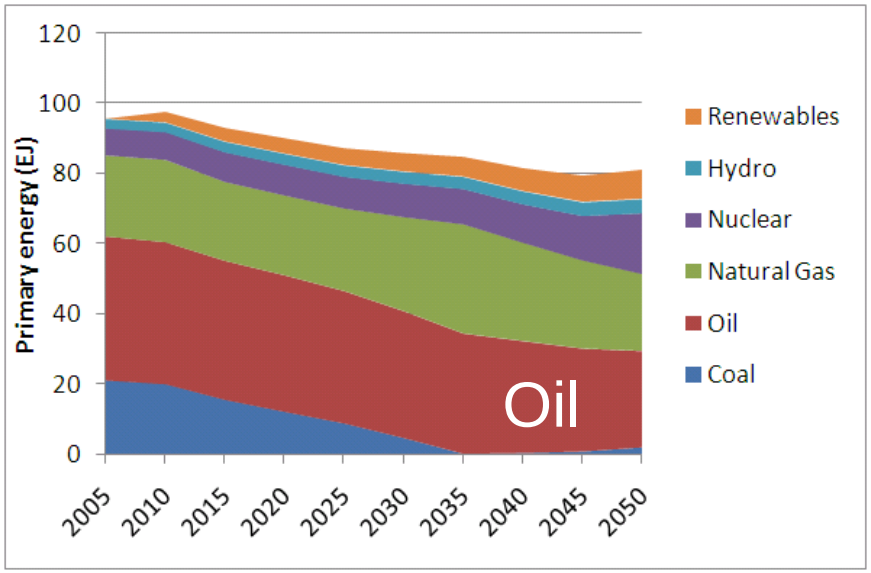
Gasoline share:

20% of fuels

20% of GHG emissions

Economy-Wide

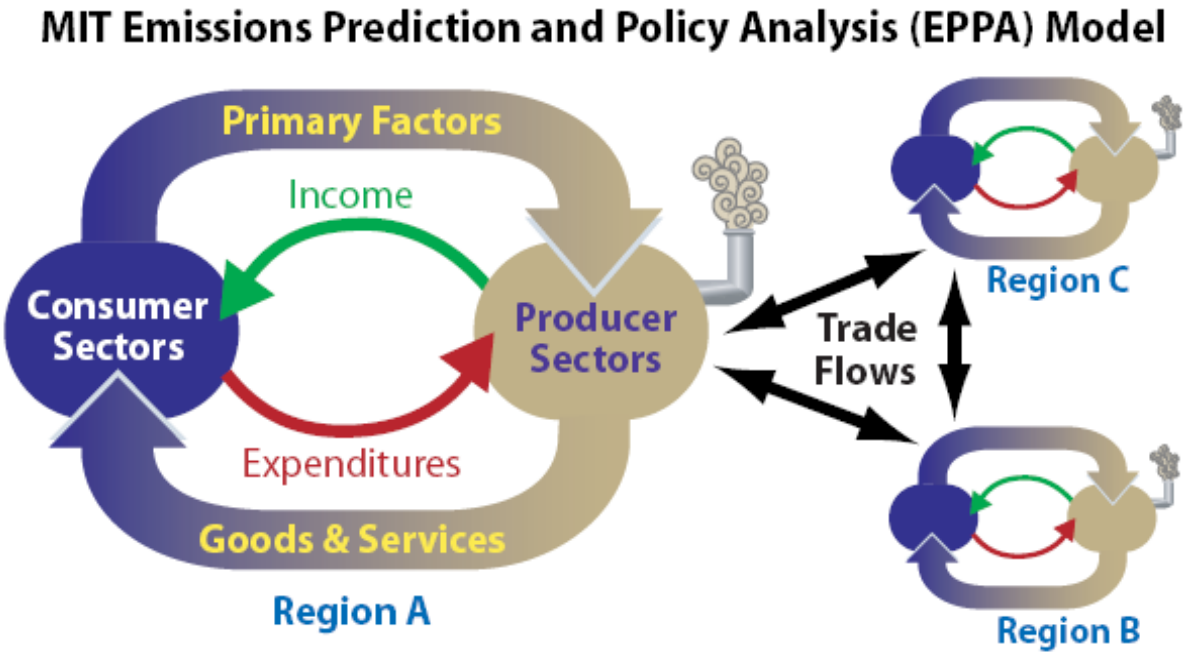
Example: consistent with H.R. 2454 (Waxman-Markey)



Cheapest reduction is in electricity

Fuel reduction depends on stringency of GHG emissions target

The MIT EPPA Model



- Multi-sector, multi-regional general equilibrium model
- Covers period 2005 to 2100 in 5 year intervals, 2004 is base year
- Technologies compete based on cost (subject to limits on new technology penetration)
- Prices are determined inside the model
- Can apply policies, e.g. cap-and-trade, fuel tax

Model :

Global – 16 regions

14 sectors

Additional energy details

Alternative Vehicle Technologies / Fuels

Improved ICE-only vehicle

Hybrid electric (HEV)

Plug-in hybrid electric (PHEV)

Biofuels

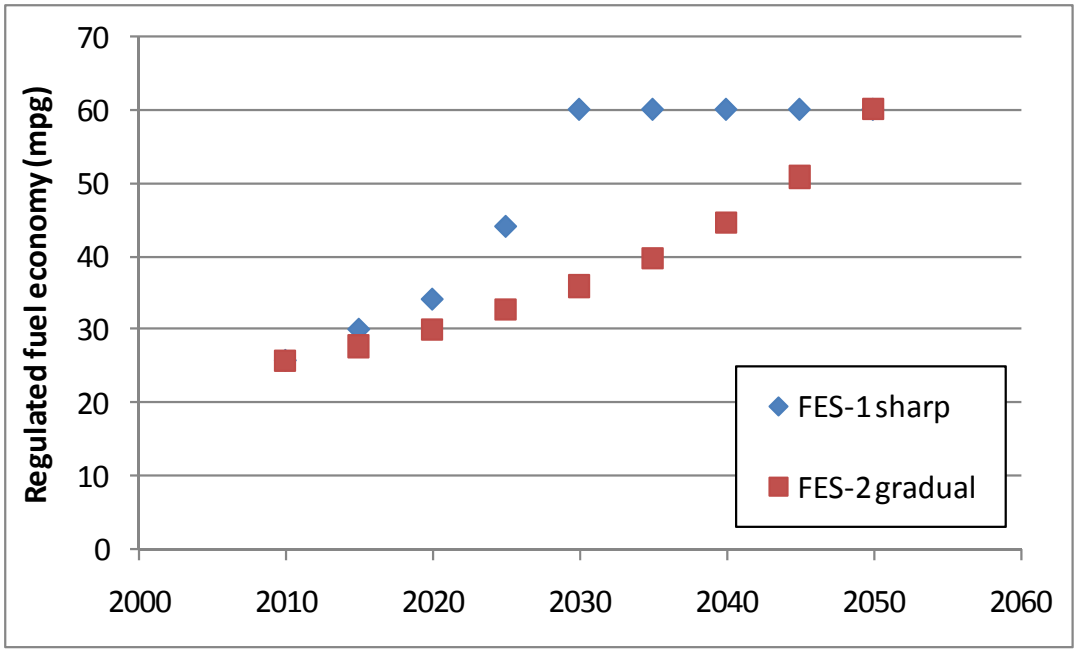
Fuel Economy (FE) Standard

Energy Independence and Security Act 2007 – 35 mpg by 2020

2010 CAFE standard – 35.5 mpg (34.1)* (combined cars and light trucks) by 2016

Discussion on future of CAFE ongoing – EPA announced new rulemaking for 2017-2025.

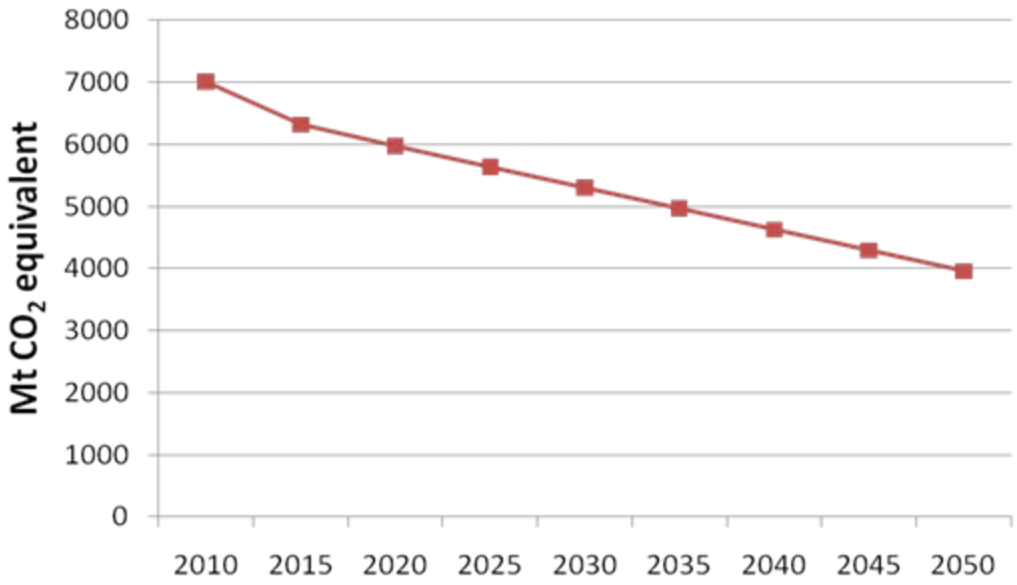
Representative policies: reaching 60 mpg by 2050
(path 1 – 60 mpg by 2030; path 2 – 36 mpg by 2030)



Cap-and-Trade (CAT) Policy

Considers a modest GHG emissions reduction path:

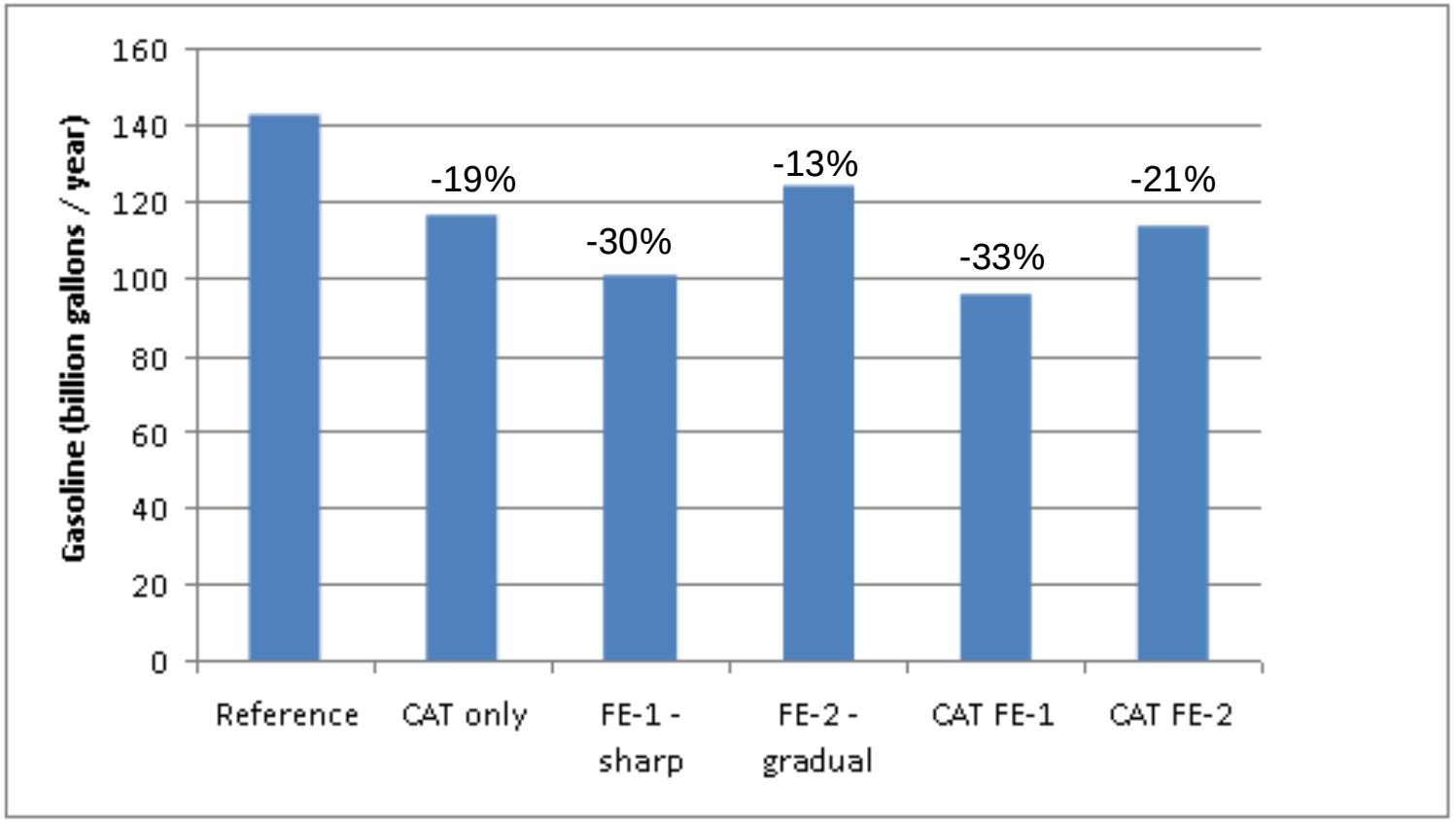
Year	% of 2010 CO_2 emissions
2010	100%
2015	90%
2020	85%
2025	80%
2030	76%
2035	71%
2040	66%
2045	61%
2050	56%



Constrains GHG emissions from all sectors U.S. economy.

Consistent with H.R 2454 with Medium Offsets.

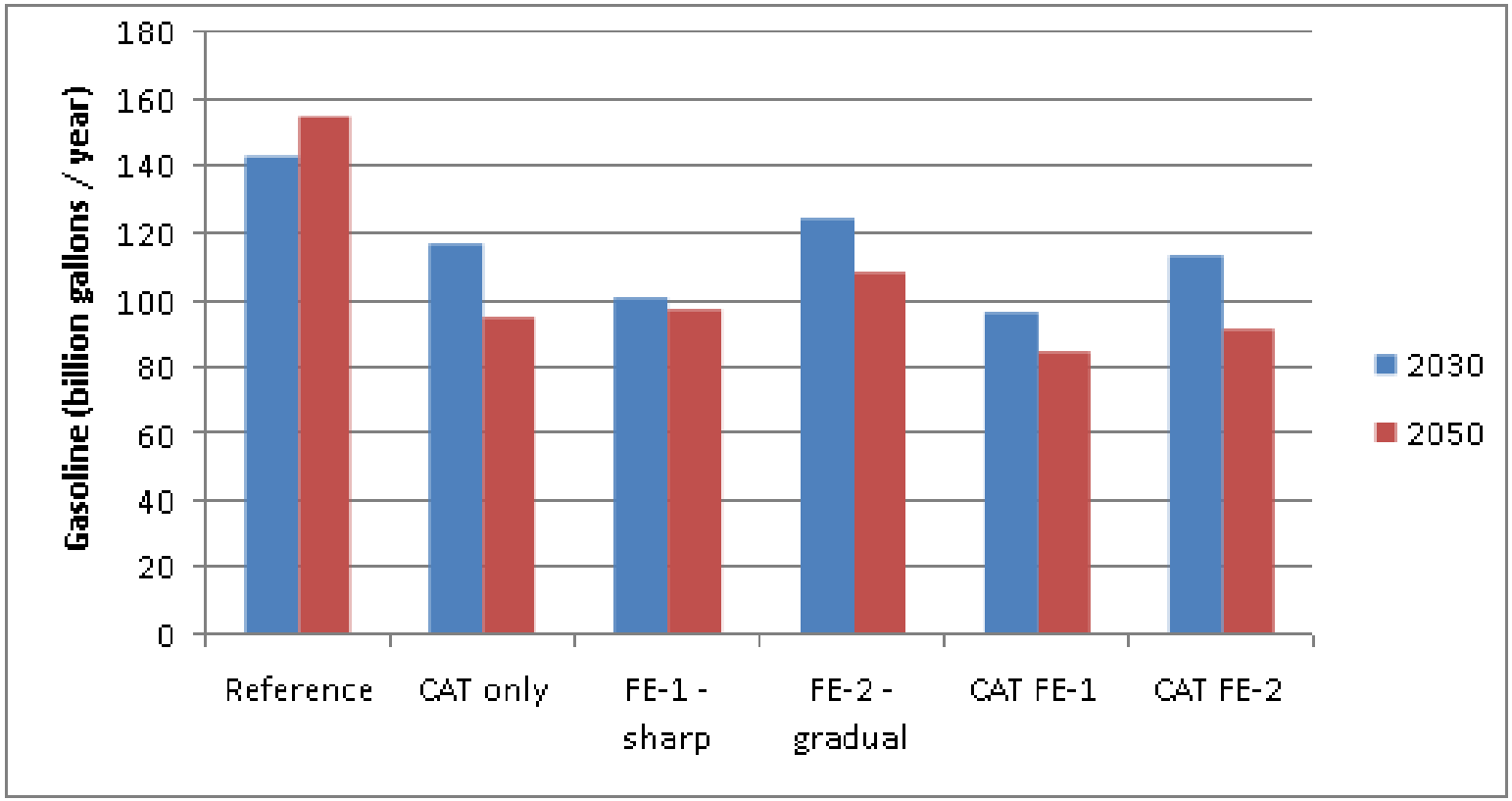
Combination of policies reduces gasoline use



% gasoline reduction is relative to No Policy in 2030.

+ Economy-wide GHG constraint (CAT policy)

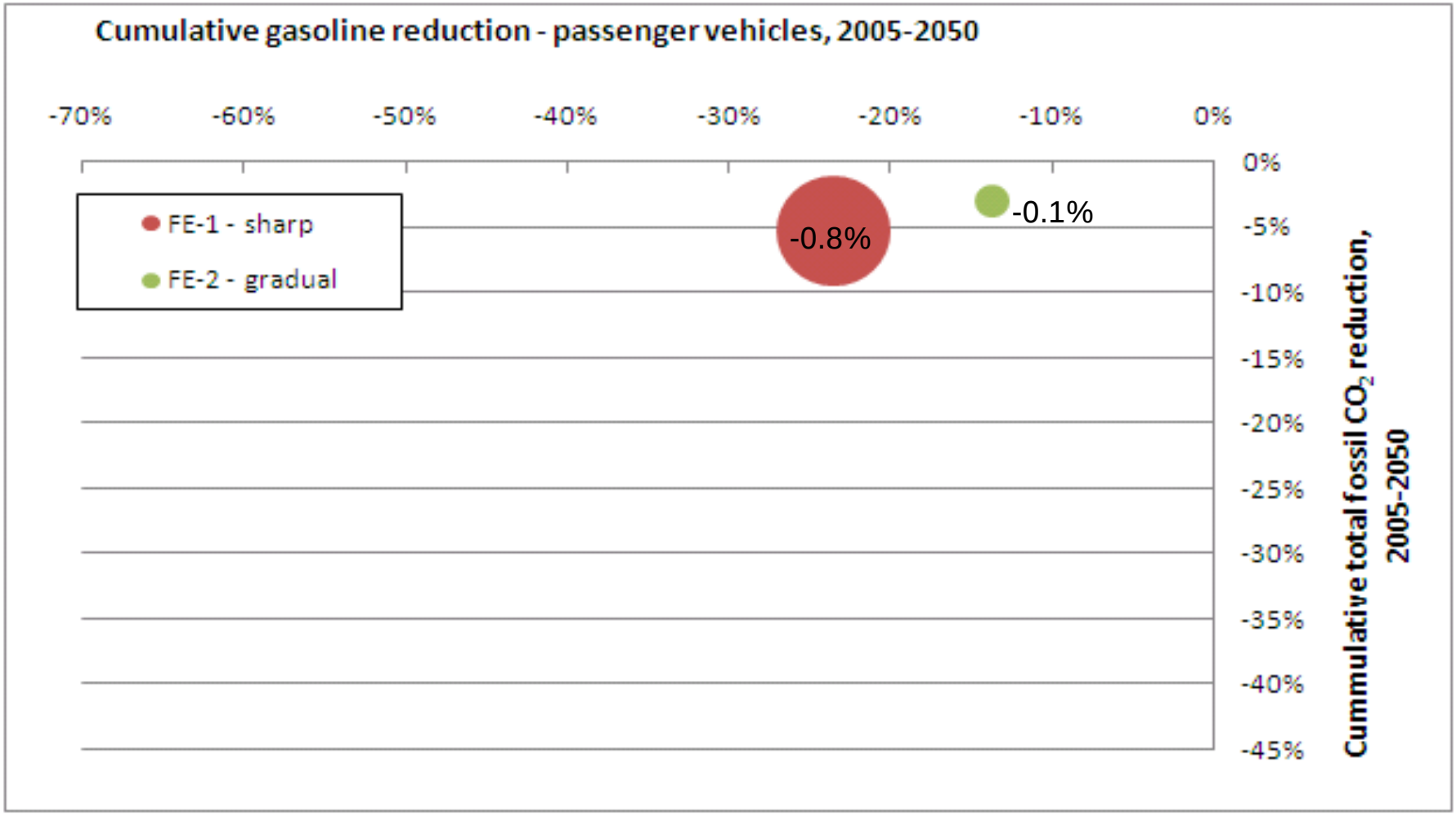
Fuel use in 2030-2050 under alternative policies



% gasoline reduction is relative to No Policy in 2030.

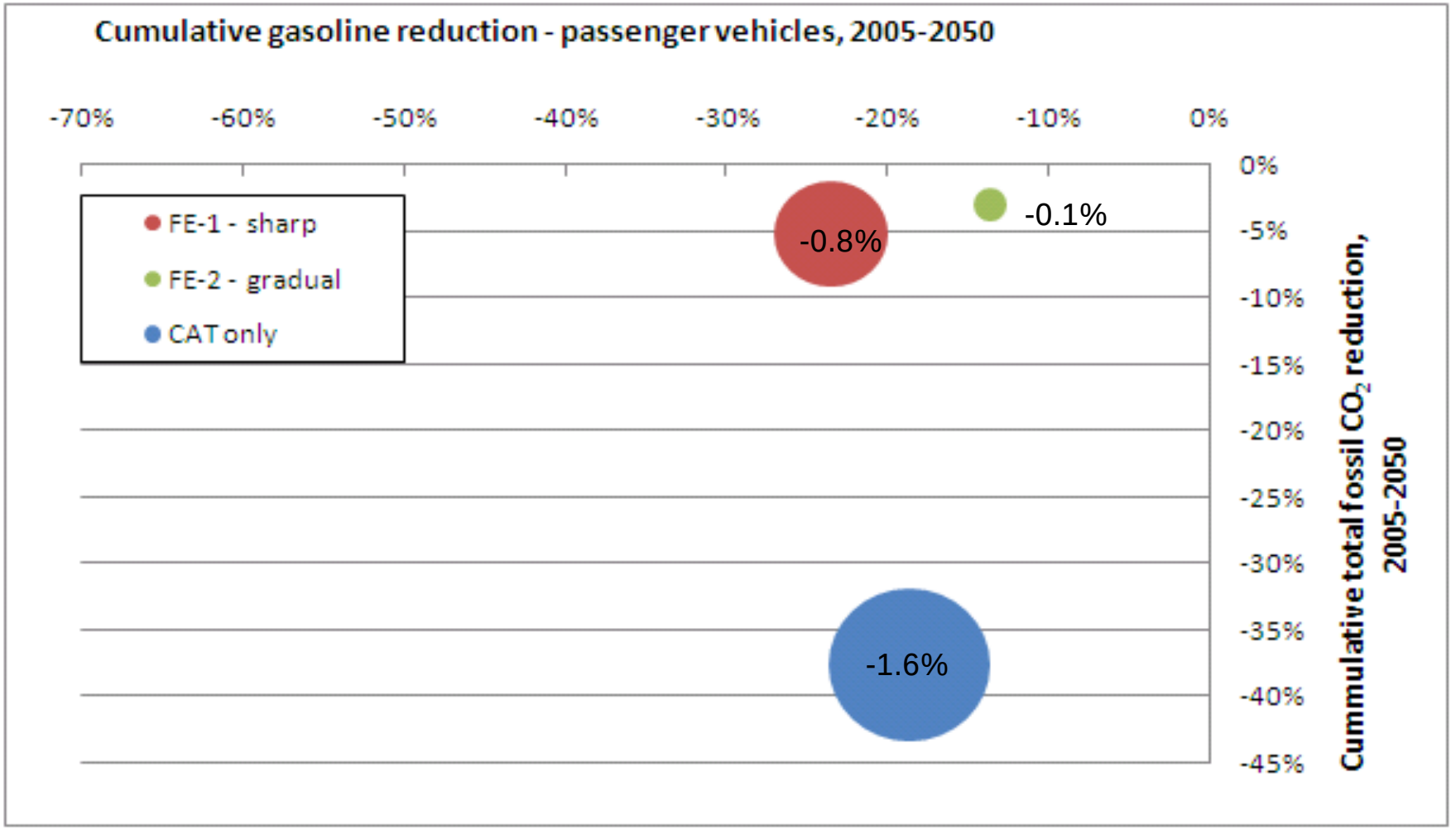
+ Economy-wide GHG constraint (CAT policy)

Fuel economy policy reduces gasoline use, reduces CO_2 emissions, imposes economic cost



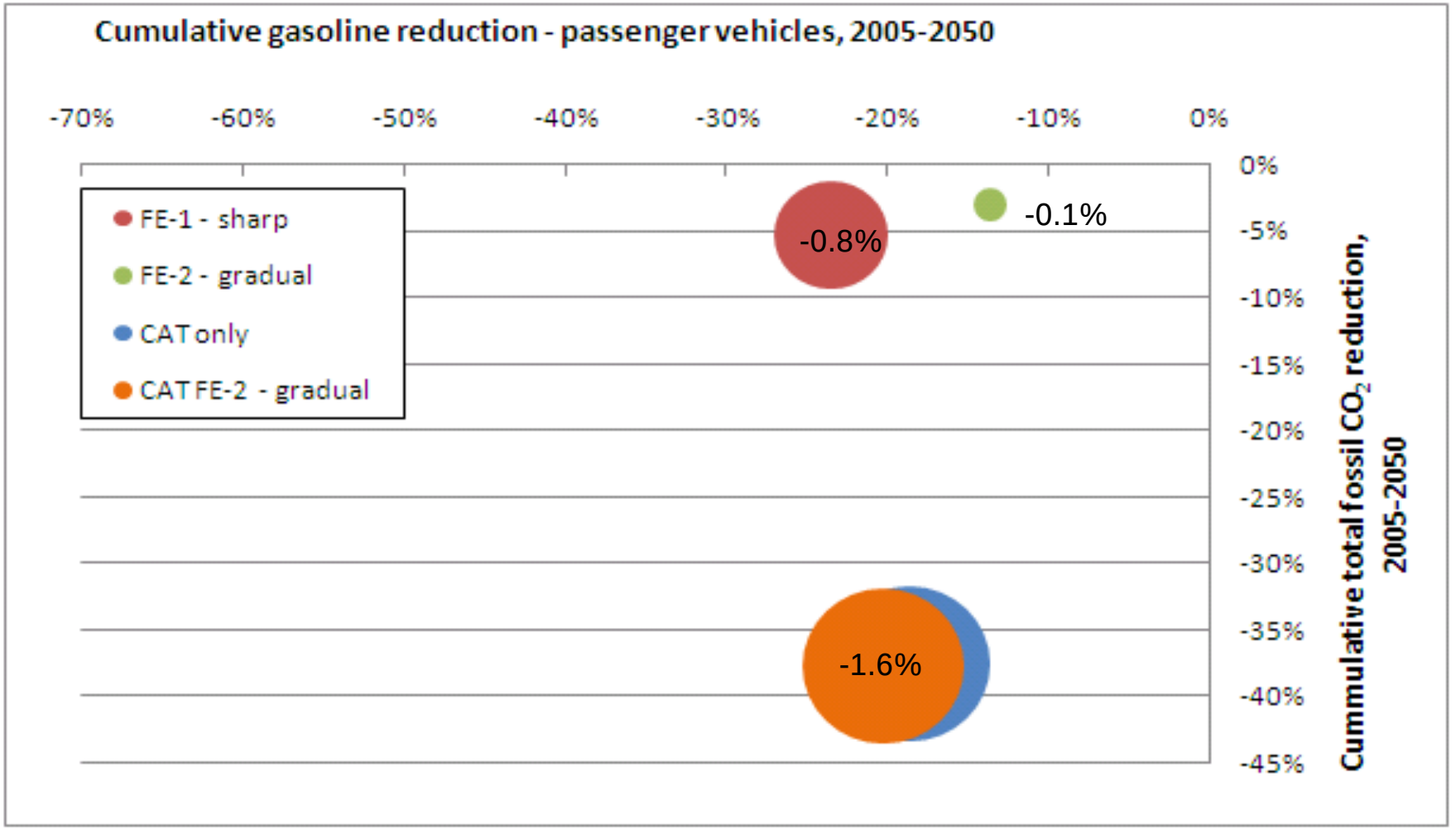
Area of the circle indicates policy cost.

Carbon policy reduces gasoline use, reduces CO_2 emissions, imposes economic cost



Area of the circle indicates policy cost.

Combining policies reduces gasoline use, increases cost, does not change CO_2 emissions



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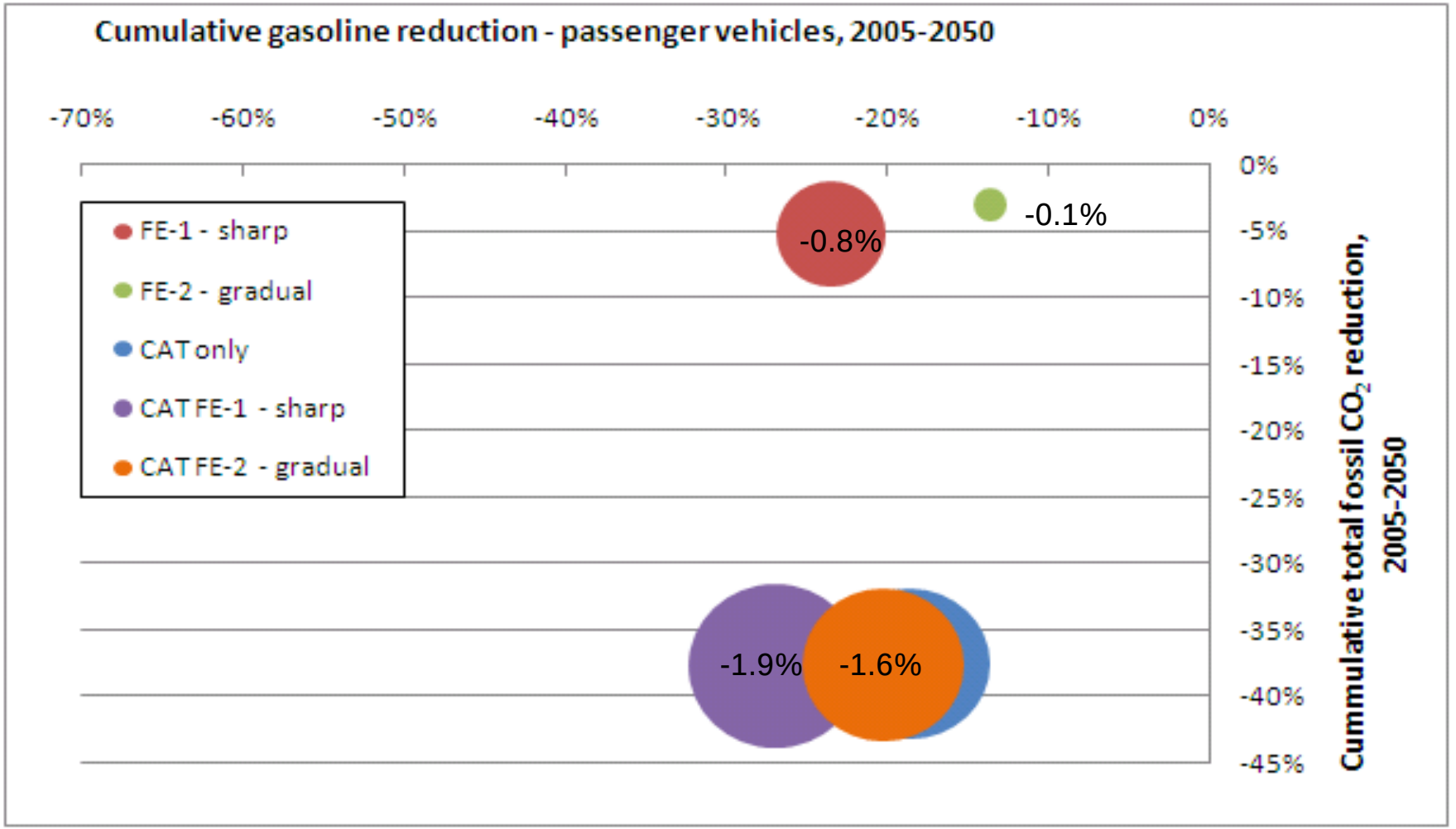

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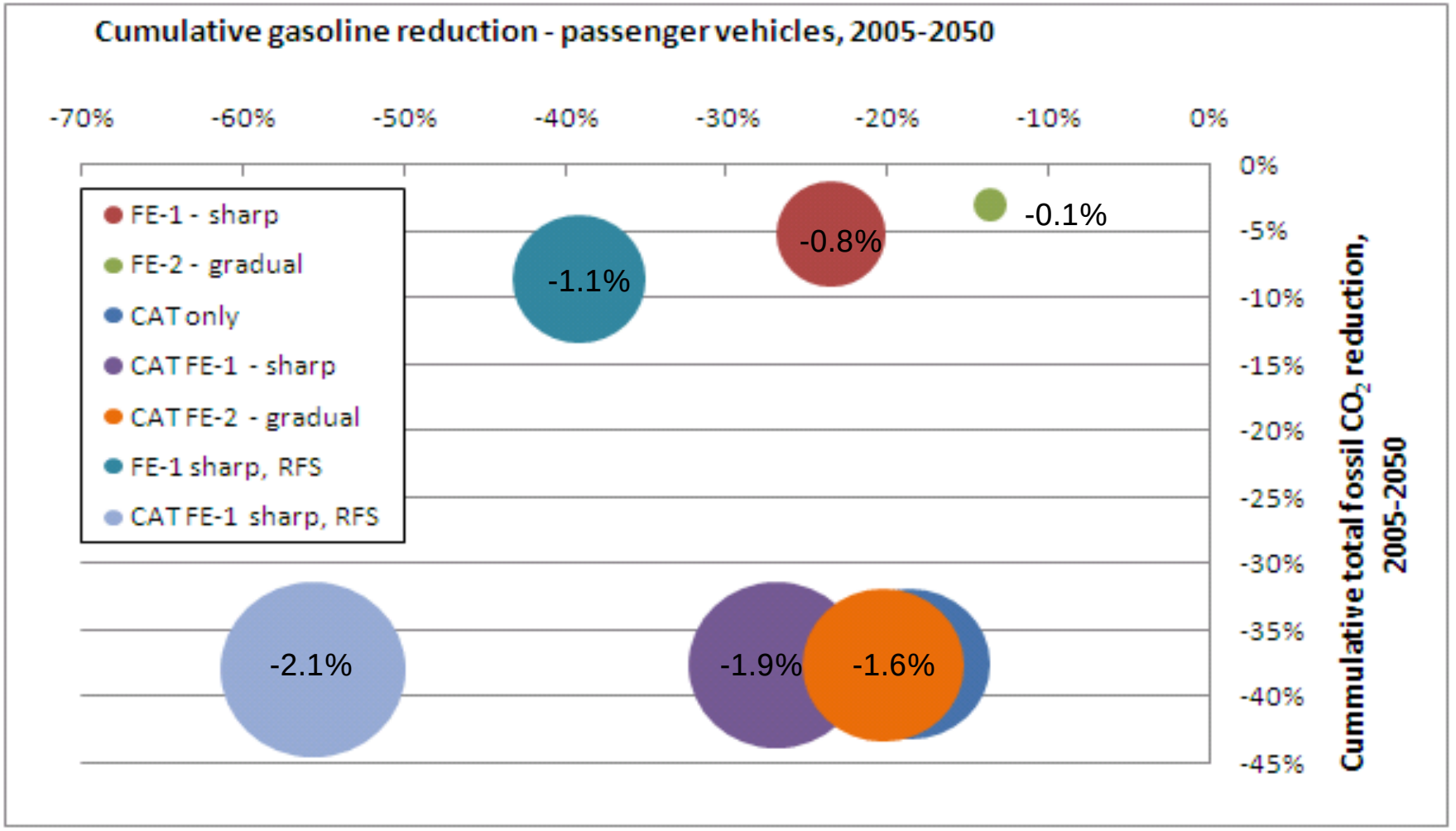
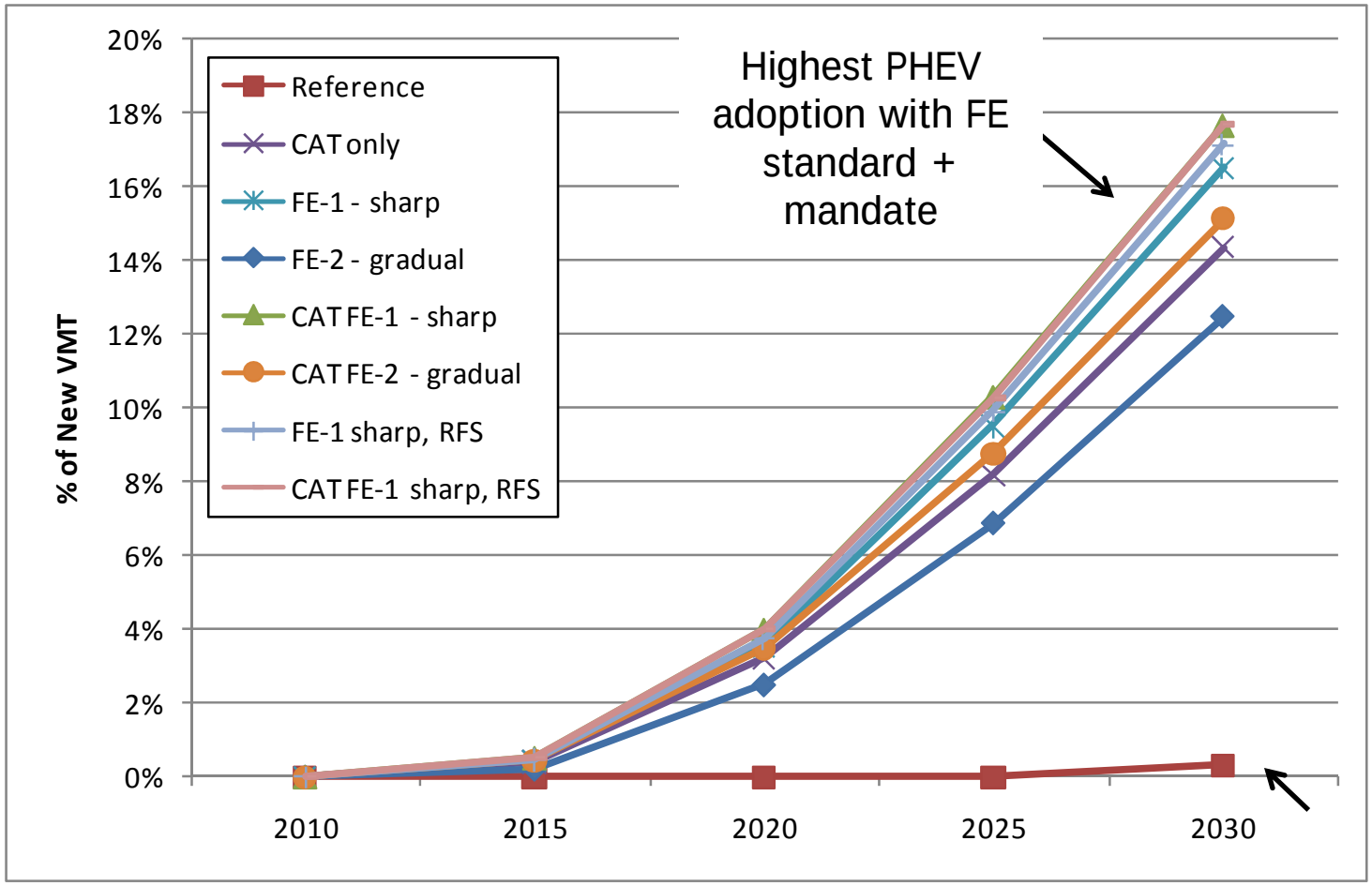


Area of the circle indicates policy cost.

Combination of policies increases adoption of plug-in electric vehicles



PHEV initially has a cost markup of 20% over the ICE-only vehicle.

PHEV is low without policy, increases to 13% in 2050.

Conclusions

Carbon policy (CAT)

Environment: Reduces economy-wide GHG emissions.

Fuels: Reduces gasoline use (and brings biofuels).

Vehicles: Increases fuel efficiency, brings PHEV/EV.

Economy: Imposes a cost.

Fuel economy (FE) policy

Environment: Does not reduce total GHG emissions substantially.

Fuels: Reduces gasoline use (reduces role for biofuels).

Vehicles: Increases fuel efficiency, brings PHEV/EV.

Economy: Imposes a cost.

Renewable fuel standard (RFS)

Advances biofuels use.

Conclusions

Combining carbon policy (CAT) and fuel economy (FE) policy

Environment: No improvement in total GHG reduction.

Fuels: Reduces passenger vehicle fuel use.

Vehicles: More efficient fleet, more PHEV adoption.

Economy: Increases compliance cost.

Magnitude of impacts depends on the stringency of the policy and the timing of required reductions.

Should an Economy-Wide Carbon Policy be Combined with a Vehicle Fuel Economy Standard?

It depends on the goals of the policy (additional reductions either small or at a high cost).

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For representative policies considered:

Environment: No improvement in total GHG reduction.

Vehicles: More efficient fleet, more PHEV adoption.

Fuels: Reduces passenger vehicle fuel use.

- Fuel economy standard only: 14-24% reduction cumulative gasoline use
- Carbon policy only: 19% reduction cumulative gasoline use
- Combined: 20-27% reduction cumulative gasoline use

Economy: Increases compliance cost.

- Fuel economy standard only: $10 billion/year (FE gradual reduction path) - $110 billion/year (FE sharp reduction path)
- Carbon policy only: $220 billion/year
- Combined: adds $1-$40 billion/year to carbon policy

Questions?

Thank you!

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