Carbon Emission Reduction Strategy & Electrification: EPRI’s Role

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Today’s Topics

- U.S. Greenhouse Gas Regulations
- Electric Sector’s Role in Economy-wide Emission Reduction and Electrification
EPA’s Updated Schedule

Clean Power Plan Timeline

- Summer 2015
  - August 3, 2015 - Final Clean Power Plan

- 1 Year
  - September 6, 2016 – States make initial submittal with extension request or submit Final Plan

- 3 Years
  - September 6, 2018 - States with extensions submit Final Plan

- 7 Years
  - January 1, 2022 - Compliance period begins

- 15 Years
  - January 1, 2030 - CO₂ Emission Goals met
EPA’s FINAL Proposal Will Have Varying State Impacts

% CO₂ Reductions by State in 2030 (from 2005)

Wide range in variation, but reduced from variation in Proposed Rule
Carbon Reduction is more than the Clean Power Plan
U.S. Greenhouse Gas Reduction Pledge, 80% by 2050 Target and the CPP

Source: US-REGEN data; Energy Modeling Forum 24

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Opportunities for Carbon Reductions

Key Categories from the EPA GHG Inventory by Economic Sector (TgCO₂e or MTCO₂e) in 2011

CO₂ Emissions from Stationary Combustion - Coal - Electricity Generation
CO₂ Emissions from Mobile Combustion: Road
CO₂ Emissions from Stationary Combustion - Gas - Industrial
CO₂ Emissions from Stationary Combustion - Gas - Electricity Generation
CO₂ Emissions from Stationary Combustion - Oil - Industrial
CO₂ Emissions from Stationary Combustion - Gas - Residential
CO₂ Emissions from Stationary Combustion - Gas - Commercial
CO₂ Emissions from Mobile Combustion: Aviation
CH₄ Fugitive Emissions from Natural Gas Systems
CO₂ Emissions from Non-Energy Use of Fuels
HiGWP Emissions from Substitutes for Ozone Depleting Substances
CH₄ Emissions from Landfills
CO₂ Emissions from Stationary Combustion - Coal - Industrial
CO₂ Emissions from Mobile Combustion: Other
CO₂ Emissions from Stationary Combustion - Oil - Residential
CO₂ Emissions from Iron and Steel Production & Metallurgical Coke Production
CH₄ Fugitive Emissions from Coal Mining

Key Categories as share of total emissions

Sectors already targeted by CAA regulations

Key Research Questions

- Objective: Examine policy alternatives to the current piecemeal regulatory approach in the US
  - Assess pathways and the role of the power sector in meeting near- and long-term emissions reduction goals → 2025 INDC and 2050 Climate Action Plan targets
  - How might technological improvements and availability influence cost, emissions, and electrification outcomes?

- Understand drivers of electrification under different policy, market, and technology settings
  - Which policy features are the most important drivers?
  - Which sectors exhibit the greatest electrification potential?
  - Prioritize future model development and structure sensitivities
E&EA Reference Comparison (with and without NSPS)
Electricity generation by technology

Reference

Reference with NSPS

TWh

2010 2020 2030 2040 2050

Solar
Geothermal
Biomass
Wind
Hydro+
Nuclear (New)
Nuclear (Existing)
Nuclear (Existing)
Gas w/CCS
Gas
New Coal w/CCS
New Coal
CCS Retrofit
Environmental Retrofit
Existing Coal
Scenario Load

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Economy-Wide 80% Cap Results
Economy-wide emissions (reference)

US-REGEN model results

Economy-wide targets (relative to 2005 levels)
- Net emissions with land sink
- Gross emissions

Economy-wide GHG Emissions (GtCO₂eq/yr)

- LLF
- SLF
- N₂O
- CH₄
- CO₂
- Sink

Net emissions with land sink
Gross emissions

2015
2020
2025
2030
2035
2040
2045
2050

1.245

preliminary
Economy-wide emissions with 80% cap
All sectors, all GHGs (with banking and borrowing)

2025 abatement (~42%) exceeds INDC pledge to bank reductions, which avoids costly abatement in later decades.
GHG emissions by sector (reference)

GHG Emissions (Gt CO₂ eq/yr)

- Non-CO₂
- Electric
- Industrial
- Commercial
- Residential
- Midstream
- Other Transport
- Light-Duty Vehicles

Years: 2010, 2020, 2030, 2040, 2050
GHG emissions by sector (80% all GHG cap)

All sectors, all GHGs (with banking and borrowing)

Significant and early abatement in the power sector and CH₄, but more limited changes in other sectors

GHG emissions by sector (GtCO₂eq/yr)

- Non-CO₂
- Electric
- Industrial
- Commercial
- Residential
- Midstream
- Other Transport
- Light-Duty Vehicles

2010
2020
2030
2040
2050

U.S. Energy and Emissions in 2050

US-REGEN Reference
AEO fuel prices thru 2040
RPS targets a/o 2015
CPP not included
U.S. Energy – Emissions Transformation: 2050 80% CO₂ Reduction Target

80% reduction in economy-wide CO₂ emissions (from 2005)
No banking or borrowing
Other Energy shift to Electricity which is more efficient
Accelerated improvement of economy-wide energy intensity
Price induced energy conservation

U.S. Energy and Emissions in 2050

Environmentally friendly consumption of energy

Electricity

Other Energy

Natural Gas

Coal

Petroleum

Low Carbon

Transportation

Industrial

Commercial

Midstream

Residential

PRELIMINARY DATA
Electrification Reduces Future GHG Emissions

Reference

80% GHG Mitigation (No Banking)
Together...Shaping the Future of Electricity