Trade-offs in Emissions Reductions with a CO_2 Policy

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Key Takeaways

Restricting carbon pricing to only the electric sector may lead to "missed" decarbonization and electrification opportunities in other sectors of the economy. This analysis shows how:

- Electric sector-only policies neglect emissions reduction opportunities in non-electric sectors.
- Even without a carbon price, electrification plays a major role in reducing transportation emissions.
- Higher electricity costs from electric sector-only policies limit additional electrification and CO_2 reductions in non-electric sectors.

A variety of policies have been proposed and promulgated in the United States with the goal of reducing CO_2 emissions in the electric sector. However, there are additional economic opportunities for reductions of non-electric CO_2 emissions through electrification of energy end-use in the buildings, transportation, and industrial sectors. Policy design can play a major role in capturing all cost-effective opportunities to reduce CO_2 emissions. Using the U.S. Regional Economy, Greenhouse Gas, and Energy (US-REGEN) model, EPRI compared the impact of economy-wide versus electric sector only carbon policy to explore these trade-offs in sectoral coverage.

Carbon policy that targets only the electric sector may inadvertently discourage opportunities to decarbonize other sectors through electrification (Figure 1). Model results suggest that while a carbon price applied only to the electricity sector leads to significant CO_2 reductions in that sector, it may lead to increased emissions in the buildings, transportation, and industrial sectors.

For this analysis, EPRI modeled three scenarios using US-REGEN:

- A **Reference** scenario that includes no carbon policy beyond existing state RPS.
- A **CLC Policy** scenario where a \$43/tCO_2 price is applied economy-wide beginning in 2021. This policy mimics the Climate Leadership Council (CLC) proposal (Baker-Schultz Plan).
- An **Electric Sector Only** scenario where the carbon price from the CLC Policy scenario is applied only to the electric sector.

In the Reference scenario, transportation electrification is economic even without a carbon price, leading to significant CO2 emissions reductions, particularly from light-duty vehicles (see USNEA report). Emissions from the electric sector also decline despite the new charging load as a result of gradual replacement of coal with natural gas and renewables. Emissions decline slightly in the buildings

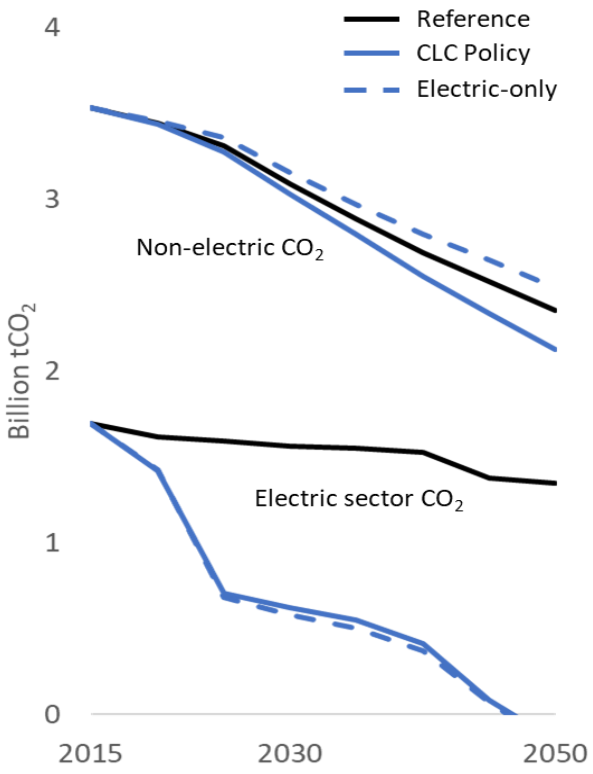

Figure 1. Trends in CO_2 emissions for the electric and non-electric sectors across the three scenarios.

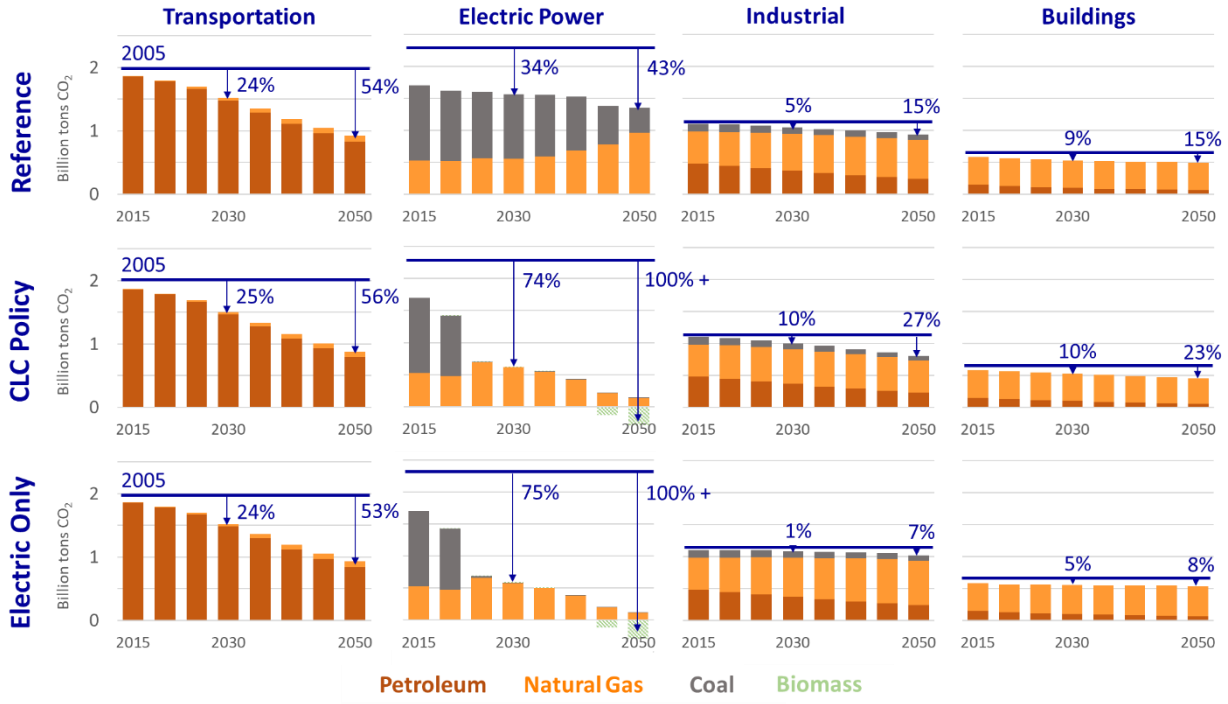

Figure 2. Reduction in CO_2 emissions by sector and fuel across the three scenarios. For example, direct emissions from buildings in 2050 are 15% below than 2005 levels in the Reference scenario.

and industrial sectors, where electrification is more limited (Figure 2).

In both carbon-constrained scenarios, CO_2 emissions decline sharply in the electric sector, driven by rapid retirement of coal and growth of renewables, nuclear, and CCS generation. Meanwhile, the economy-wide carbon policy scenario leads to additional but more moderate reductions from the reference baseline in the non-electric (i.e. end-use) sectors, driven primarily by accelerated electrification, i.e. fuel-switching away from petroleum and natural gas toward electricity.

An economy-wide carbon price modestly improves the economics of vehicle electrification, which were already favorable in the Reference scenario. In the buildings and industrial sectors, the economy-wide carbon price is more decisive in encouraging electrification. However, economy-wide carbon pricing leads to a smaller shift in the relative cost of fossil fuels in the end-use sectors as compared to the electric sector, where fossil fuels represent a larger share of total costs, and more low-emitting technologies are available.

When the carbon price is applied only in the electric sector, the price of electricity is increased without a corresponding penalty on direct use of fossil fuels. This effect disincentivizes customers from adopting electric technologies in the end-use sectors. In the Electric Sector Only scenario, the economics of vehicle electrification worsen, and the more limited electrification in the industrial and buildings sectors under an economy-wide policy disappears.

Key Insight: An economy-wide carbon price accelerates electrification in all end-use sectors relative to the reference case, while an electric sector only carbon price decelerates electrification and associated emissions reductions.

Contact Information

For more information, contact Geoff Blanford (gblanford@epri.com). Additional results are provided in EPRI Product #3002015050. USNEA report is available as EPRI Product #3002013582. Model documentation can be found at http://esca.epri.com.

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