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Economic Impact of Low-Carbon, Renewable Fuels

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Insight in Economics™

Background

- Definition of Low Carbon Fuel Standard (LCFS)
  - Based on California program
  - Life cycle emission factors assigned to fuels
  - Timetable for percentage reduction in emissions intensity ($MMTCO_2/GJ$) relative to base year
  - Implemented with tradable credits
- Intention to force technology
  - Fuel mix and emission factors well beyond what a carbon pricing policy would produce

Macroeconomic impacts of low carbon fuels policies are negative

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- Computable general equilibrium models show consistent results for low carbon fuels standards
  - At state and national levels
  - With and without a price on CO_2 emissions
- Impacts are uniformly negative
  - Higher costs of transportation fuels
  - Lower GSP and GNP
  - Lower real wages and/or employment
  - Reduced real consumption per household
- Differences in impacts depend on cost of low carbon fuels and the gap between required reductions and available low carbon fuel supplies

Results of prior studies by the NERA team

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National economic impacts in 2025 of LCFS

- Jobs: loss of over 2.3 million net jobs from baseline levels; this projection takes into account all “green jobs” that would appear
- Household annual purchasing power: down by $1,400 to $2,400
- GDP: 2% to 3% or $410 to $750 billion loss

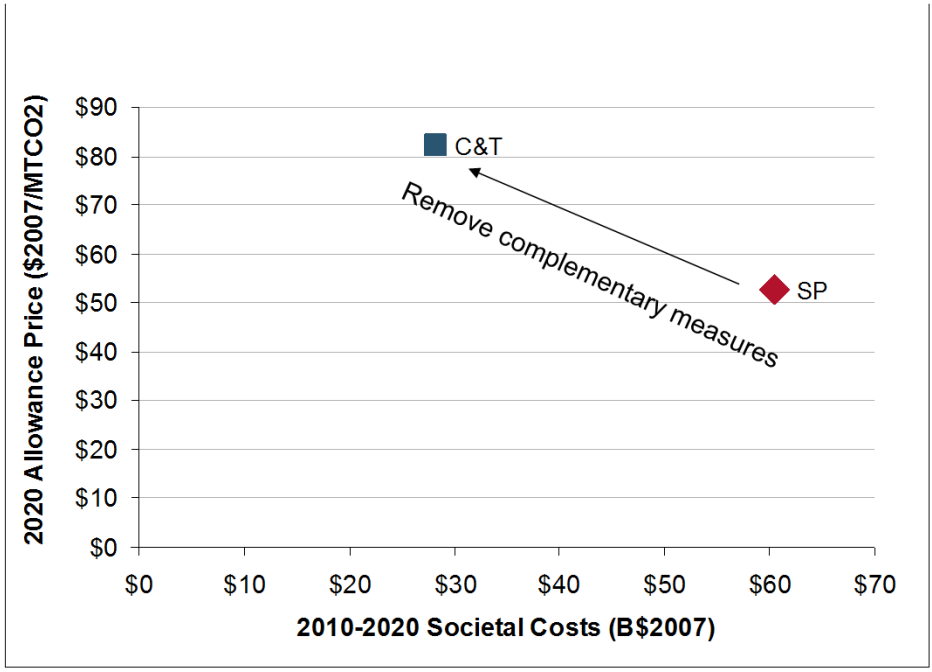
National energy impacts in 2025 Fuel prices (gasoline and diesel): 90% to 170% increase relative to the baseline

- Personal and commercial VMT: reduced by 9% to 14% relative to the baseline

Regional impacts of a national LCFS in NE/MA

- Jobs: loss of over 750,000 total jobs (again, taking into account any “green jobs” created)
- Gross regional product: 1.7-3.5 % or $140-290 billion

Impacts of a California LCFS



	SP (Case 1)	C&T
All Complementary Measures	Included	Excluded

Note: LCFS policy most costly of the complementary measures

Source: Paul Bernstein, presentation to California Air Resources Board, April 21, 2010

Why are impacts so severe?

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- Low carbon fuels are like coffee with cream
  - If enough cream is not on the table to achieve the desired mix, then the only alternative is to drink less coffee
- "Technology forcing" targets require a larger supply of fuels with lower life cycle emission factors than can be achieved in the time allowed
  - The only remaining alternative is to ration transportation fuel use so that the available supply of low carbon fuels is sufficient
- To meet LCFS with limited supplies of biofuels requires significant reduction in total fuel consumption
  - To reduce transportation fuel consumption sufficiently requires fuel prices increases to drive VMT down and fleet fuel economy up
  - Relative supply of biodiesel and low carbon ethanol determines the mix of impacts between personal and commercial transportation

Why do many studies incorrectly find positive impacts?

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- Examples: Washington, Oregon and NESCAUM studies
- Excessive technology and market optimism
  - Technology forcing regulations will work without fail
  - Low carbon fuels will cost no more than gasoline
  - Blendwall and fuel infrastructure constraints can be ignored
- Economic modeling errors
  - Failure to account for the opportunity cost of investment in fuels
  - Fallacy of composition – national is not sum of positive impacts calculated one state at a time
- Unlikely regional economic assumptions
  - Each state that adopts standards will produce its own feedstocks and fuels
  - All investment will come from outside the state

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What leads to erroneous results

FAULTY ASSUMPTIONS, ERRORS AND OMISSIONS

1. Fuel standards will force development of new technology

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- State standards will only lead to adoption of currently available, more costly technology
- Failure to motivate breakthrough R&D is due to
  - Lead times that are too short
  - Commitment is not credible
  - Scope is too narrow

2. There will be no cost

- Fuels with very low life cycle emissions are
  - Substantially more costly than gasoline
  - Subject to infrastructure constraints
  - Not technologically ready
- When a standard collides with reality the result is
  - Rationing gasoline to make available supplies of alternative fuels sufficient to meet percentage reduction targets
  - Revising the standard, thereby stranding investments and reducing credibility of future policies

3. There will be ample supplies of low carbon fuels

- Taking a one-state-at-a-time perspective is misleading
- Not if many states do it together
- Not if the standards are unrealistic

4. Opportunity costs can be ignored

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- If investment and workers are devoted to producing low carbon fuels, the opportunity cost of their alternative employment must be included
- When a higher cost fuel is forced into the market in place of a lower cost fuel, the difference in cost is lost output in the economy as a whole
- A comprehensive model must address not just jobs in producing low carbon fuels and its supply chain, but jobs lost elsewhere in the economy

5. Each state that adopts standards will produce its own fuels and feedstocks

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- Fuels and feedstocks will be produced where there is the greatest comparative advantage not where their use is required
- Even US wide mandates and subsidies have not prevented solar and other renewable equipment manufacturing from moving offshore

6. Investment will all come from outside the state

- Investment will go to where the fuels and feedstocks can be produced at least cost
- Regulatory mandates and high fuel costs make states less attractive to investors, not more
- Especially for state-level programs, there is no guarantee that the investment will ever come as firms may see better opportunities in other markets

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How better to achieve goals

COMPREHENSIVE CARBON POLICIES WILL BRING IN LOW CARBON FUELS

Role of low carbon fuels in national policy

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- Comprehensive policies to put a price on carbon do lead to economic introduction of biofuels
  - Near term reductions in carbon are much less costly in electricity than transportation
  - Achieving 80% or greater reductions in nationwide emissions require decarbonization of transportation as well as electricity
- Petroleum-based fuels begin to be replaced after 2030
  - Competition between biofuels and electrification of transportation
  - Resulting mix of transportation fuels depends on future technologies not knowable today
- R&D in biofuels and other petroleum alternatives has very high social and real option value

Technology forcing standards vs. comprehensive policy

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- A fuel neutral carbon policy
  - Causes emission reductions to occur in the sectors where they are least costly to achieve
  - Brings in low carbon fuels later
- Identical climate results for far lower costs are achievable without LCFS
- Allowing market-driven R&D to bring in low carbon fuels greatly lowers cost

An LCFS greatly increases costs of meeting carbon targets

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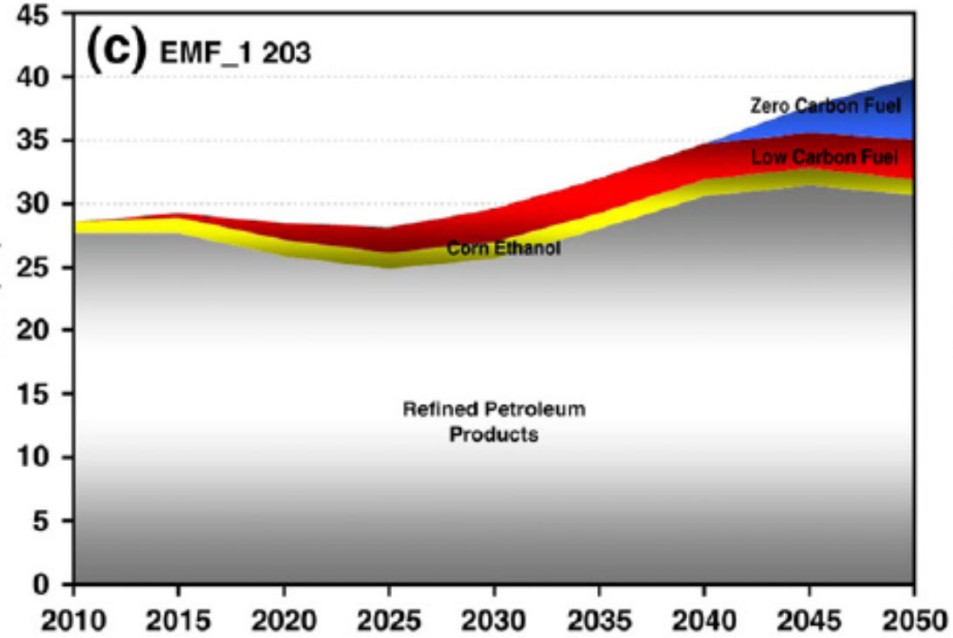
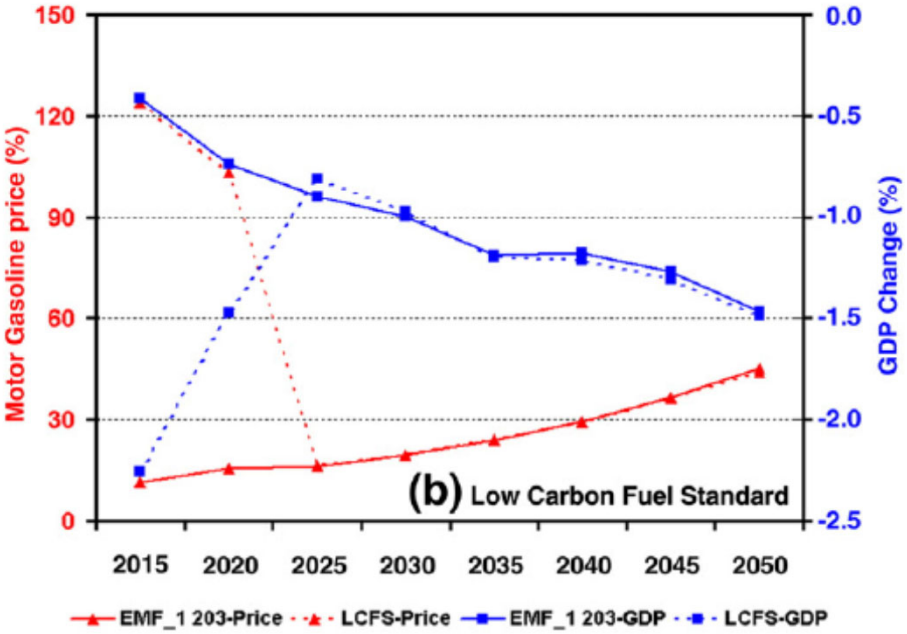
A fuel neutral carbon policy to reduce U.S. CO_2 emissions to 70% of baseline levels by 2050 would lead to substantial introduction of low carbon fuels without standards

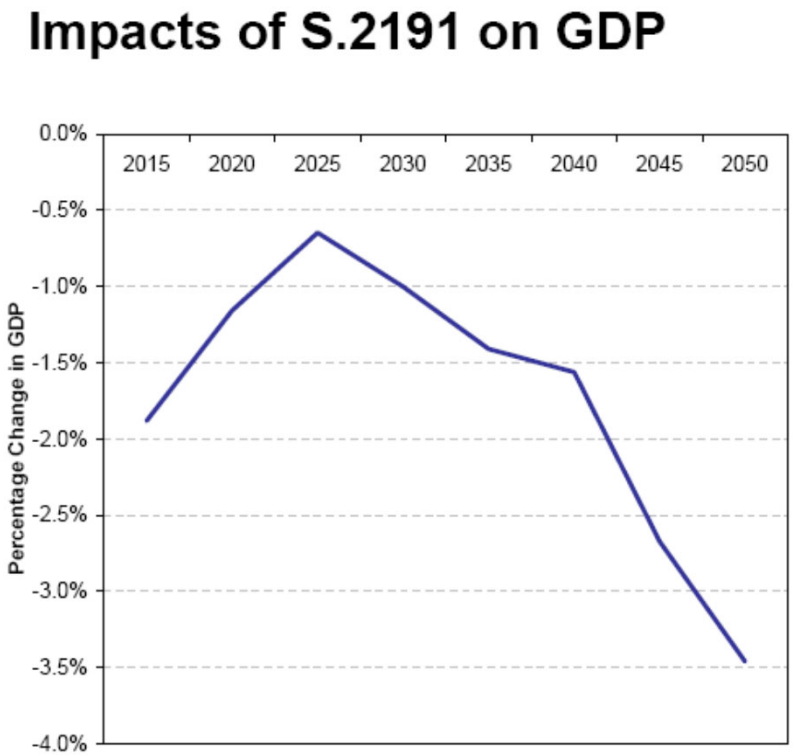
Layering an LCFS on top of the emission cap causes more rapid introduction of low carbon fuels and much higher fuel costs and losses in GDP

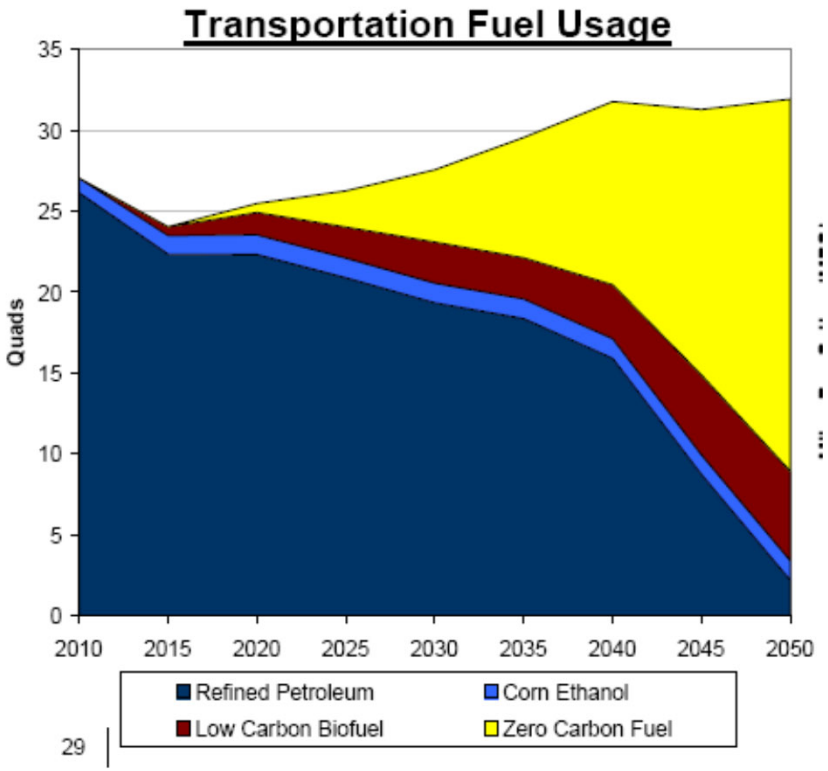




Source: Sugandha D. Tuladhar, Mei Yuan, Paul Bernstein, W. David Montgomery, Anne Smith. A top–down bottom–up modeling approach to climate change policy analysis. Energy Economics 31 (2009) S223–S234

Tight LCFS drives total fuel use down to achieve standard





LCFS causes large near-term reduction in VMT and large GDP losses

Source: Economic Analysis of the Lieberman-Warner Climate Security Act of 2007 [S.2191] Using CRA's MRN-NEEM Model: Summary of findings. W. David Montgomery and Anne E. Smith April 8, 2008

Errors in judgment are less damaging with price policy

- LCFS provides no safety valve
- If costs are higher or availability less than required, the targets must still be met
- Errors are very costly
- A comprehensive carbon price lets the next best alternative take over
- If low carbon fuels do not pan out as regulators wish, then under cap and trade the electric sector would take up the slack

Costs of errors about LCFS cost and feasibility are high

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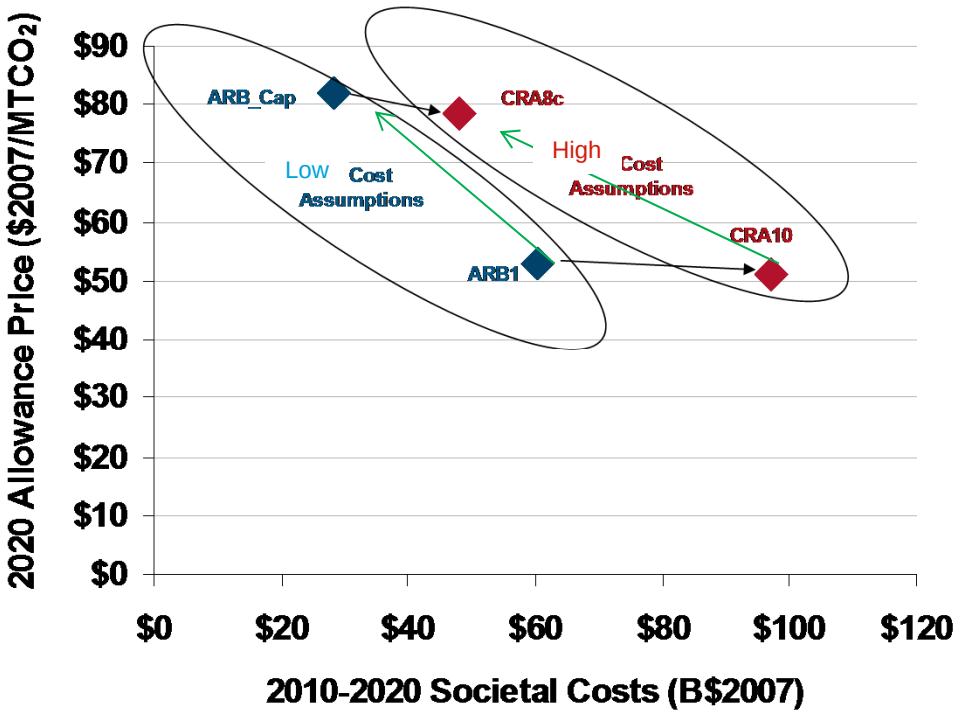
Results Are Sensitive to Assumptions about Alternative Transportation Fuels



	ARB1	ARB_Cap	CRA10	CRA8c
Complementary Measures	Included	Excluded	Included	Excluded
Cost Assumptions	Low	Low	High	High

- Accounting for likely higher costs of procuring and delivering advanced low carbon fuels to the California fleet adds $20 to $40 billion dollars to the overall program costs
- When complementary measures are excluded program costs are less sensitive to technology uncertainty because the market is no longer constrained in its choice of technologies

Source: Paul Bernstein, Analysis of the California ARB's Scoping Plan and Related Policy Insights, March 24, 2010

The NERA energy and environment team

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- Decades of experience working together in analyzing energy and environmental policies
- Joined NERA in 2011
- Developed the N_{ew}ERA model that combines detailed representation of the electricity and transportation sectors with a CGE model of the U.S. and state level economies
- Using the model for national and state-level analysis of policies that include fuel economy standards, LCFS, CSAPR, HAPS, and carbon pricing

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