

The Low Carbon Fuel Standard

Transportation and Climate Policy
Asilomar Conference Center
Pacific Grove, California

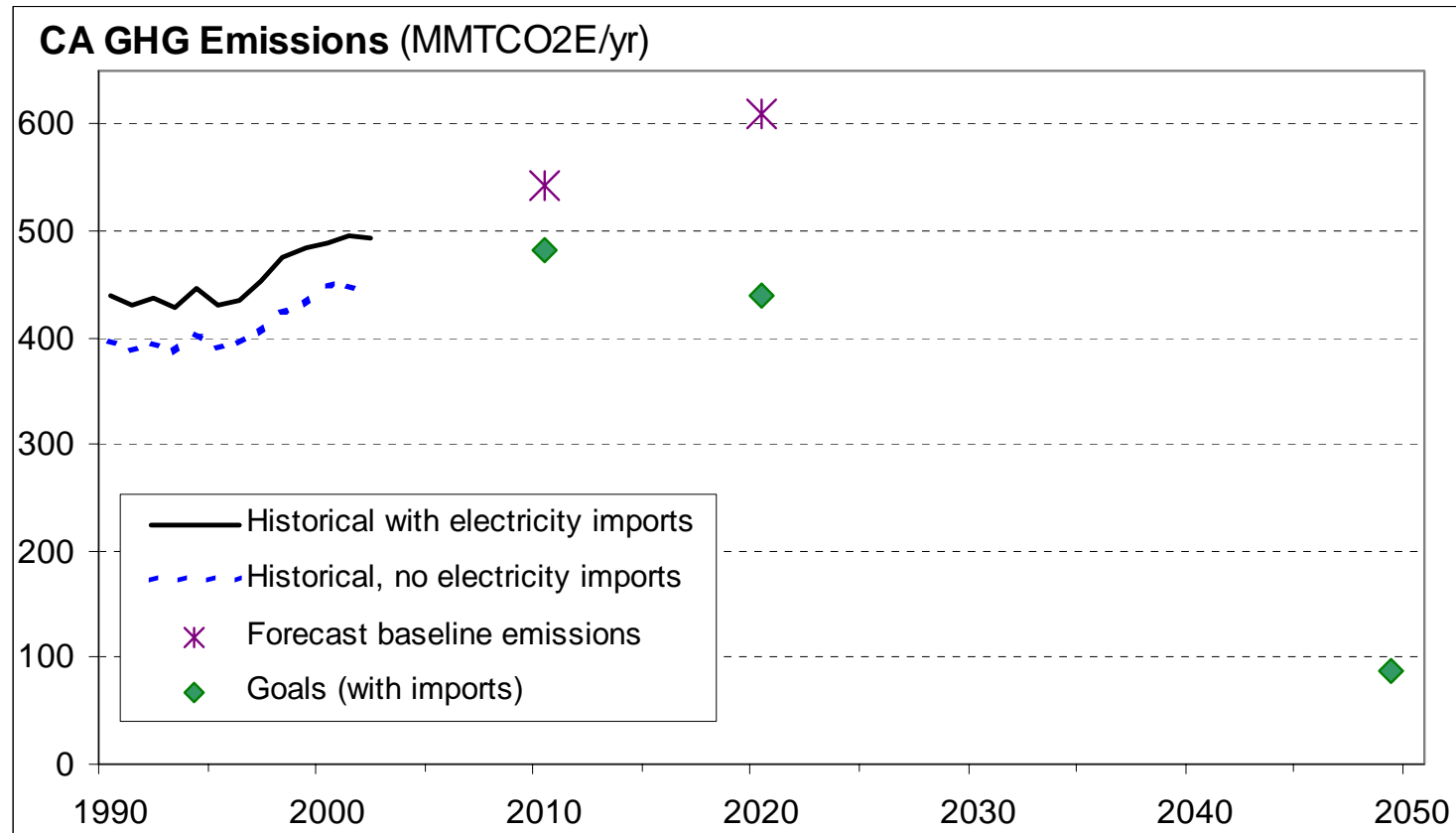
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California has the kind of ambitious targets needed globally to stabilize the climate



- Executive Order S-3-05 GHG emission reduction targets
 - 2010: maintain 2000 levels (~10% reduction from baseline)
 - 2020: return to 1990 levels (~25% reduction from baseline) → **AB32**
 - 2050: attain 80% below 1990 levels

California's climate change strategy has three overarching goals

- 1. Deploy near-term technologies to cut emissions by ~25% by 2020**
- 2. Stimulate innovation & investment in new technologies needed to meet the 2050 stabilization target**
- 3. Contribute to related objectives**
 - Economic growth
 - Air quality
 - Affordable energy prices
 - Diversity of energy sources
 - etc.

California has developed a comprehensive, sectoral strategy to cut GHG emissions

- **Overall goals**

- Executive Order S-3-05 (2005)
- Global Warming Solutions Act 2006 (AB 32)
- Energy Action Plan (CEC and CPUC)
- Bioenergy Action Plan (CARB, CEC, CPUC, etc.)

- **Energy research portfolio**

- **Buildings and appliances**

- Energy efficiency standards (CEC)

- **Electricity other large sources**

- Carbon Adder (CPUC)
- Renewable portfolio standard for electricity (SB 107)
- GHG performance standard (CPUC and SB1368)
- GHG emissions cap (CPUC)
- Energy efficiency targets for utility companies (AB 2021)

- **Transportation**

- Vehicle GHG performance standard (AB 1493, CARB)
- Low Carbon Fuel Standard (Executive Order S-1-07, CARB, CEC, and others)*
- Reduce vehicle usage

- **Other policies**



Achieving the 2050 stabilization target requires a sectoral policy

- **Technological innovation is needed in every sector, which economy-wide prices are unable to achieve**
 - Vehicles
 - Fuels
 - Travel modes
- **Multiple market imperfections**
 - Inadequate R&D for environmental technologies
 - Network effects require cross-industry coordination
 - Infrastructure is often required (especially for transit)
 - High discount rates of private companies and of consumers
 - Risk aversion of consumers
 - Market power

Poor fuel-on-fuel competition in the transport sector adds to the need for a sectoral policy

- **Implications of a \$25/tonne CO₂ tax (or price)**
 - Nuclear + renewable electricity \$00.01/MWh
 - Integrated gasification combined cycle with carbon capture and storage (IGCC+CCS) \$02.5/MWh
 - Natural gas combined cycle (NGCC) \$12.5/MWh
 - Pulverized coal (PC) \$20/MWh
 - Gasoline \$0.22/gallon
 - Corn ethanol \$0.11 to \$0.23/gallon
- **A single, economy-wide price may induce tremendous technological change in the electric sector, but little in the transport sector (vehicles, fuels, travel choices)**

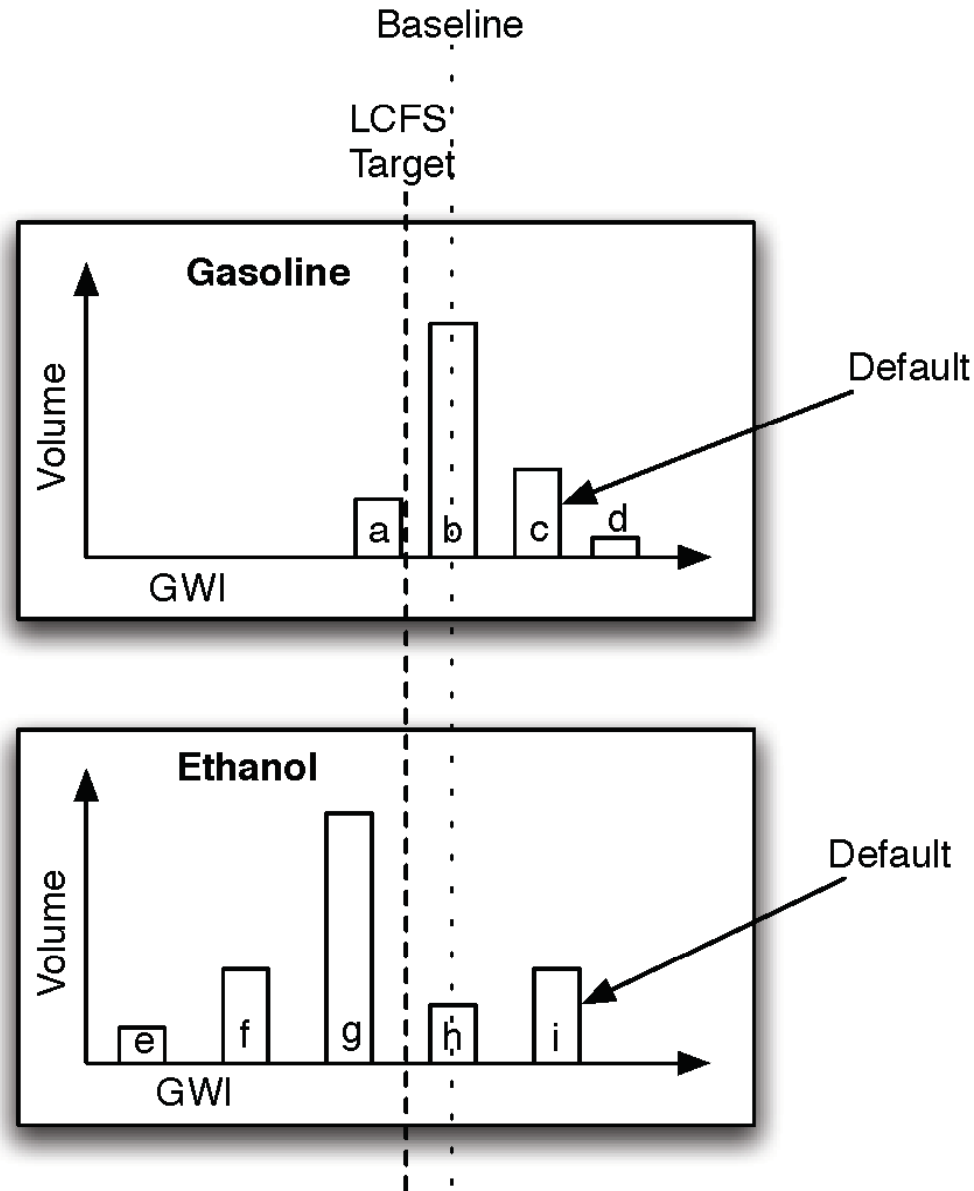
Low Carbon Fuel Standard (LCFS)

- **Carbon intensity must be measured on a lifecycle basis**
 - Global warming intensity
 - Average Fuel Carbon Intensity (AFCI) in gCO₂e/MJ
 - Adjusted for inherent drivetrain efficiency: Gasoline = 1.0 by definition, Diesel = 0.78, Electricity = 0.20, H₂ = 0.47
 - AFCI must decline by at least 10% by 2010
- **Compliance by manufacturers or importers of fuels**
- **Performance standard (no 'picking winners')**
- **Additional to vehicle performance standards**
- **Overcompliance creates credits can be traded or banked**
- **Similar to emerging European biofuel approach**
- **Could be implemented in addition to tax or cap**

Regulatory Approach

- **Firms report average carbon intensity of fuels**
 - Carbon intensity of inputs are recorded
 - Compared to standard that declines over time
- **Default: all fuel inputs are assigned a carbon intensity**
 - Fuel inputs must be categorized
 - Highest value in common use is the default value
 - Encourages opt-in and focuses management attention
- **Opt-in: suppliers with lower carbon intensity can get certified at a lower value**
 - Requires protocol development and data collection
- **Compliance options**
 - Improve energy efficiency or lower upstream CO₂ emissions
 - Blend in fuels with lower carbon intensity
 - Sell fuels with low carbon intensity (e.g. electricity)
 - Buy credits from within the fuels sector

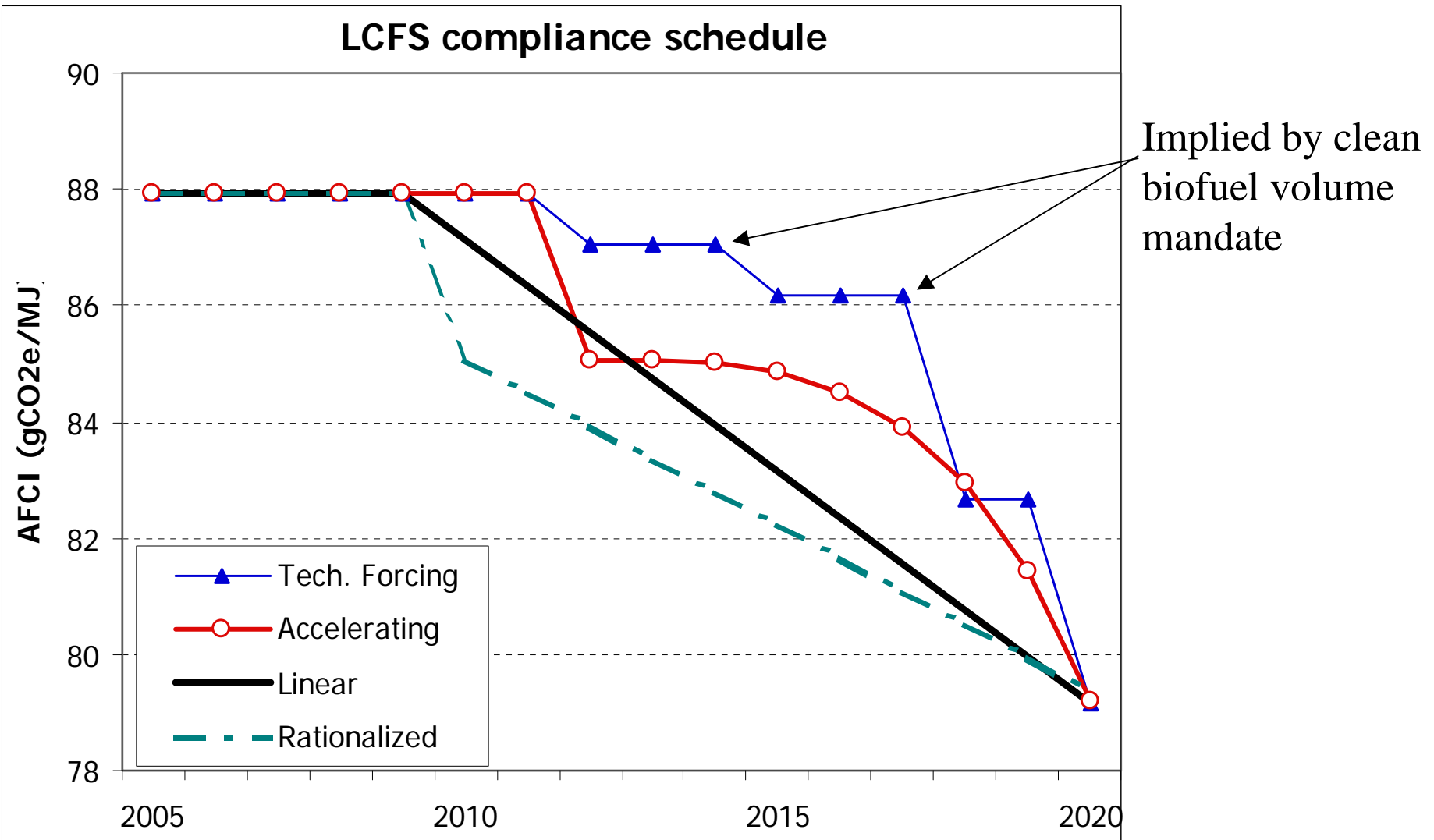
Illustration of default and opt-in approach



Illustrative defaults (a limited set)

- Fuel default
 - Gasoline, diesel, ethanol, biodiesel, natural gas, electricity
- Feedstock default
 - Gasoline: conventional oil, heavy oil, tar sands, coal
 - Diesel: conventional oil, heavy oil, tar sands, coal
 - Ethanol: U.S. corn, Brazilian sugar, U.S. switchgrass
 - Electricity: (?) CA average, CA marginal,
- Feedstock & processing default
 - Gasoline: conventional oil, conventional oil with CCS, heavy oil, heavy oil with cogeneration, tar sands with nuclear process heat, etc. (Regions or specific crudes are possible)
 - Ethanol: U.S. corn pre-2000 wet mill, U.S. 2004 natural gas dry mill, Brazilian sugar, U.S. switchgrass, etc.
 - Electricity: ???

Possible compliance schedules



- Rationalization (aka shuffling, leakage)
- Technological innovation

Key issues and questions

- Basis of competition

- Electricity**

- Rate-of-return regulation

- All emissions capped (?)

- Local

- “Ratepayer subsidies”

- Oil**

- Competitive

- Intensity target

- Global

- “Capital at risk”

- Including “upstream” emissions

- Improved LCA methods

- Better data

- Transparency

- Better methods

- Land use change

- Compliance schedule

- Complementary regulations and government actions

- Availability of offsets, interactions with AB32 allowances¹²

LCFS developments worldwide

- **Renewable Fuel Standard (RFS)**
 - US: 7.5 billion gallons (gge) biofuel 2012 to ~6% of gasoline (EPACT).
 - US: 24 billion gallons (gge) biofuels by 2025 (Exec. Order)
 - UK: Renewable Transportation Fuel Obligation (RTFO): 5% by 2010
- **Low Carbon Fuel Standard (LCFS)**
 - California: regulations to be in effect 2010 (AB32 and Exec. Order)
 - Federal regulations: Proposed Rule November 2007 (Exec. Order)
 - Federal bills: Boxer, Feinstein, Obama, Inslee, Dingle-Boucher, etc.
 - European Union: monitoring in 2009, reductions start in 2011
 - United Kingdom: RTFO requires GHG monitoring, pilot in 2007
 - Germany: Sustainability requirements for biofuels
 - Others: BC, WA, OR, AZ, NM, MN, and...?

Thank You

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