

# Policy Pathways to Emissions Reductions and the Role of Carbon Pricing in the Industrial Sector

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Technologies and Policies to Decarbonize the Industry Sector

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# A point of departure....

## Addressing industrial sector emissions requires cross-sector system level thinking

### **Carbon pricing is the only systematic approach**

- Pricing provides a method to rationalize efforts across sectors

Carbon pricing addresses the three general equilibrium “channels” of action:

- Input substitution
- Abatement
- Output substitution

Carbon pricing leaves decisions to agents who have the information and willingness to take risk.

# Carbon pricing is imperative but it is not sufficient

## Reality bites

- Leakage significantly erodes the economic and political sustainability of pricing
  - Compared to regulation, political/market volatility raises option value cost of investments
  - The public prefers regulation
  - Moderate pricing will not ignite innovation sufficient for the energy transformation
  - Numerous transitional, environmental justice concerns surface under pricing
- The project for economics and policy science is to identify instruments that mimic the attributes of carbon pricing across the three general equilibrium channels ...and that provide a policy sequence that leads to increasing stringency.
- To borrow from the Tanaloa Dialogue, we know where we are and where we want to go.  
**The question is how do we get there.**

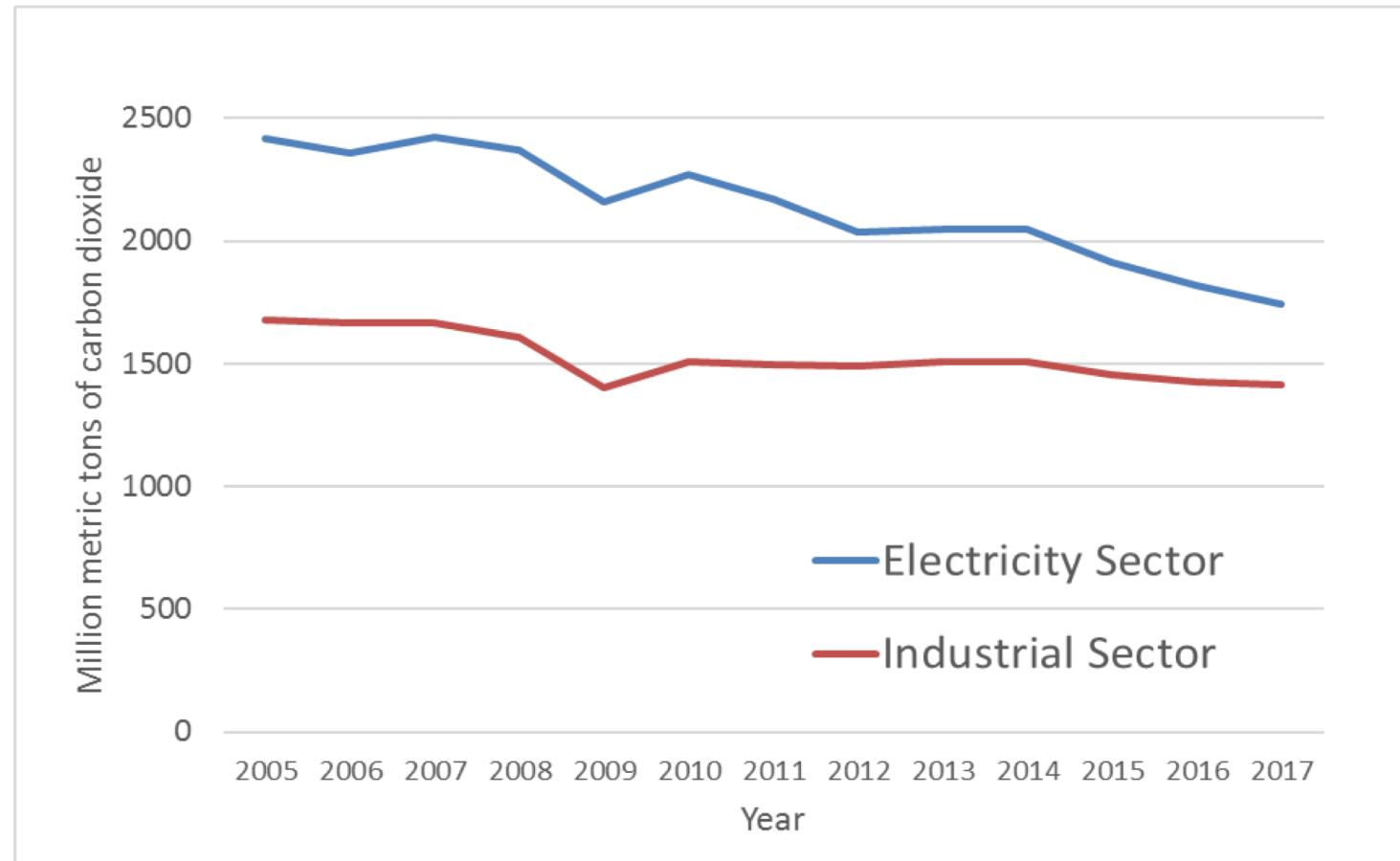
# The Policy Portfolio

## Companion policies for carbon pricing

1. Research
2. Market liberalization
3. Environmental and technology regulation
- 4. Intensity standards**
5. Subsidies
6. Procurement
7. Information disclosure
8. Other?

# 1. Research

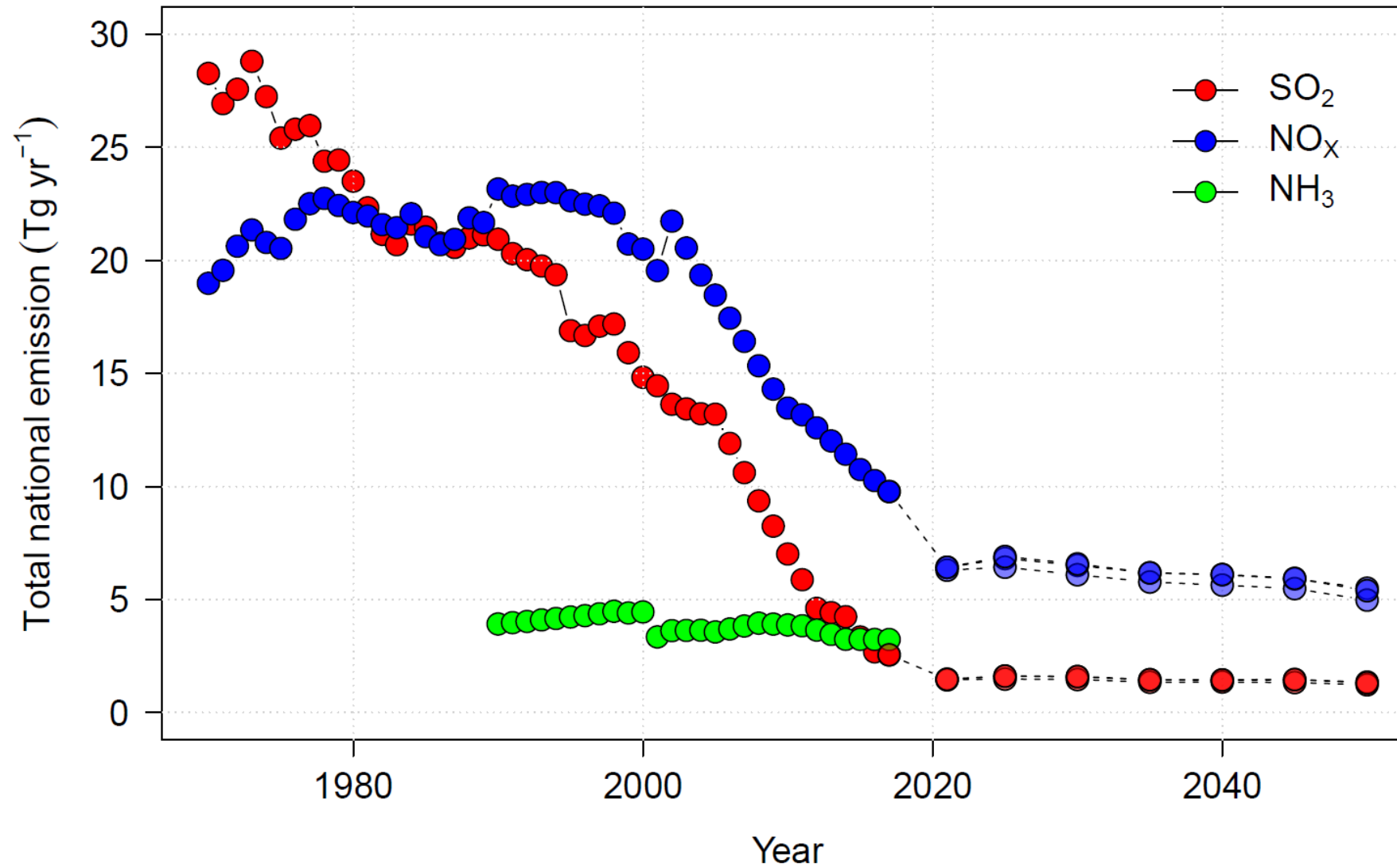
Since 2005, US electricity sector emissions have declined by 28 percent. Industrial emissions have declined by over 15 percent (faster than the economy as a whole), and since 2010 they have declined by 6 percent.



Natural gas availability has driven most of these reductions; little electrification.

## 2. Market liberalization > Railroads > Electricity > Natural gas

These played a large role in sulfur reductions!



## 3. Regulation

The Clean Air Act made  
America Great Again!

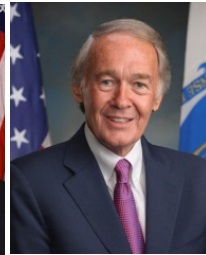
Environmental pricing  
played almost no role.

# GHG Regulation

In 2008 technical papers, EPA identified technology performance standard opportunities for emissions reductions across industrial sectors.

<i>Source category</i>	<b>CO<sub>2</sub>e emissions (percentage of total)</b>	<b>CO<sub>2</sub>e emissions (MtCO<sub>2</sub>e)</b>	<b>CO<sub>2</sub>e reduction (percentage of sector)</b>
Iron and steel	1	71	19
Pulp and paper	1.4–3	99–212	14
Cement	2	141	1–10
Boilers (industrial, commercial, institutional)	20	1411	1–10
Petroleum refineries	3	212	1–10
Boilers (electricity): coal-fired	28	1975	2–5

# Partial Timeline of US GHG Regulations for Power Sector



Waxman-Markey (WM) bill  
(national cap and trade)  
passed in the House of  
Representatives



Obama's  
Climate Action  
Plan

Final CPP released;  
  
Also final  
standards for new  
generators under  
the CAA 111(b)

Trump proposes  
replacement to the  
CPP.

Affordable Clean  
Energy rule limited  
to heat rates

2007

Jun 2009

Jul 2010

Jun 2013

Jun 2014

Aug 2015

Feb 2016

Aug 2018

Supreme Court  
affirmed  
in *Massachusetts v.*  
*EPA* that greenhouse  
gases are covered by  
the Clean Air Act  
definition of air  
pollutant

Senate  
failed to take  
up WM bill.  
Legislative  
approach  
failed.

EPA proposed Clean  
Power Plan (CPP) for  
existing electric  
generators

US Supreme  
Court imposed  
stay on EPA  
enforcement of  
CPP





## Returning to the prospect of regulation has the attention of industry

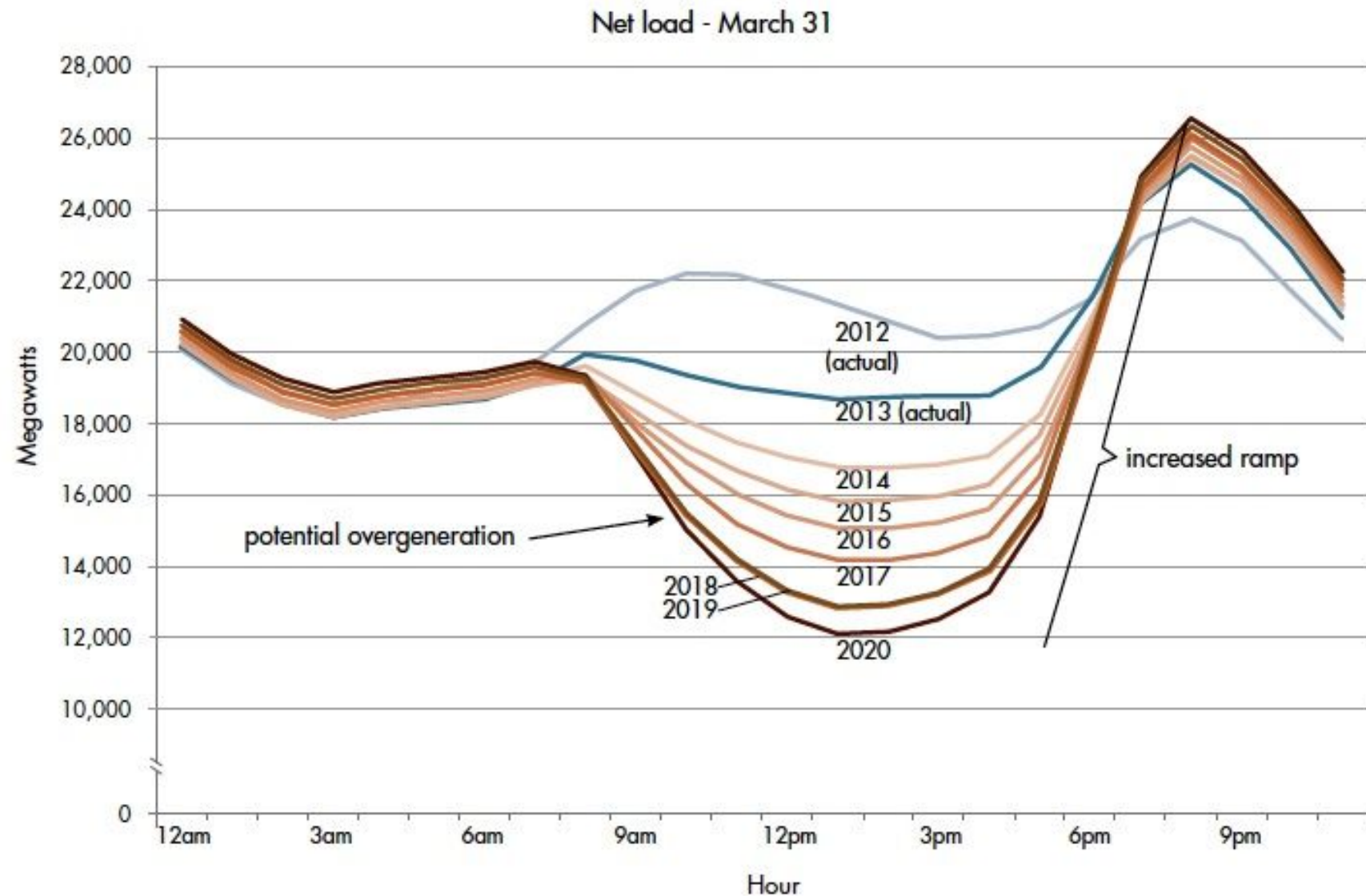
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Affordable Clean  
Energy Rule

Even under attack, the formal process of regulation has durability

## 4. Intensity Standards

Renewable Portfolio Standards (RPS) and other technology support policies have done **much more** for decarbonization of electricity than carbon pricing



# California's Renewable Portfolio Standard

The question of technology neutrality? When is it a good idea?

2017 SB350: Increased target to 50% by 2030

2018 SB100: Increased to 50% by 2026; 60% by 2030; 100% **CES** (!) by 2045

Compare to:

- 1976 PURPA / qualifying facilities

- Feed-in tariffs in Europe

- Long term power purchase agreements and community choice aggregators

These identified a technology with fixed payment at avoided cost or specified cost, with both positive and negative consequences.

A lesson for supporting embryonic technologies:

Caution about carve outs; ratio trading among tech is better; sunset always.

# Low Carbon Fuel Standard

An intensity standard can be applied across sectors to promote coordination

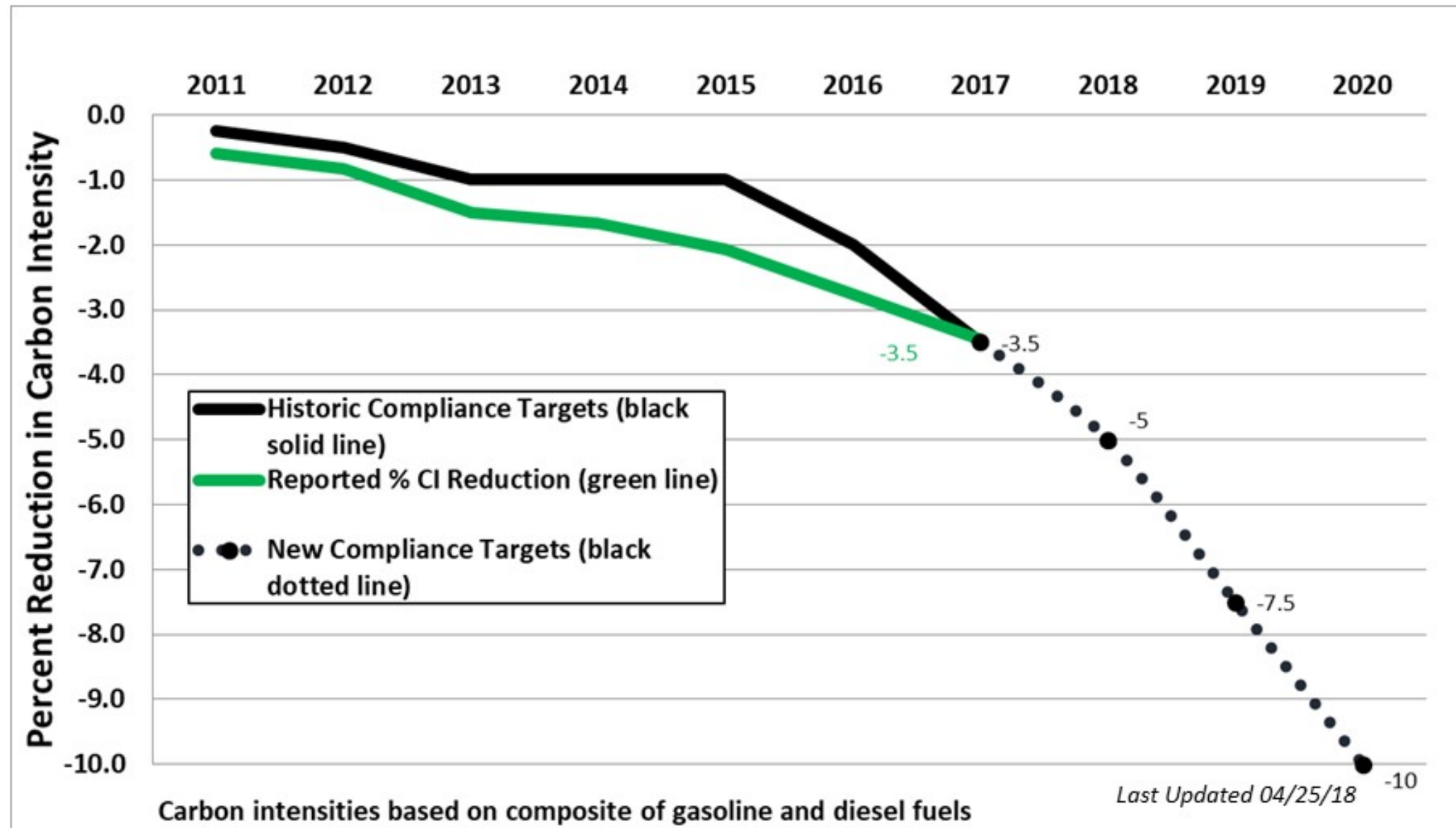
Originally adopted in 2009 to reduce carbon intensity of transportation fuel by 10% by 2020; update 20% by 2030

- Sets carbon intensity standards for gas, diesel, and fuels that replace them
- Carbon intensity life cycle: grams CO<sub>2</sub>e/MJ.
- Includes indirect effects associated with crop-based biofuels
- Fuels above standard buy credits; fuels below standard create credits.
- Technology neutral
  - Full life cycle in petroleum (well to wheels)
  - Electric vehicles crediting
  - Agricultural methane introduced to natural gas network
  - Renewable diesel is 10% of diesel supplied to CA



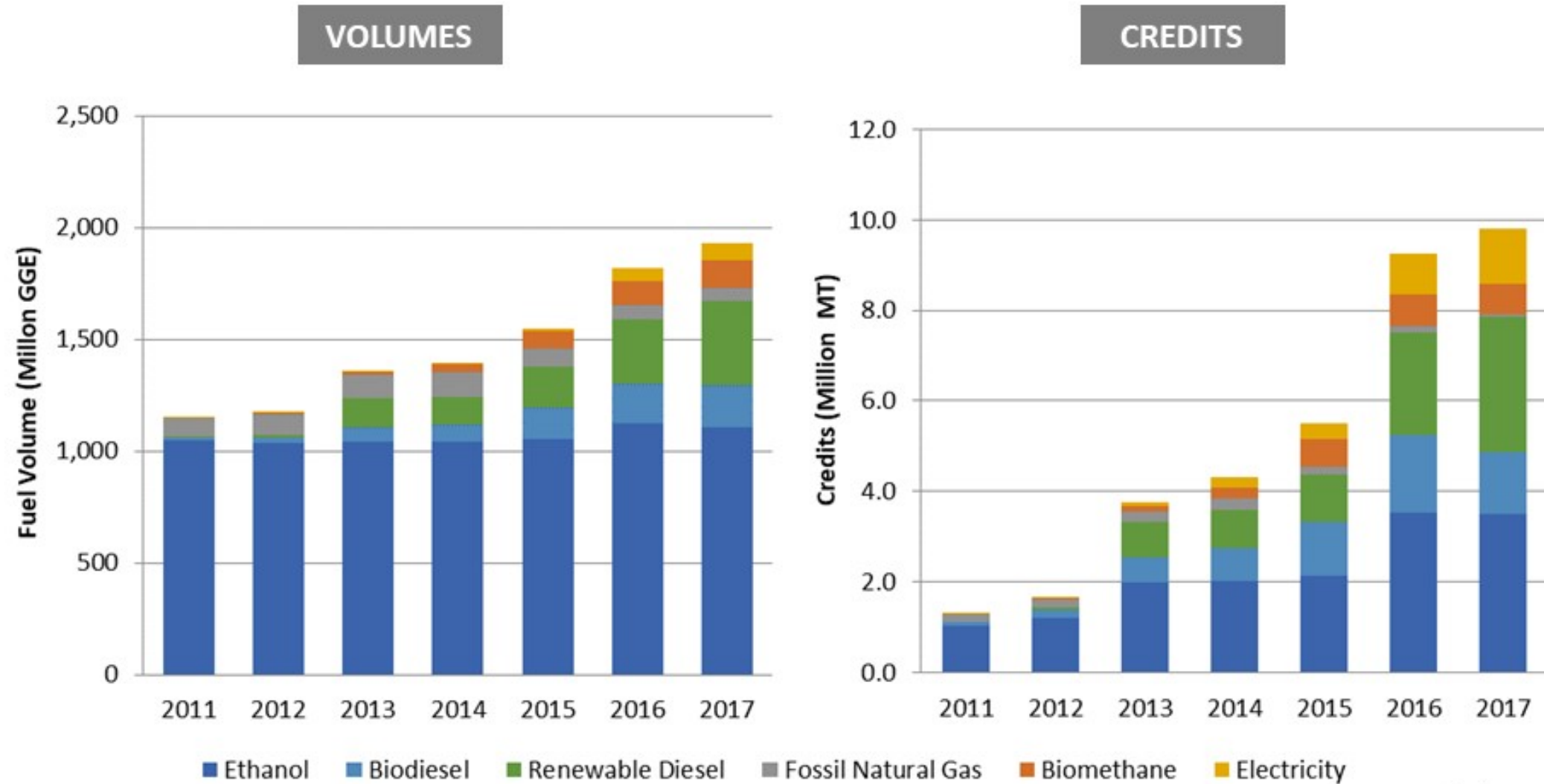
# Low Carbon Fuel Standard

2011-2017 Performance of the Low Carbon Fuel Standard



# Low Carbon Fuel Standard

## Alternative Fuel Volumes and Credit Generation



Last Updated 04/25/2018

# Intensity standards are on the pathway to carbon pricing

Sector specific policies have managed to achieve most of observed reductions

- Intensity standards – **two polices in one!**
  - **Tax and subsidy**
  - Facilities above standard
    - (a) incentive to reduce intensity
    - (b) incentive to substitute away from activity
  - Facilities below standard
    - (a) incentive to reduce intensity
    - (b) incentive to increase activity



Input channel: Strong

Abatement channel: Strong

Output channel: Weak or Negative

(Proposals for consumption-based fix to output channel – EU cement; China electricity)

# Benchmarks and Output Based Allocation

These are like intensity standards. Implementation matters.

Carbon pricing in EU, CA/QE **fight leakage** with free allocation of allowances

- This is not your “*grandfather’s*” type of free allocation (based on history)

Benchmarks (tons/output):

- Product or process based
- Ideally tied to best global practice; 90<sup>th</sup> percentile(?); annual rate of progress
- Dynamic! Tied to production (output) – it is updated!
  - ❖ In practice, though, rate of progress has not been adequately enforced and updating is delayed or does not occur

Differs from intensity standard because cap is enforced.



# Take Away Points

Intensity standards provide a pathway to stringency and carbon pricing

Intensity standards can be stringent! Keeps carbon value in the sector.

Sector specific policies have achieved most of observed reductions

Sector specific policies address shortcomings of a modest carbon price

- Affirm commitment to policy
- Provide incentive for targeted innovation and investment
- Introduce stringency while protecting domestic economic activity

Intensity standards can coordinate across products/processes/and sectors like carbon pricing

- Example: LCFS and electric vehicles
- Can share a price ceiling – alternative compliance payment
- Or better, credit trading (with exchange ratios?) across industry standards
- Enable compliance with emissions market allowances?

# An entry point for intensity standards for industry

## Federal Technology Regulation Remains Relevant

### Federal Clean Air Act

- Performance standards seem likely again, although modest and slow to emerge
- States, firms want to position themselves favorably, e.g. introduce shadow pricing for investment planning
- States, firms want a model that can influence federal program design

### State/Regional Anticipation: Emissions Reduction Baseline and Credit

- Voluntary participation creates adverse selection but brings forward information about emissions reductions opportunities. Opportunity to earn early reduction credits.
- Baseline (benchmark) based on voluntary program. Credits earned relative to baseline.
- Baseline reduced over time.
- Desire for flexibility (out-of-sector credits) motivates expansion to other sectors

# 5. Subsidies

## 26 U.S. Code § 45Q - Credit for carbon dioxide sequestration

- Tax credit for utilization \$35 per ton of CO<sub>2</sub>, for storage \$50.
- No volumetric limit
- Transferable: A facility owner that is unable to use the credit may be able to monetize the credit by admitting a tax equity investor into a partnership that will own the carbon capture equipment (regulations being written)
- Secretary of the Treasury to promulgate regulations that provide for recapture of a credit with respect to carbon oxide that ceases to be captured, disposed of or used as a tertiary injectant.

Subsidies tend to be sticky. Always sunset.

## 6. Procurement Policy

- Industry has technical ability, but requires a demand for low-carbon product

## 7. Disclosure

- Image branding important for consumers, also for recruiting
- Builds information enabling development of performance standards



# Closing perspective

- ✓ Radical incrementalism
  - Large breakthroughs are accidental consequence of incremental actions
  - Incremental policies build institutions
- ✓ Harvest the low hanging fruit
  - Cost effectiveness
  - Politically valuable within organizations
  - Example for industry: harvest facility, transportation and building operations through efficiency, electrification
    - These measures bring ancillary benefits; address environmental justice concerns; change the culture

# Thank you



RESOURCES  
FOR THE FUTURE