# US GHG and Energy Polices – Background and COP21 Commitment

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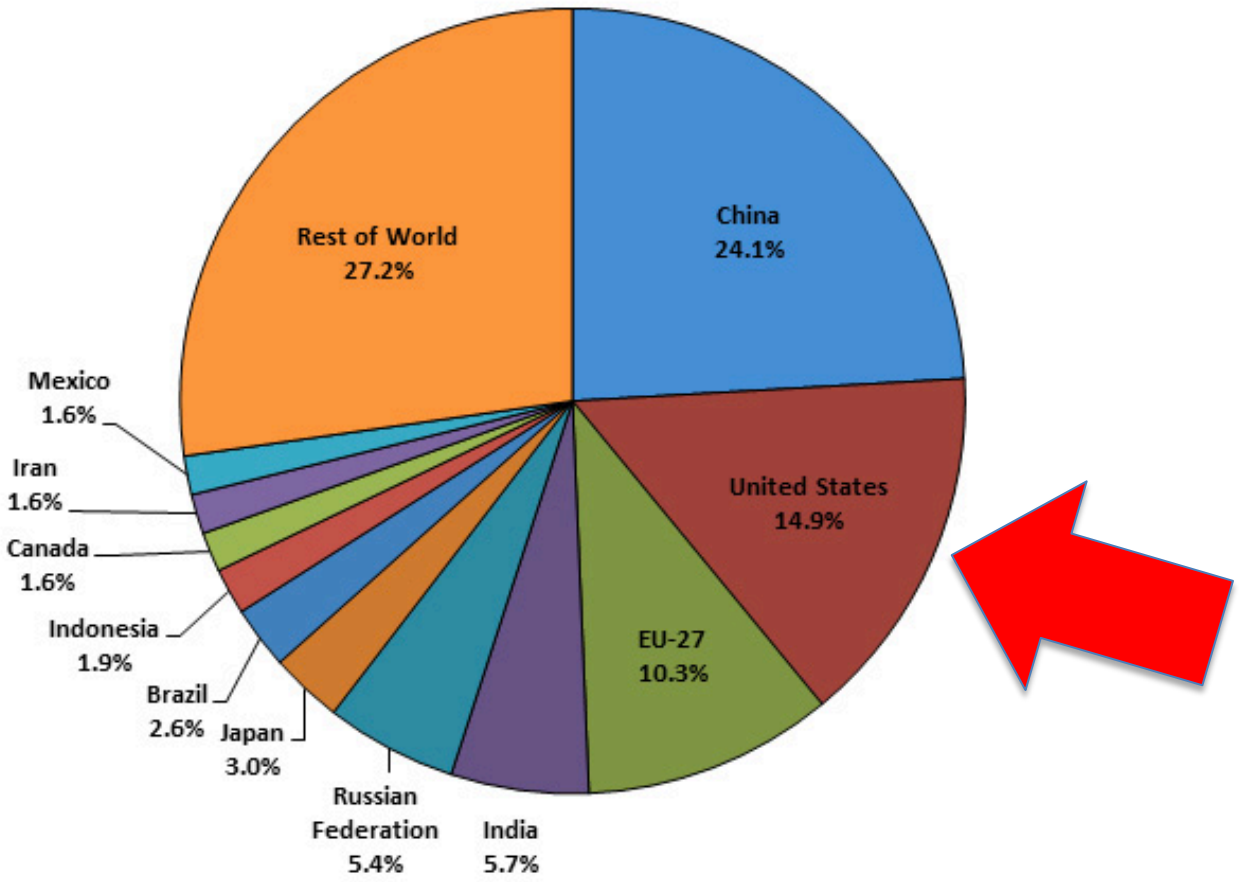
# Outline

1. **Summary of U.S. GHG Emissions in Global Context**
2. **A Brief Recap of Past U.S. Domestic Climate Politics and GHG Control Policies**
3. **A Quantitative Review of Current U.S. GHG Emissions and GHG Control Pledges**
4. **The U.S. EPA's Clean Power Plan**
5. **Independent State GHG Policies**
6. **Leading from the States: California's Climate Change Policies**

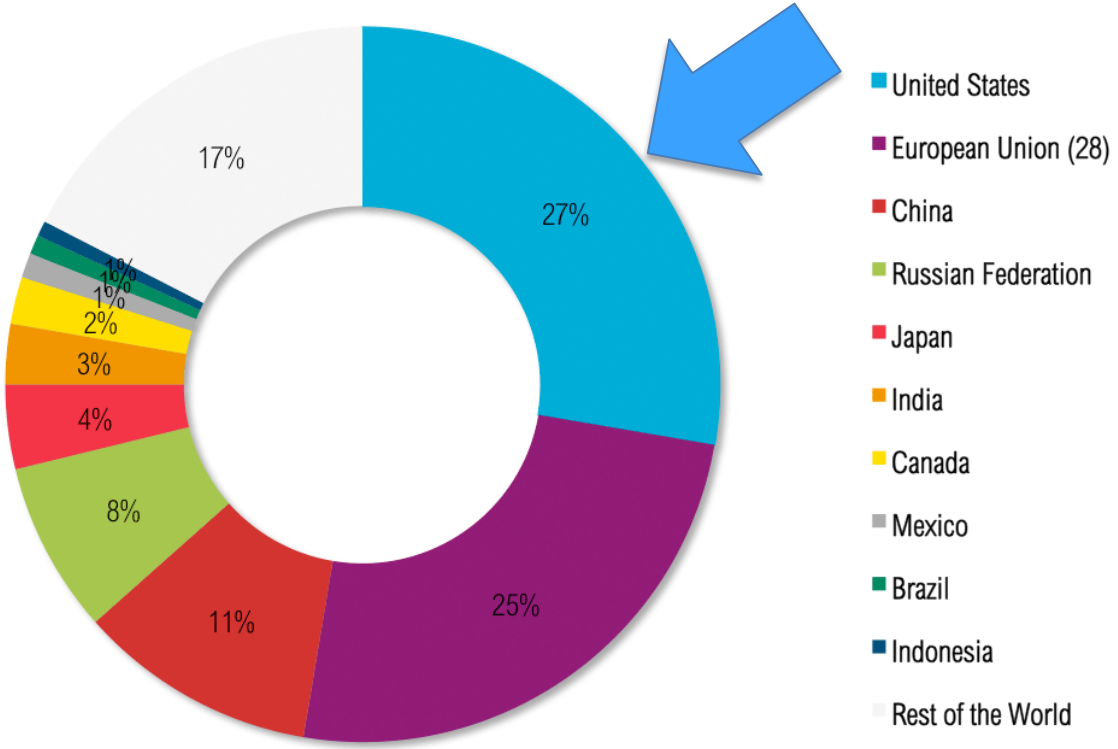
# Summary of U.S. GHG Emissions in Global Context

# Total Global GHG Emissions by Country: 2011




Source: World Resources Institute 2014, CAIT database

# Shares of Cumulative $CO_2$ Emissions by Country 1850-2011

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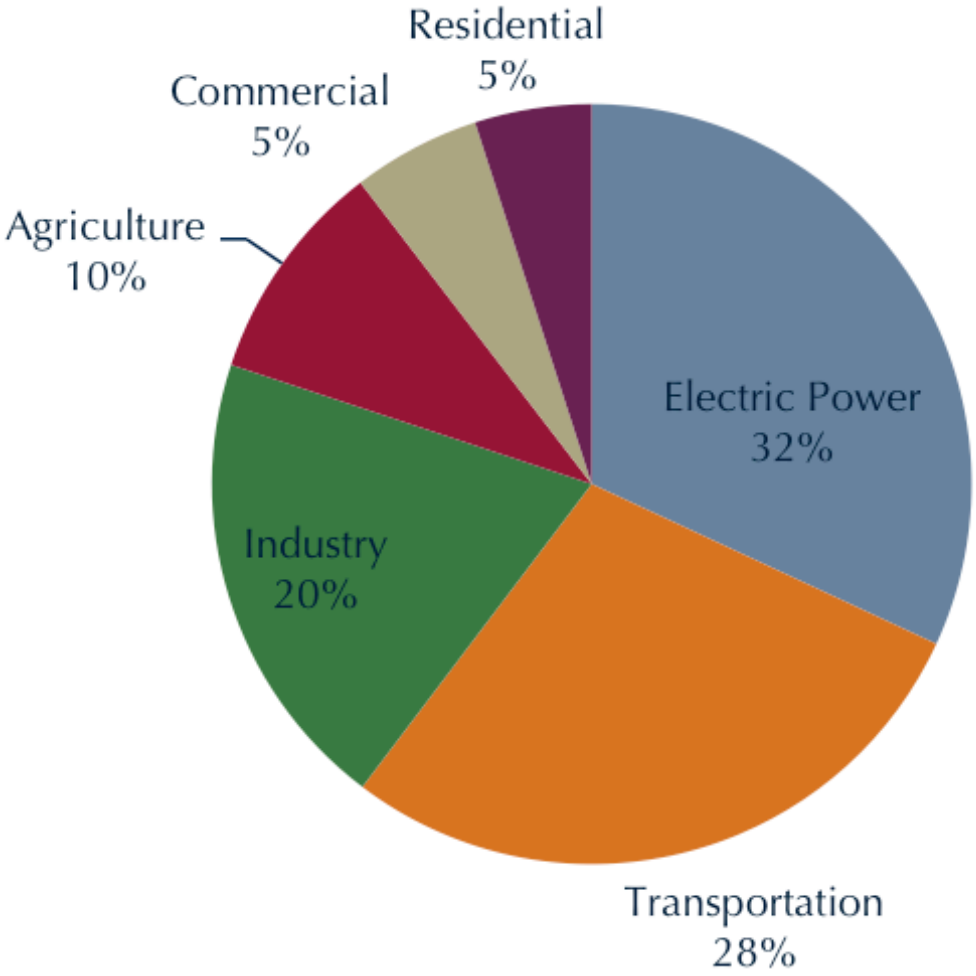
WORLD RESOURCES INSTITUTE

# U.S. Greenhouse Gas Emissions by Economic Sector in 2012




Source: U.S. EPA

# A Brief Recap of Past U.S. Domestic Climate Politics and GHG Control Policies

# Presidents George Bush I and Bill Clinton Years

- **1992: Bush I attended the Earth Summit** and the U.S. immediately signed and **ratified the UNFCCC**—the first industrialized country to do so.

- **1995**: The **Berlin Mandate** adopted at COP-1 created domestic political barriers for U.S. adoption of the Kyoto Protocol.
  - The Berlin Mandate exempted developing countries from making binding commitments.

- **1997**: The **U.S. Senate** voted **95-0** to adopt the **Byrd-Hagel Resolution.**
  - The Senate would not ratify any international agreement that did not include binding targets and timetables for developing as well as industrialized nations.

- **1998**: Vice President Al Gore **symbolically "signed" the Kyoto Protocol**, *but* the Clinton Administration never submitted the protocol to the Senate for *ratification*.

# The Bush II Years:
# *A Critical Overall Perspective*

- The President Bush II/Vice-President Cheney strategy seems to have been the following:

  1. Emphasize **scientific uncertainty** and **encourage public skepticism**. **Stifle and censor** contrary views coming out of scientists in the federal agencies.

  2. **Appear to be doing something**, while really doing very little; pursue mostly low-impact “no regrets” measures.

  3. Pursue **separate international initiatives** that **distract and undercut the mainstream efforts** being pursued through the UNFCCC COP process.

# The Bush II Years:
# *Some Salient Details*

- **2001**: Bush immediately **reversed his campaign pledge** to "require all power plants to meet clean-air standards in order to reduce emissions of carbon dioxide within a reasonable time period."

- **2002**: Bush launched a **new climate initiative** focused on reducing **"GHG intensity"** (emissions/GDP)—a policy appearing to promise a lot while really delivering very little.

- **2003**: The U.S. Senate **rejected** 43-to-55 the **McCain-Lieberman** Climate Stewardship Act to establish a broad **carbon cap-and-trade program**.

- **2005**: The U.S. Senate adopted a **"Sense of the Senate" Resolution** calling on Congress to enact "comprehensive and effective…mandatory, market-based limits" to slow, stop, and reverse the growth of GHG emissions, at a rate and manner that would **not "significantly harm"** the U.S. economy.

# The Bush II Years: Some Salient Details (cont'd)

- **2006:** Bush launched the **Asia-Pacific Partnership on Clean Development and Climate (APP)**, which many suspect was intended to distract and undercut the central efforts of the UNFCCC COP process.

- The **Bush EPA** continually took the position that $CO_2$ was **not an "air pollutant"** under the meaning of the **Clean Air Act** and that EPA was not authorized to regulate carbon emissions.

- **2007**: In ***Massachusetts v. EPA*** the **Supreme Court** rejected the Bush EPA's interpretation that $CO_2$ is not an "air pollutant" under the CAA.

# The Supreme Court Ruling in *Massachusetts v. EPA* (April 2007)

- By a split **5-4 decision**, in *Massachusetts v. EPA* the U.S. Supreme Court ruled:

  1. **$CO_2$ is an "air pollutant"** under the Clean Air Act

  2. Therefore, the EPA **must consider and rule** on whether $CO_2$ creates an **"endangerment"** to human health and welfare.

  3. If $CO_2$ does create an "endangerment", the EPA **may still exercise its discretion not to regulate it**, but the EPA must ground its reasons for action or inaction in the statute.

- The **Bush Administration responded** to the Court's ruling by initiating EPA proceedings but "**kicking the can down the road**" into the next presidential administration for a final EPA decision.

# The Obama Administration: *A Critical Overall Perspective*

- The Obama Administration has been subject to a good amount of **criticism by disillusioned environmentalists**.

- However, especially in view of the difficult domestic political situation, the **Obama EPA has been rather aggressive in pursuing climate change policy** within the **existing authorities** in the Clean Air Act.

- The **existing provisions of the Clean Air Act are not well structured** for regulating $CO_2$. In an ideal world, Congress would enact **amendments to the CAA** to enable the EPA to regulate GHG emissions through more straightforward and efficient programs.

# The Obama Administration:
# *Some Salient Details*

- **2008**: **Obama pledged** to make climate change one of the **top priorities** of his Administration.

- **2009**: **U.S. House of Representatives passed** the American Clean Energy and Security Act (the **Waxman-Markey Bill**) to establish a **national cap-and-trade program**, *but the **bill failed in the Senate***.

- **2009**: In advance of COP-15 in Copenhagen, Obama announced a provisional pledge to **reduce U.S. GHG emissions by 17% below 2005 levels by 2020 and 83% by 2050**.

- **2010**: The Obama EPA issued an "**Endangerment Finding**" and **proceeded to regulate** GHGs under the CAA.

# The Obama Administration: *Some Salient Details (cont'd)*

- **2010**: EPA issued final rules requiring "Best Available Control Technology" on **new or substantially modified fossil-fuel power plants**.

- **2010-2013**: Substantial tightening of **Corporate Average Fuel Economy (CAFÉ) standards** for all vehicles for 2012-2025 model years.

- **2013**: In his State of the Union address, Obama pledged to implement climate initiatives **through executive orders and other actions if Congress refuses to act on the issue**.

- **2013**: Obama announced his "**Climate Action Plan**" directing the EPA to place certain requirements on the EPA to limit carbon emissions from new and existing power plants.

# The Obama Administration: *Some Salient Details (cont'd)*

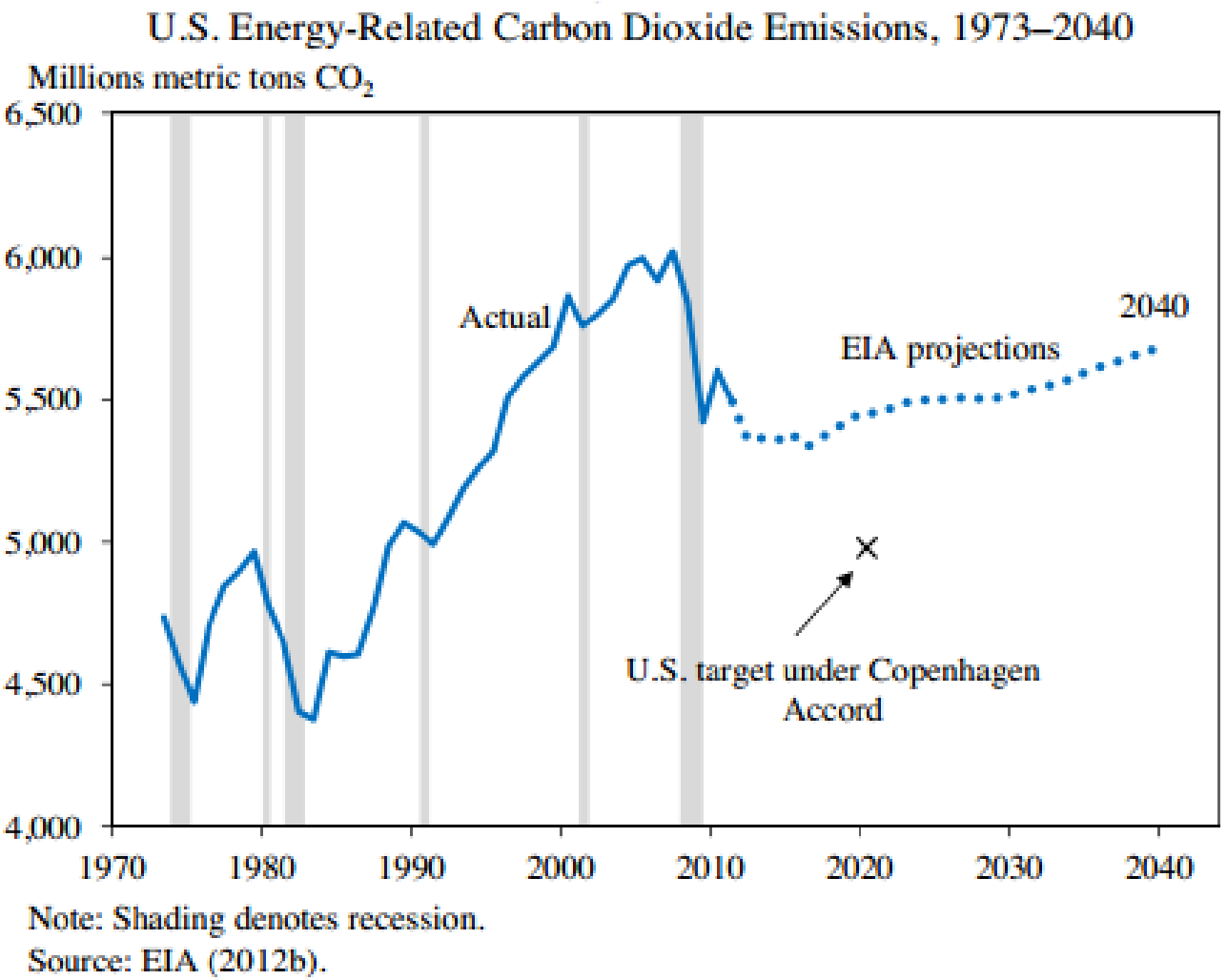
- **2014**: EPA issued its very far-reaching **Clean Power Plan** to address GHG emissions throughout the electric power sector.

- **March 2015**: The Obama Administration submitted its **Intended Nationally Determined Contribution** (INDC) to GHG emissions reductions in preparation for COP-21. The U.S. INDC pledges emission reductions of **26-28% below 2005 levels by 2025—**a doubling of the recent experienced rate of decline in U.S. emissions.

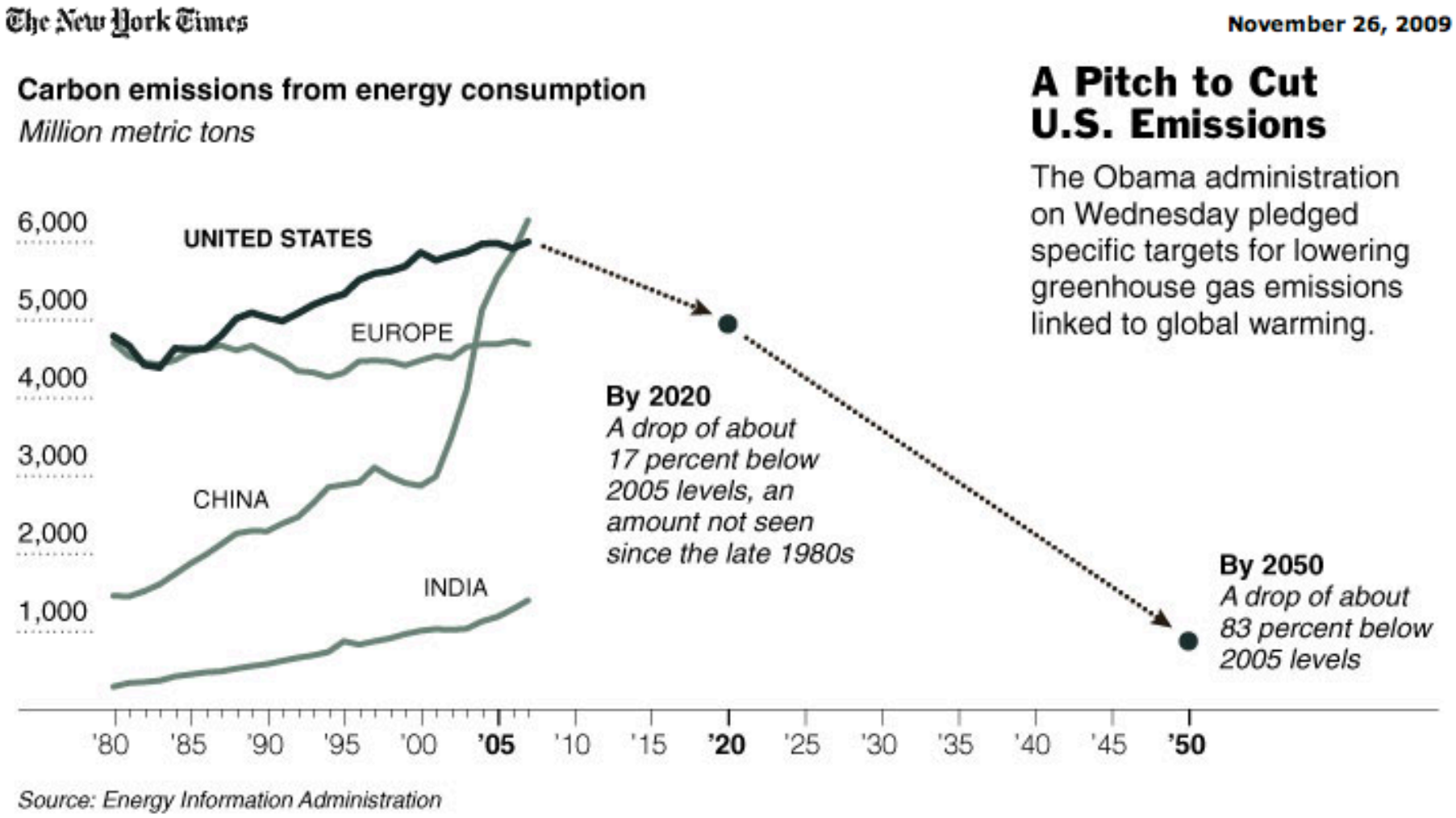
- **August 2015**: The EPA **finalized** its **Clean Power Plan**.

# A Quantitative Review of Current U.S. GHG Emissions and GHG Control Pledges

# U.S. Energy-Related $CO_2$ Emissions: 1973-2014



# Obama's 2009 Provisional Pledge
# Just Prior to COP-15 in Copenhagen



# In 2013, Obama Announced His "Climate Action Plan"

1. **Reduce U.S. GHG Emissions Substantially**

2. **Prepare for Impacts of Climate Change**

3. **Provide Leadership in International Efforts**

# Reducing GHG Emissions under the Climate Action Plan

**Electricity**

- Reduce **existing power plant** emissions
- Promote use of **renewable power**
- Promote **advanced fossil energy projects**

**Transportation**

- Increase vehicle **fuel economy**
- Develop and deploy **advanced transportation technologies**

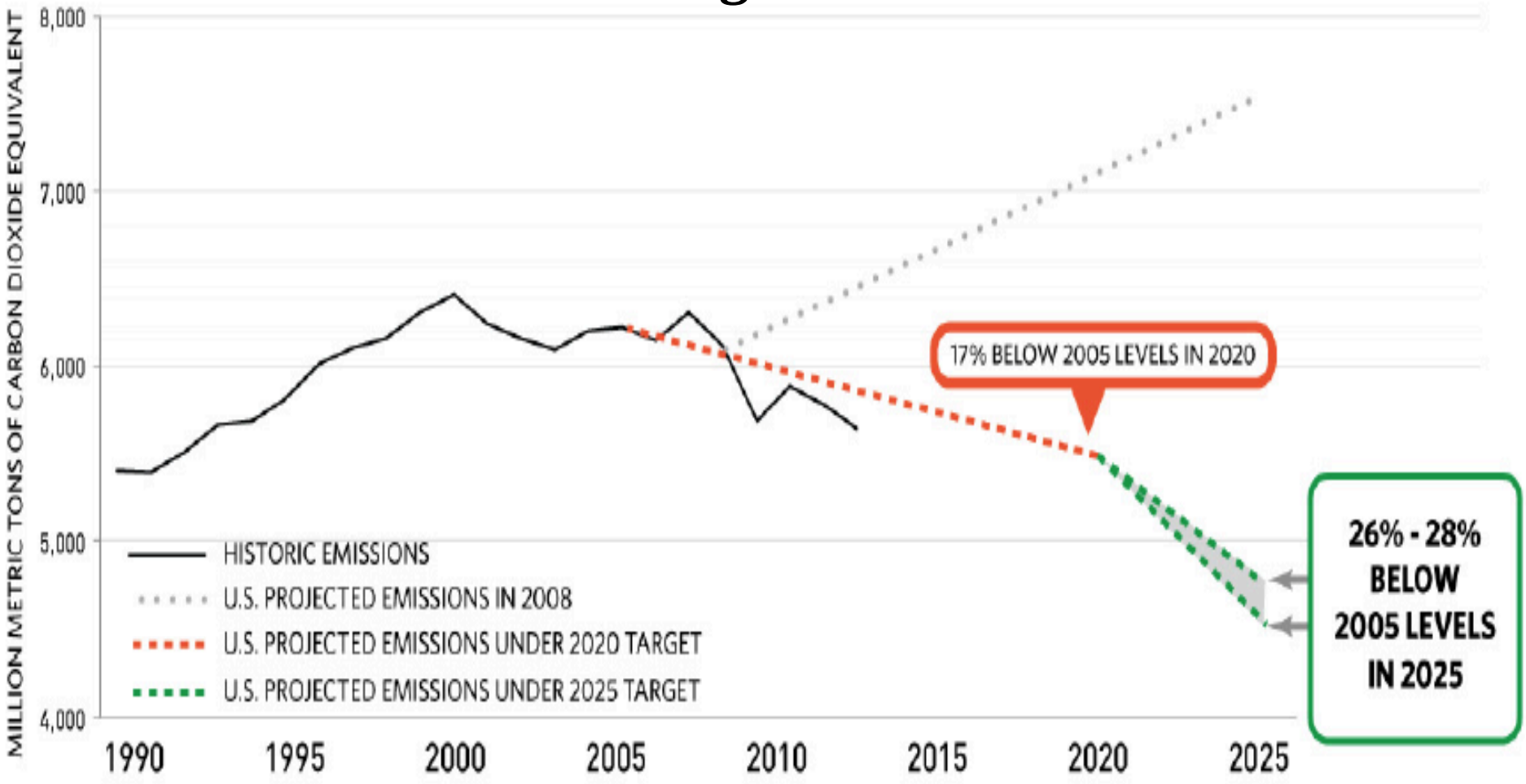
**Buildings**

- Increase **energy efficiency** practices and investments

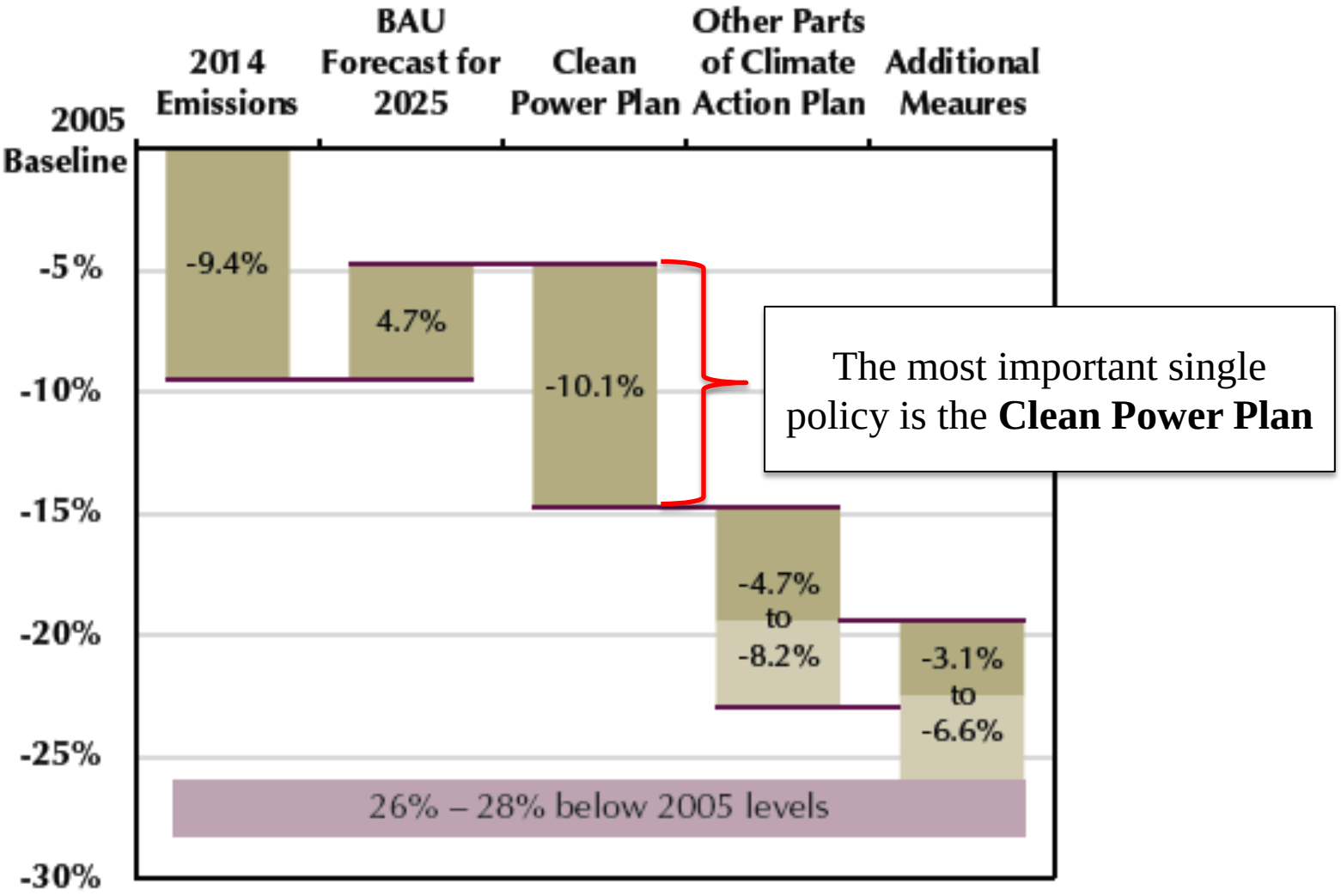
**Non-Carbon Emissions**

- Reduce **HFC** emissions
- Reduce **Methane** emissions

# U.S. Emissions under COP-15 Target for 2020, and "Intended Nationally Determined Contribution" INDC Target for 2025



# Broad Plan for Achieving the U.S. "Intended Nationally Determined Contribution" Targets

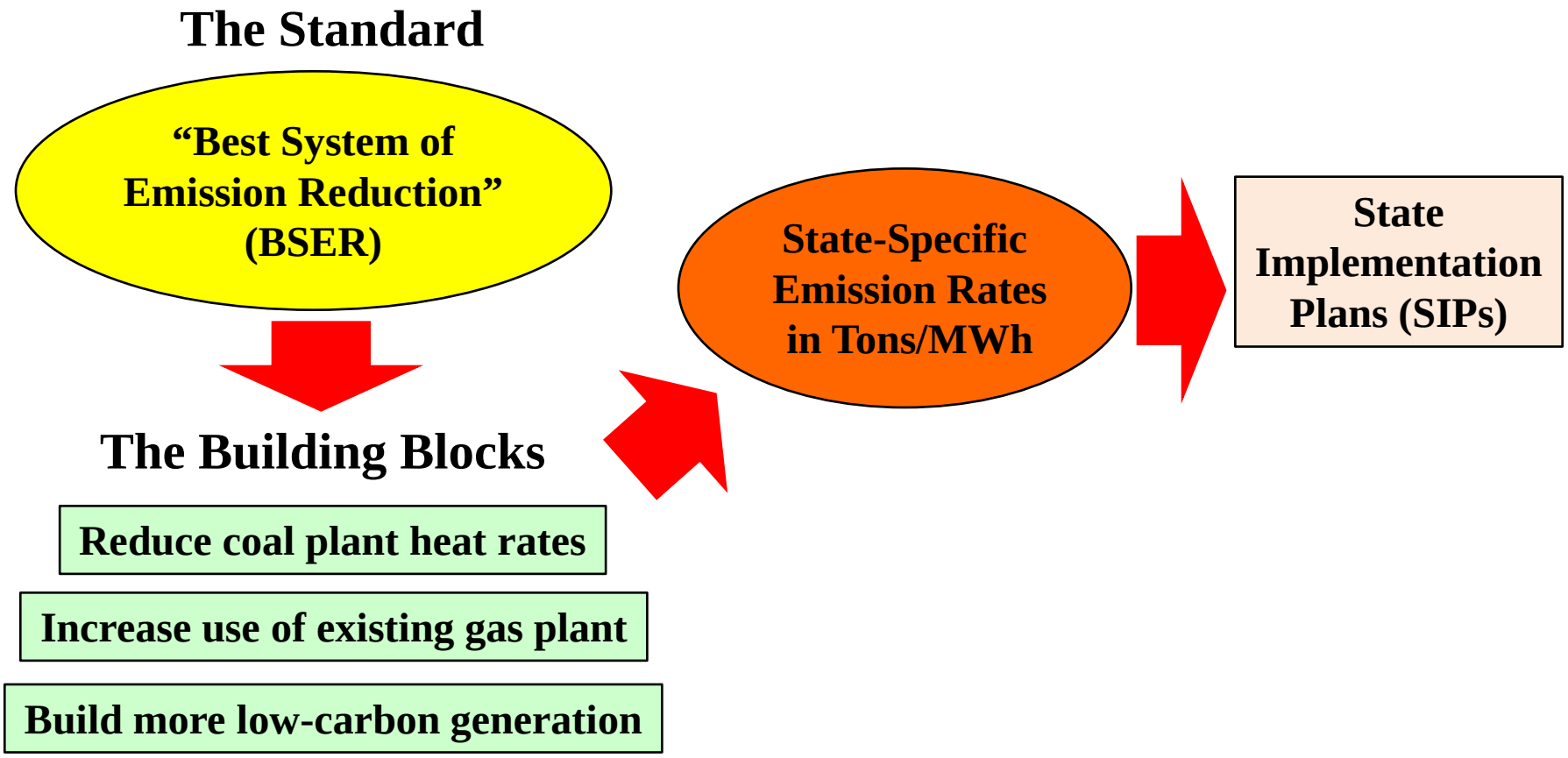


# The Environmental Protection Agency's "Clean Power Plan"

# EPA's *Final* Clean Power Plan

- The final Clean Power Plan requires **32% reductions** of CO2 emissions (compared to 2005 levels) **from existing power plants** by the year **2030**.
- The EPA has asserted its authority under Section III(d) of the CAA to impose "**Best System of Reduction**" (**BSER**) on the electric power sector.
- The EPA has established BSER standards for each state by **modeling** the results of applying **three well-known** feasible and cost-effective **"building block" strategies** for reducing power plant source emissions.
- **States have broad flexibility** in achieving their **overall BSER goals**. They need not apply the building blocks in the specific ways modeled by the EPA for their state.
- Each state must file a **State Implementation Plan** (SIP) for achieving its designated BSER goal.

# The Broad Framework of the Clean Power Plan



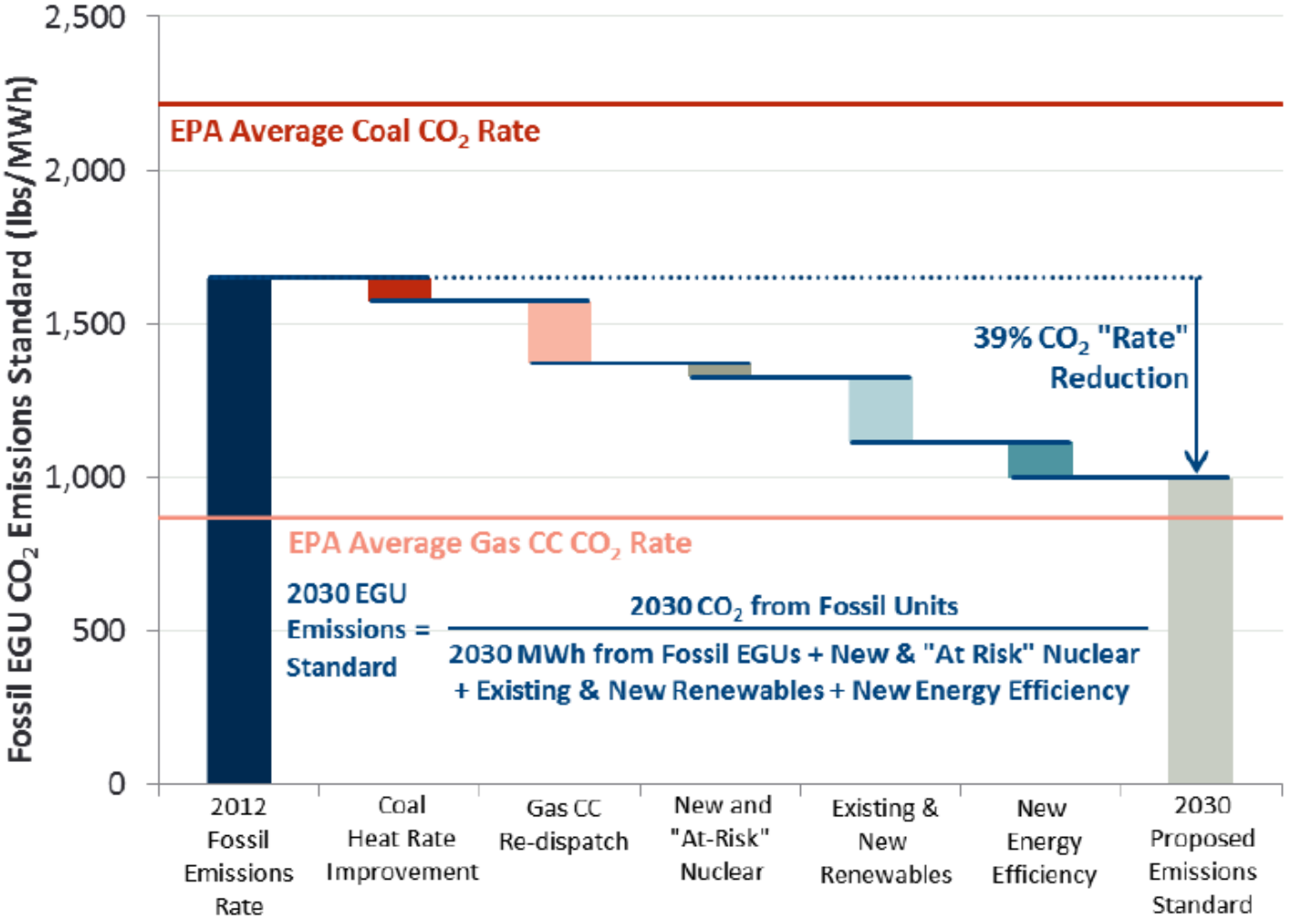
# The EPA's Four Building Blocks and *Specific Modeled "BSER" Strategies*

| **Building Blocks** | **EPA Modeling Assumption** |
|---|---|
| 1. Make **coal-fired plants** more emissions efficient | • **6%** efficiency improvements thru O&M and capital investments |
| 2. Increased use of existing **natural gas plants** | • Increase average **capacity factors** of existing very efficient Natural Gas Combined Cycle (NGCC) plants to **70%** |
| 3. Increased use of **low-carbon and zero-carbon generation** | • Achieve **renewables development** consistent with average regional renewables targets; preserve the 6% of **nuclear plants** forecast to be retired; successfully complete new nuclear plants now under construction |

# The EPA's Three Building Blocks and *Potential State Compliance Strategies*

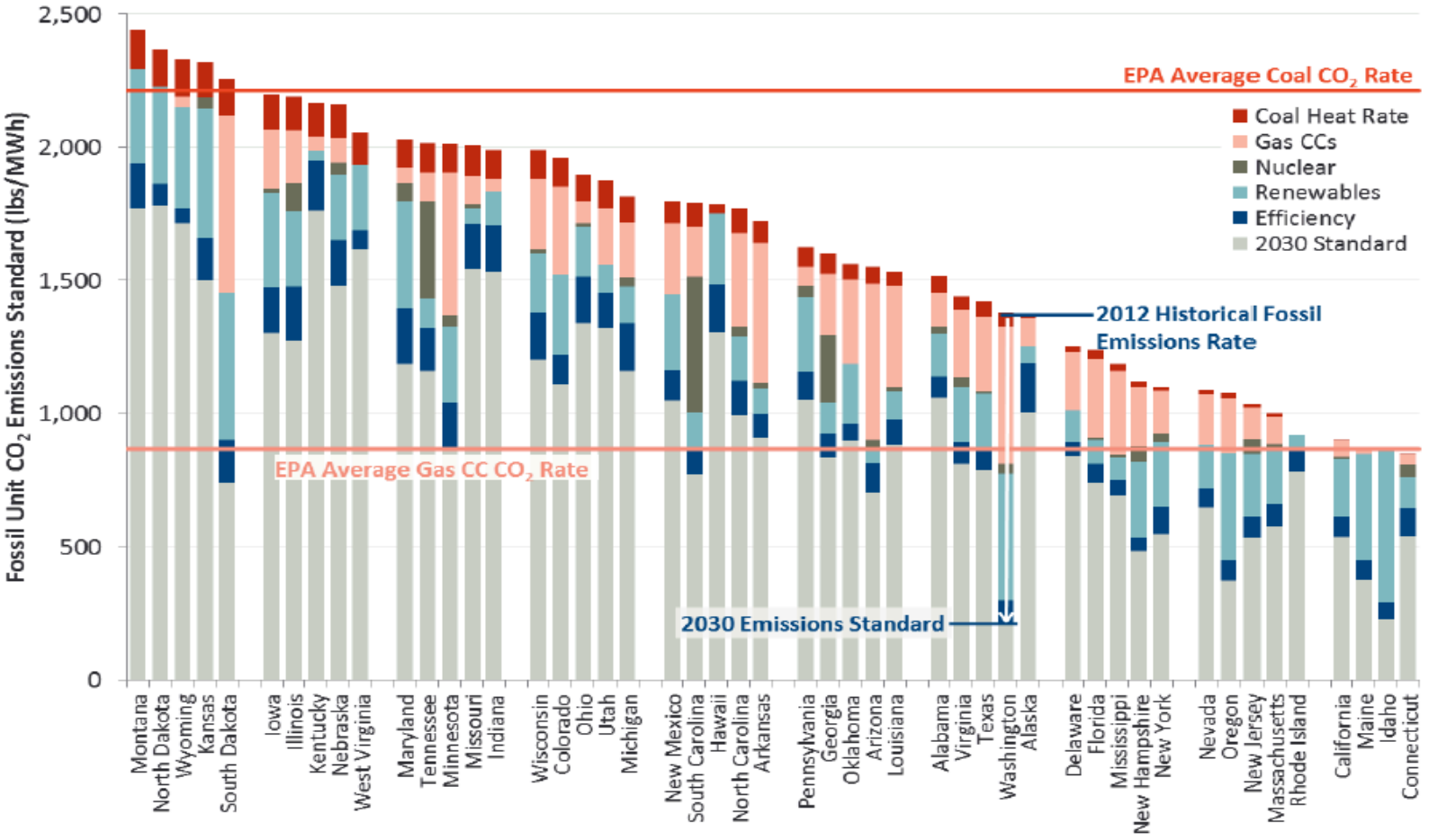
| Building Blocks | Potential Strategies |
|---|---|
| 1. Make coal-fired plants more carbon emissions efficient (reduce $CO_2$ per MWh) | • Increase input-out efficiency of coal plants<br>• **Co-fire** coal with natural gas or other lower-carbon fuel (e.g., closed-loop biomass)<br>• **Repowe**r coal plant to **burn gas**<br>• **Retire** coal plants<br>• Retrofit **Carbon Capture & Sequestr**ation (CCS) to an existing coal plant<br>• Retirement of **high-emitting gas plants** |
| 2. Increased use of existing natural gas plants | • Increase dispatch of NGCC<br>• More emissions-efficient **regional dispatch** |
| 3. Increased use of low-carbon and zero-carbon generation | • New renewables (including closed-loop biomass)<br>• Preserve existing nuclear<br>• New nuclear<br>• **New Cogeneration**<br>• **New NGCC**<br>• **New coal with CCS** |
| Other compliance measures beyond source-based "building blocks" | • Increased **customer energy efficiency** ("conservation programs")<br>• **Transmission efficiency** improvements |

# National Average Electricity Sector Emissions Rate Reductions (lbs/MWh) under Clean Power Plan

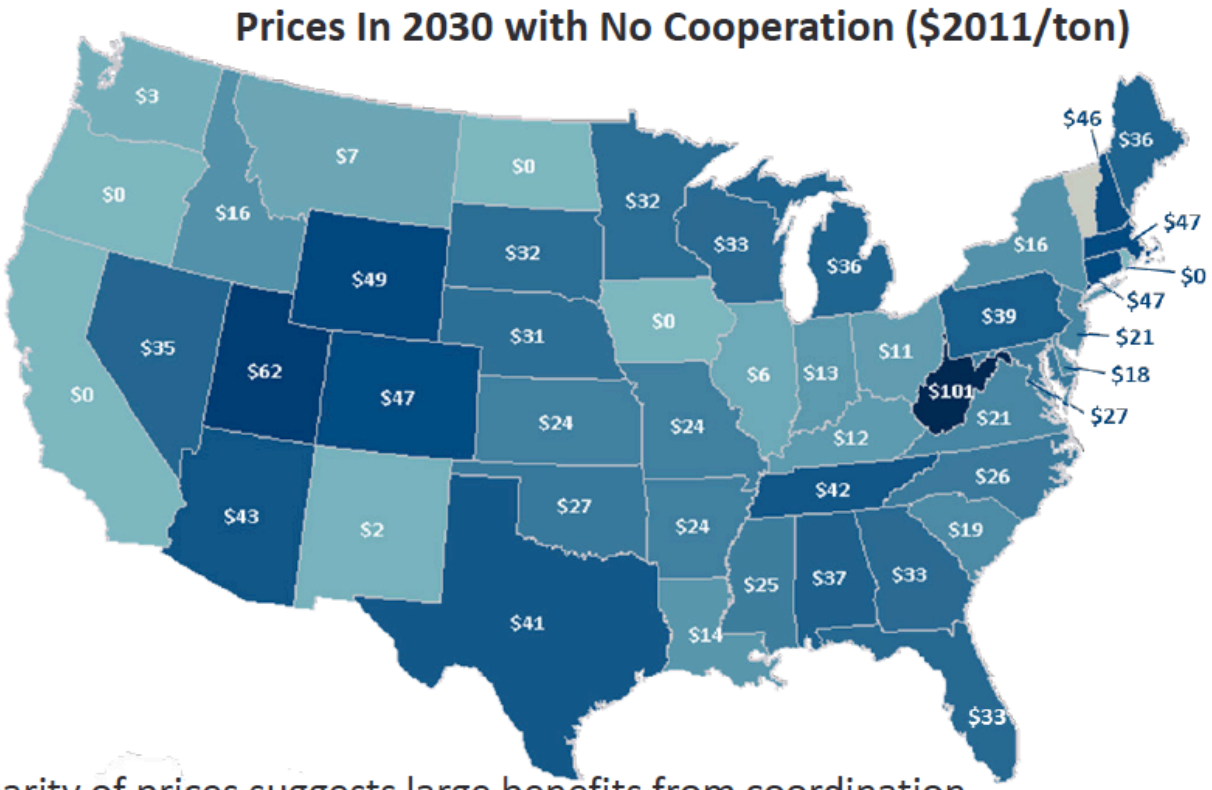


# Clean Power Plan Emissions Standards by State:

## State standards vary considerably relative to current fossil emissions levels due to modeled emission reduction opportunities



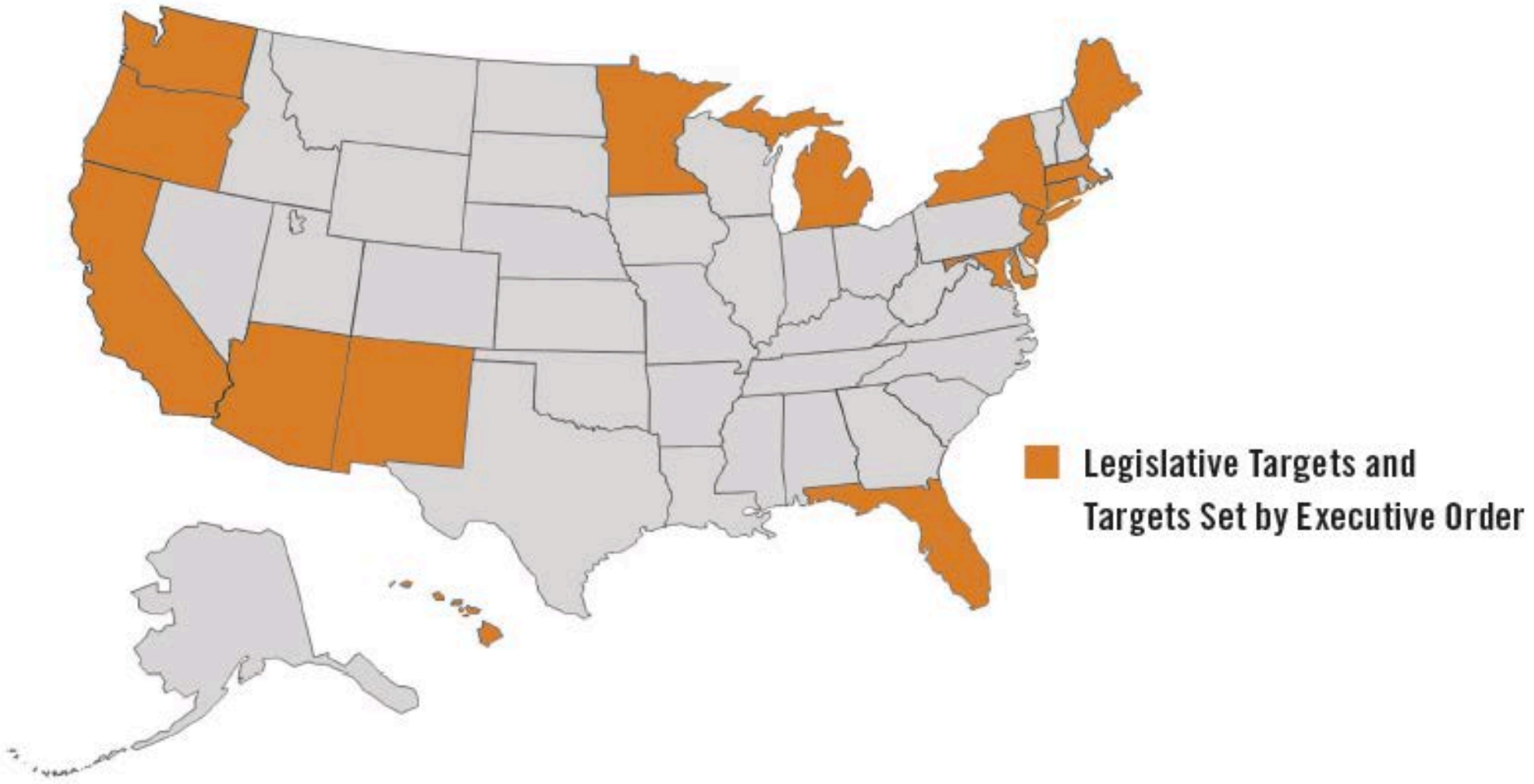
# EPA's Calculated Marginal Cost of $CO_2$ Control Indicates Gains Are Available from Regional Cooperation




- Disparity of prices suggests large benefits from coordination
- National average cost of compliance is $15 per ton without interstate cooperation
- EPA's modeled rate-based cooperation reduces the average compliance cost to $13/ton
- Mass-based allowance trading would likely reduce the compliance cost even further

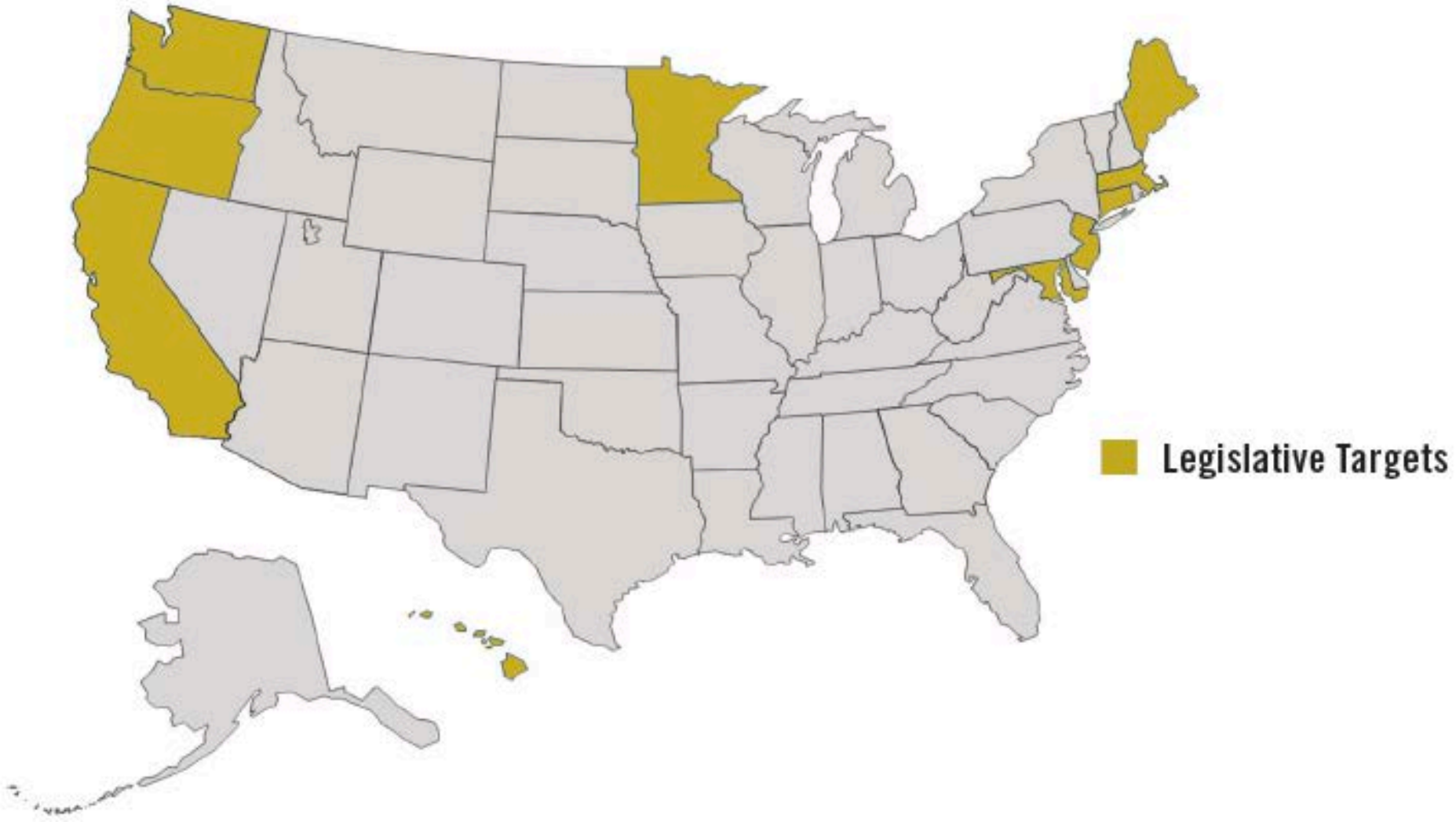
# Independent State GHG Policies

# States with Mandatory GHG Reduction Targets Set by Legislation or Governor's Executive Order



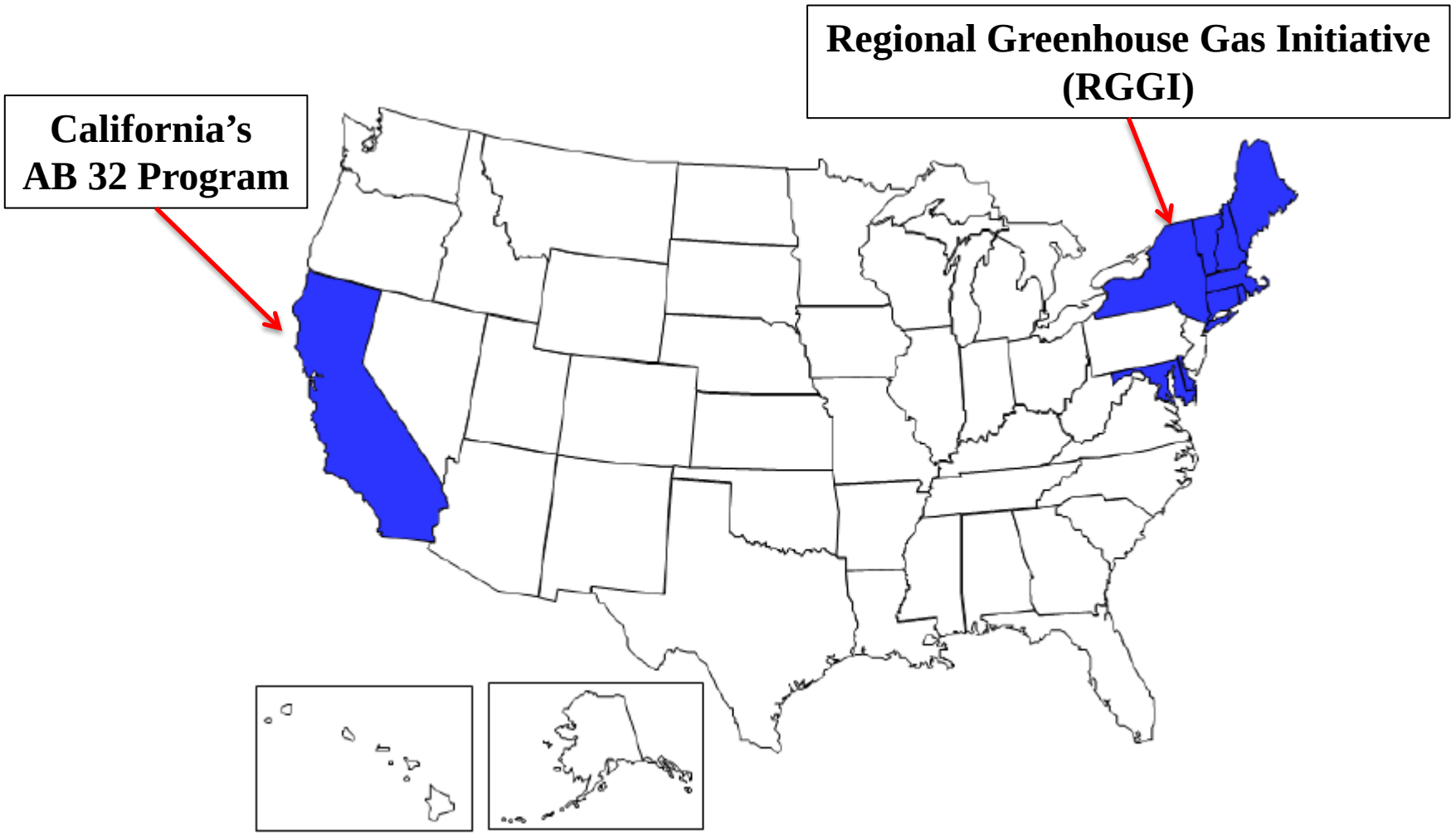

**Source: WRI**

# States with GHG Reduction Targets Set by Legislation




**Source: WRI**

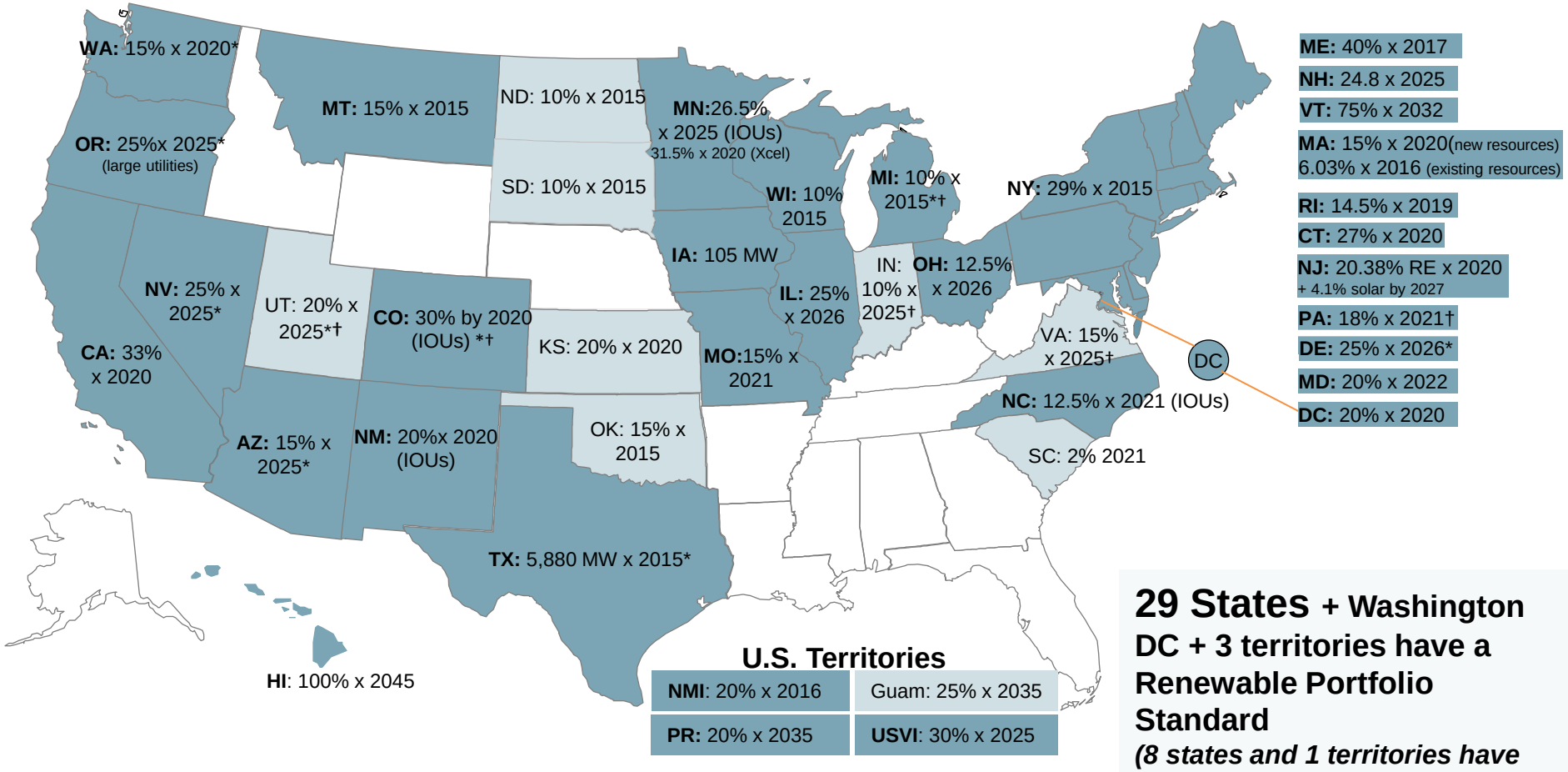
# States with Active GHG Cap-and-Trade Programs




Source: EPA's "Survey of Existing State Policies and Programs"

# Renewable Portfolio Standard Policies

**www.dsireusa.org / June 2015**




## U.S. Territories

| | |
|---|---|
| **NMI**: 20% x 2016 | Guam: 25% x 2035 |
| **PR:** 20% x 2035 | **USVI**: 30% x 2025 |

**29 States + Washington DC + 3 territories have a Renewable Portfolio Standard**
***(8 states and 1 territories have renewable portfolio goals)***

Renewable portfolio standard

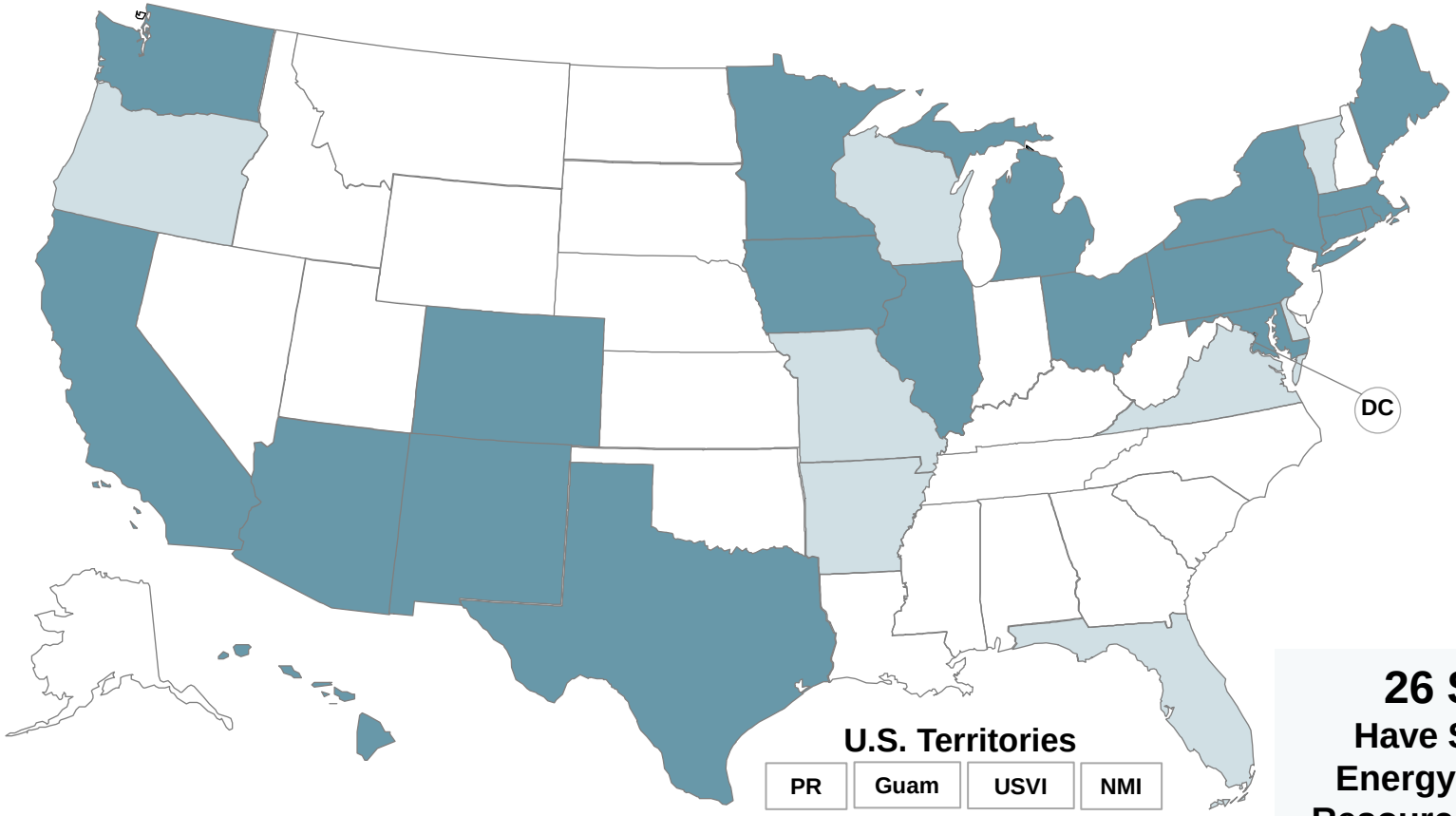
Renewable portfolio goal

* Extra credit for solar or customer-sited renewables

† Includes non-renewable alternative resources

# States with Energy Efficiency Resource Standards (and Goals)

**www.dsireusa.org / March 2015**




**26 States**
**Have Statewide Energy Efficiency Resource Standards (or Goals)**

States with an Energy Efficiency Resource Standard

States with an Energy Efficiency Resource Goal

No State Standard or Goal

# Leading from the States: California's Climate Change Policies

# California's Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32)

- California is the **12th largest emitter** of GHGs worldwide.
- **Beginning in 2012**, the California Air Resources Board was required to develop regulations and market mechanisms to reduce GHG emissions to **1990 levels** by 2020—a **25% reduction below forecast BAU in 2020.**
- In **2013,** the **cap-and-trade program** became effective for electric utilities and large industrial facilities.
- In **October 2013,** California and the **Province of Quebec** linked their cap-and-trade programs making compliance allowances interchangeable starting on January 1, 2014.
- In **2015**, the **cap-and-trade program** began being applied to **fuel distributors** (e.g., gasoline, natural gas, etc.)

# California's Low-Carbon Fuel Standard

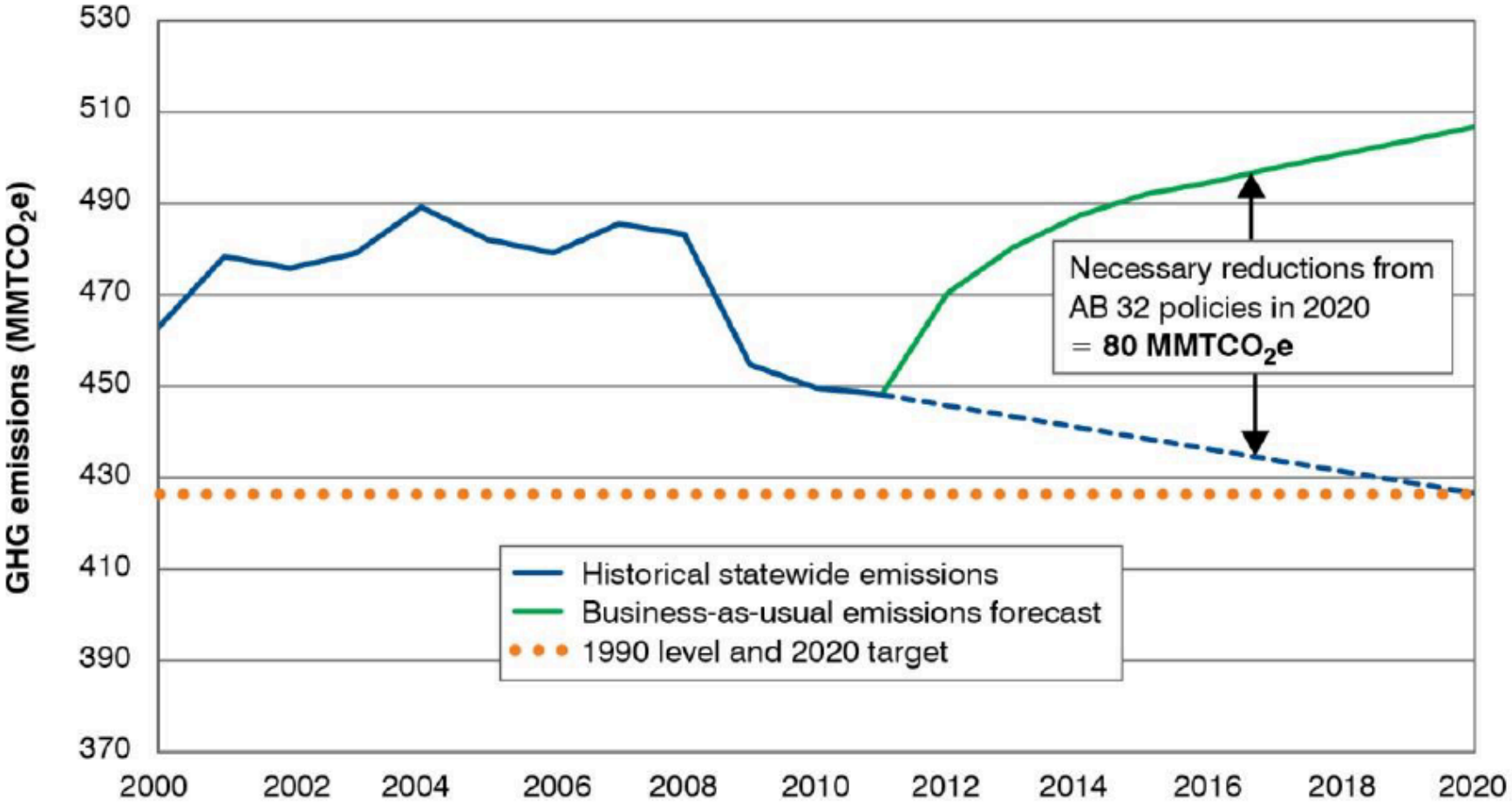
- Governor Schwarzenegger issued **Executive Order S-1-07 in 2007** creating the world's first low-carbon fuel standard.

- The LCFS call for a reduction of at least **10% in the carbon intensity of transportation fuels by 2020.**

- The LCFS is based on all **"well-to-wheels" and "seeds-to-wheels"** GHG emissions due to production, distribution and use of transportation fuels.

- The LCFS is a "**technology-forcing**" policy intended to:
  1. Reduce CA's dependence on petroleum;
  2. Create a market for clean transportation technology;
  3. Stimulate the production and use of alternative, low-carbon fuels

# The Basic Goal of AB 32: Roll California GHG Emissions back to 1990 Levels by 2020

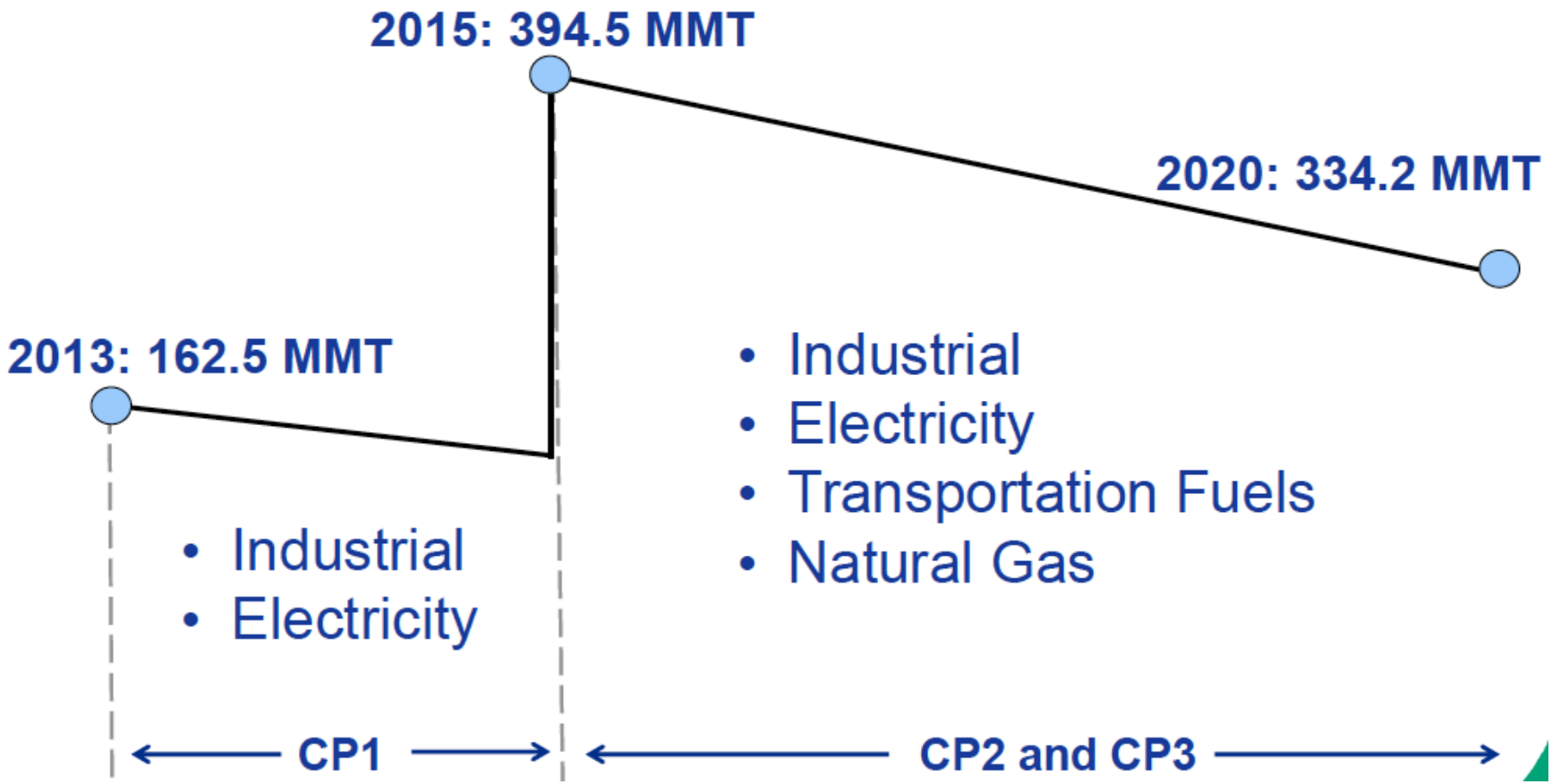



Source: Historical 2000 to 2011 GHG Emissions Data and Emissions Forecast from California Air Resources Board

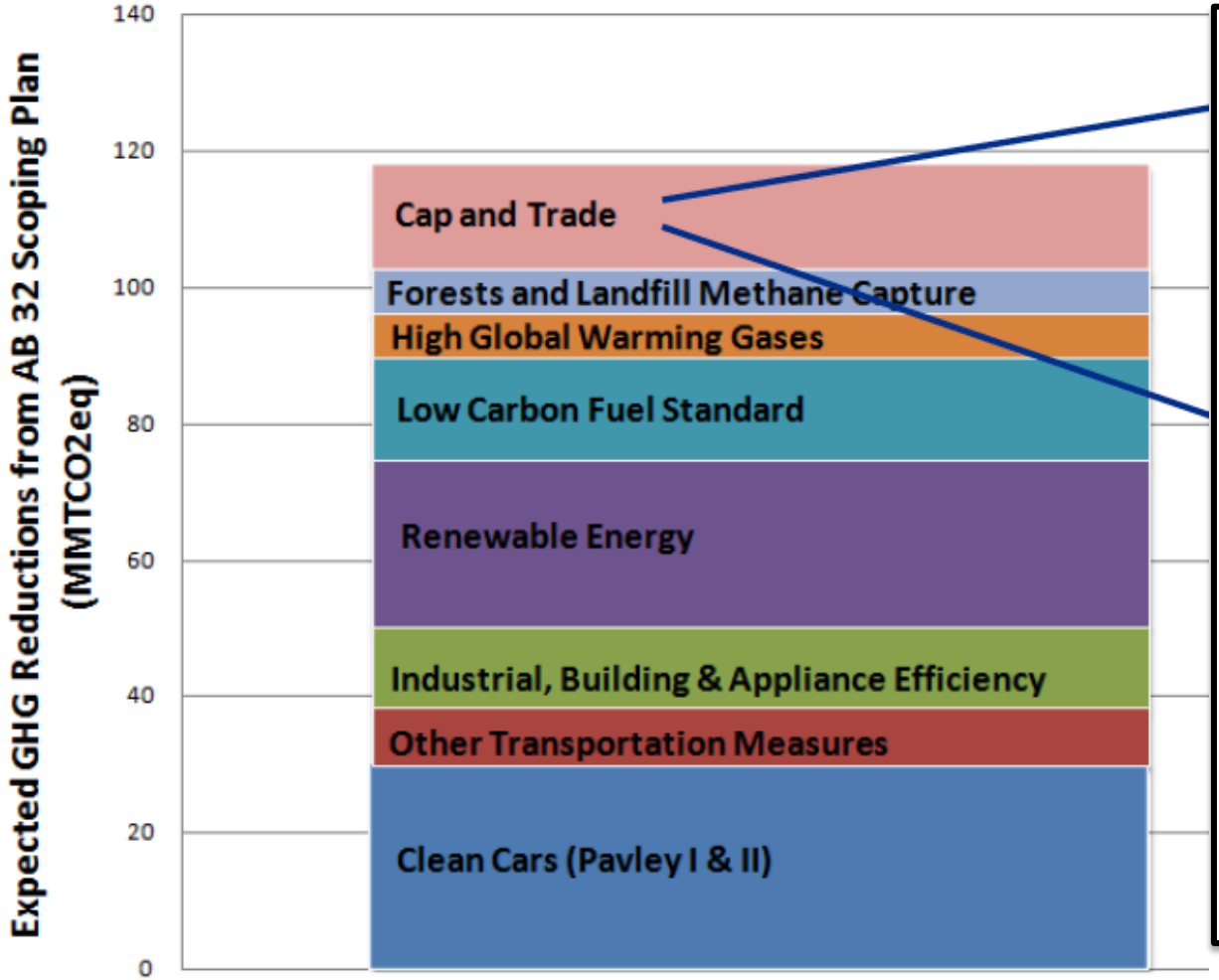
# California's Plan Is Comprehensive

1. Electric Power
2. Transportation
3. Commercial and Residential (especially building and appliance efficiencies)
4. Industrial Facilities
5. Recycling and waste
6. High Global warming Potential Gases (e.g. refrigerants)
7. Agriculture
8. Forests and other natural lands

# Phasing-in of Sectors Covered by Cap-and-trade



# Seven Major Complementary Policies for Achieving California's GHG Reduction Goals

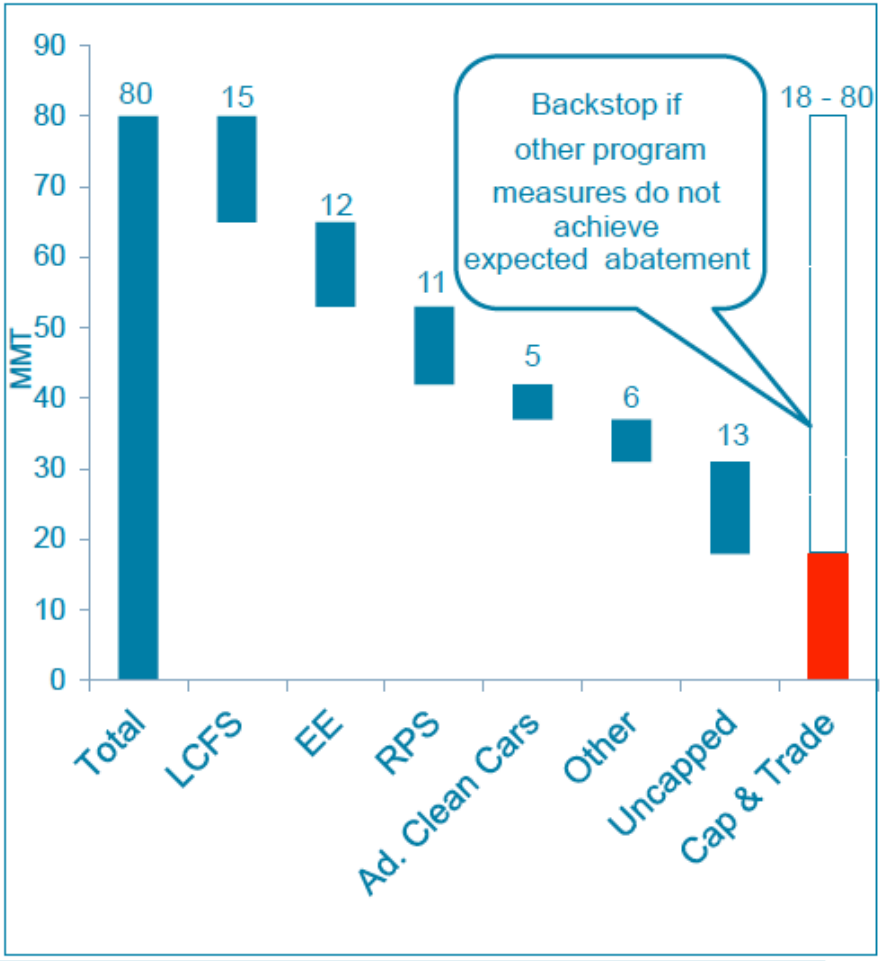



**Cap-and trade:**

- **90% of the attention, but only 20% of the reductions**
- **Hopefully will drive $billions in investments, and serve as a model and coordination device for national and international collaboration and participation**

# Seven Major Complementary Policies for Achieving California's GHG Reduction Goals

- **Low Carbon Fuel Standard**
  - Reduce carbon intensity of transportation fuels by 10% (below 2010) by 2020
- **Energy Efficiency (EE)**
  - Utility programs, state buildings and standards
- **Renewable Portfolio Standards (RPS)**
  - Procure 33% from eligible renewables by 2020
- **Advanced Clean Cars**
  - Mandate auto manufacturers to sell PEVs, and Fuel Cell vehicles by 2020
- **Other Measures**
  - Million solar roofs, high speed rail, regional targets
- **Measures in uncapped sectors**
  - Refrigerant tracking, sustainable forests, landfill methane control measure
- **Cap & Trade**
  - Backstop to ensure reductions are achieved regardless of the performance at other program measures.

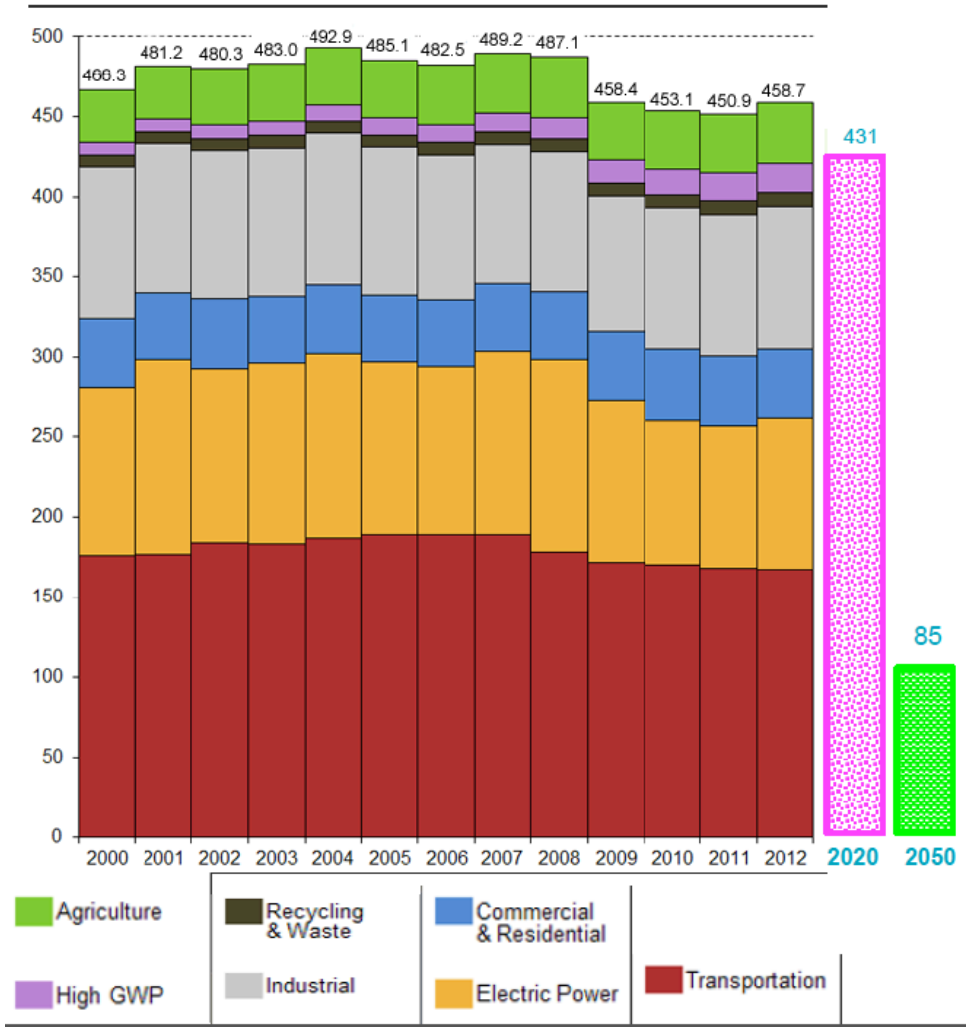


# California's Climate Change Policies: *Some* Future Challenges

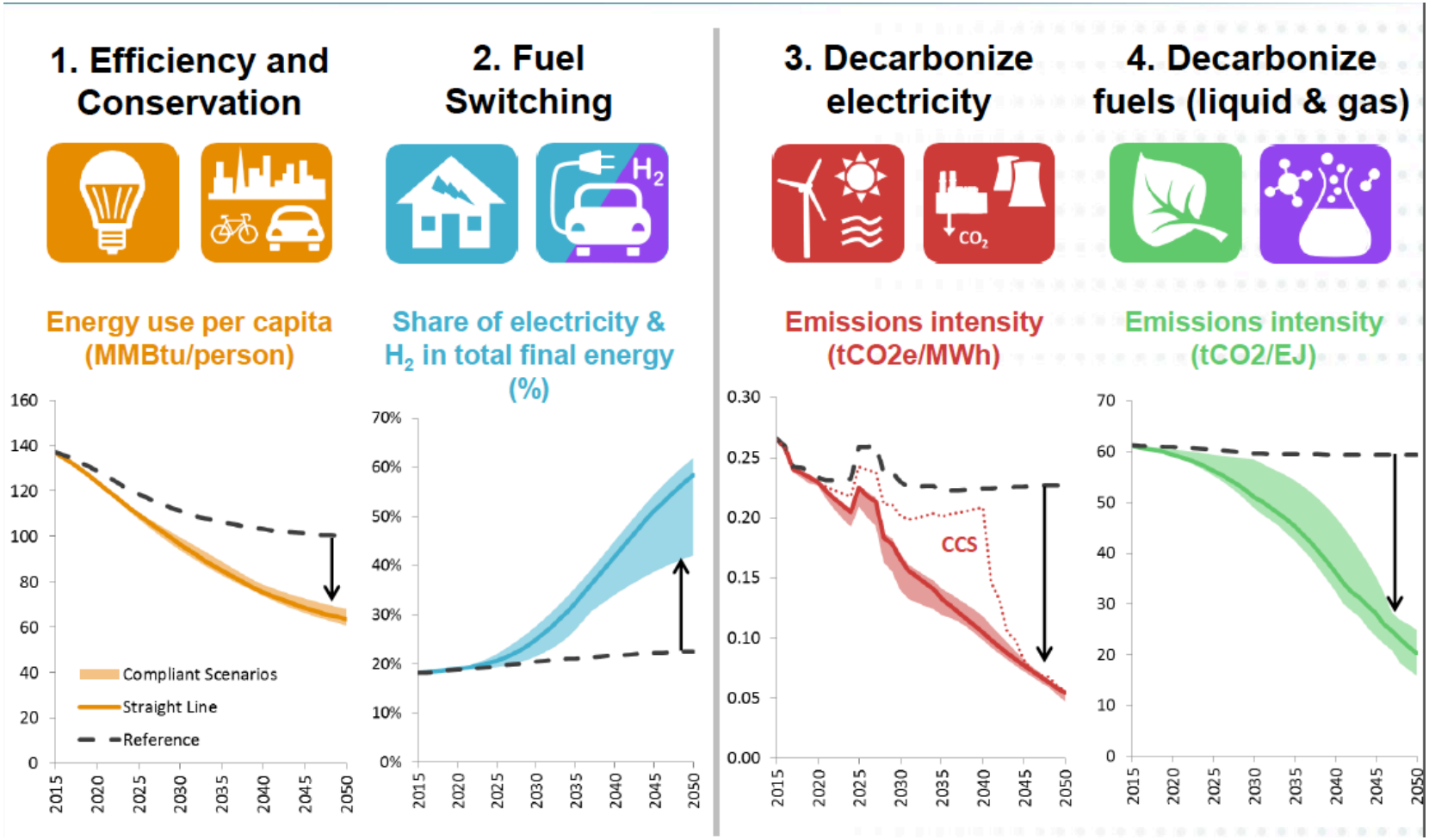
# California Continues to Push Aggressive Policy Goals

- On January 5, 2015, CA's Governor Gerry Brown proposed increasing CA's **RPS** to **50% by 2030**.
  - CA's current RPS is 33% by 2020
- On April 29, 2015, Brown issued an Executive Order setting a goal of reducing **all GHG emissions** by **40% below 1990 levels by 2030**.
- On June 3, 2015, the CA **Senate passed SB 32** (Pavley) setting a goal of **40% reductions below 1990 levels** by 2030 and **80% reductions by 2050**.
  - The 80% by 2050 goal had originally been set by Schwarzenegger Executive Order 5-3-05 in 2005
- Pending CA **Senate Bill 350** (De Leon) would mandate by **2030** a 50% reduction in petroleum use, a 50% RPS, and a 50% increase in building energy efficiencies.

# Achieving an 80% Reduction in GHGs by 2050 Will Require Huge Contributions from All Sectors but Transportation and Electricity are Especially Important



# E3: Decarbonizing California's Economy Depends on Four Critical Energy Transitions

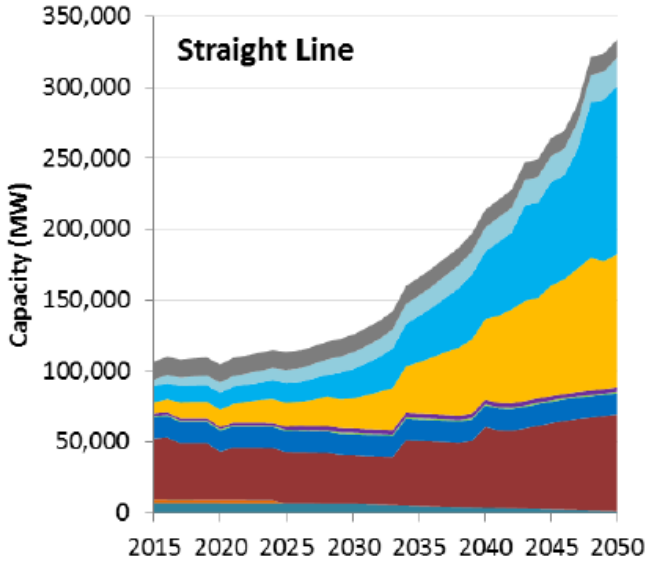



**Source: Energy+Environmental Economics (E3)**, "California Pathways: GHG Scenario Results", April 6, 2015

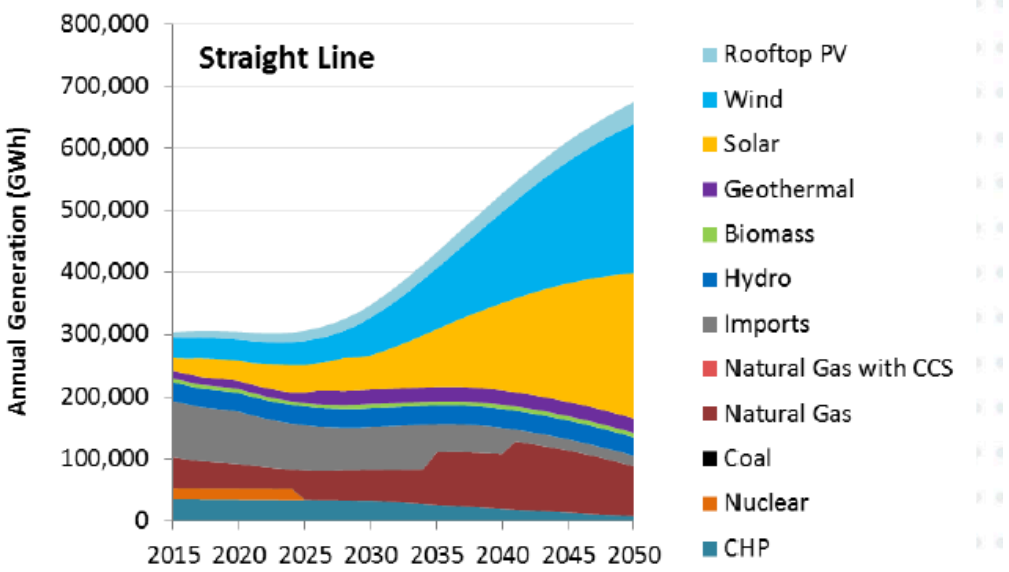
# E3: Electricity Generation Increases Significantly Due to Fuel Switching in Buildings, Industry, and Transportation

- **Low-carbon electricity is primarily provided by solar and wind resources, natural gas generation continues to provide energy when solar and wind are not available**
- **Electric loads increase significantly between 2030 – 2050 due to fuel switching in buildings, industry & transportation**

Generating capacity by fuel type



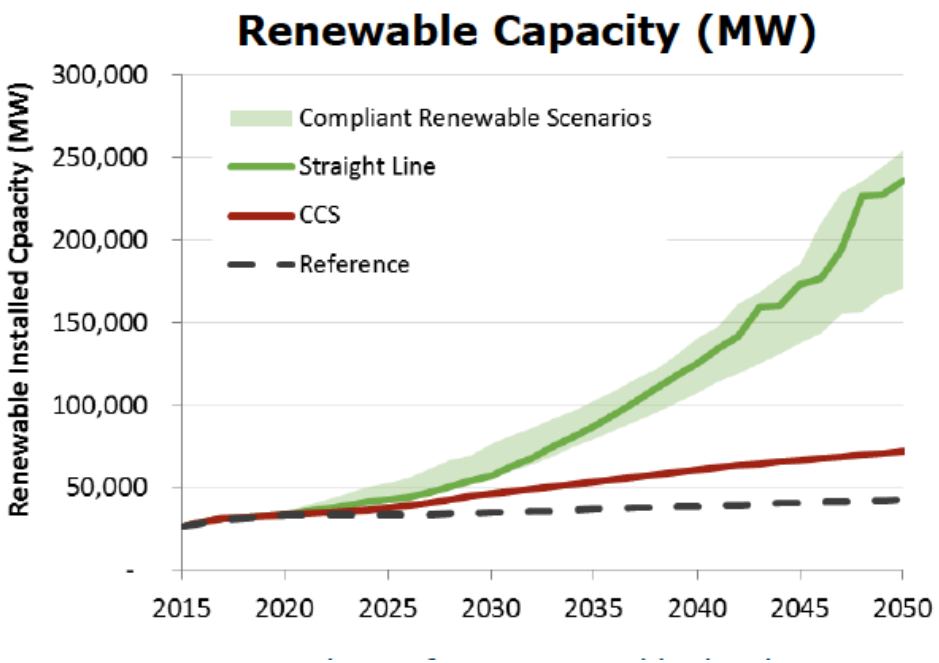

Annual Generation by fuel type




**Source: Energy+Environmental Economics (E3)**, "California Pathways: GHG Scenario Results", April 6, 2015

# E3: Electricity is Decarbonized Though Huge Additions of Renewables

+ **Straight line scenario targets 50% renewables in 2030**
  - 75 – 86 % renewables in 2050, except for CCS scenario
+ **Renewable capacity needs increase dramatically post-2030 due to higher electric loads and higher renewable goals**




**Integration solutions needed:**

+ Hydro & thermal generation
+ Renewable diversity, regional coordination, renewable curtailment
+ Increased reliance on flexible loads, especially flexible fuel production (grid electrolysis) in scenarios with fuel cell vehicles
+ 4-8hr stationary storage is needed in high BEV scenario due to no flexible grid electrolysis

**Source: Energy+Environmental Economics (E3)**, "California Pathways: GHG Scenario Results", April 6, 2015

# Decarbonizing Fuels and Fuel Switching Involve Two Basic Complications in California

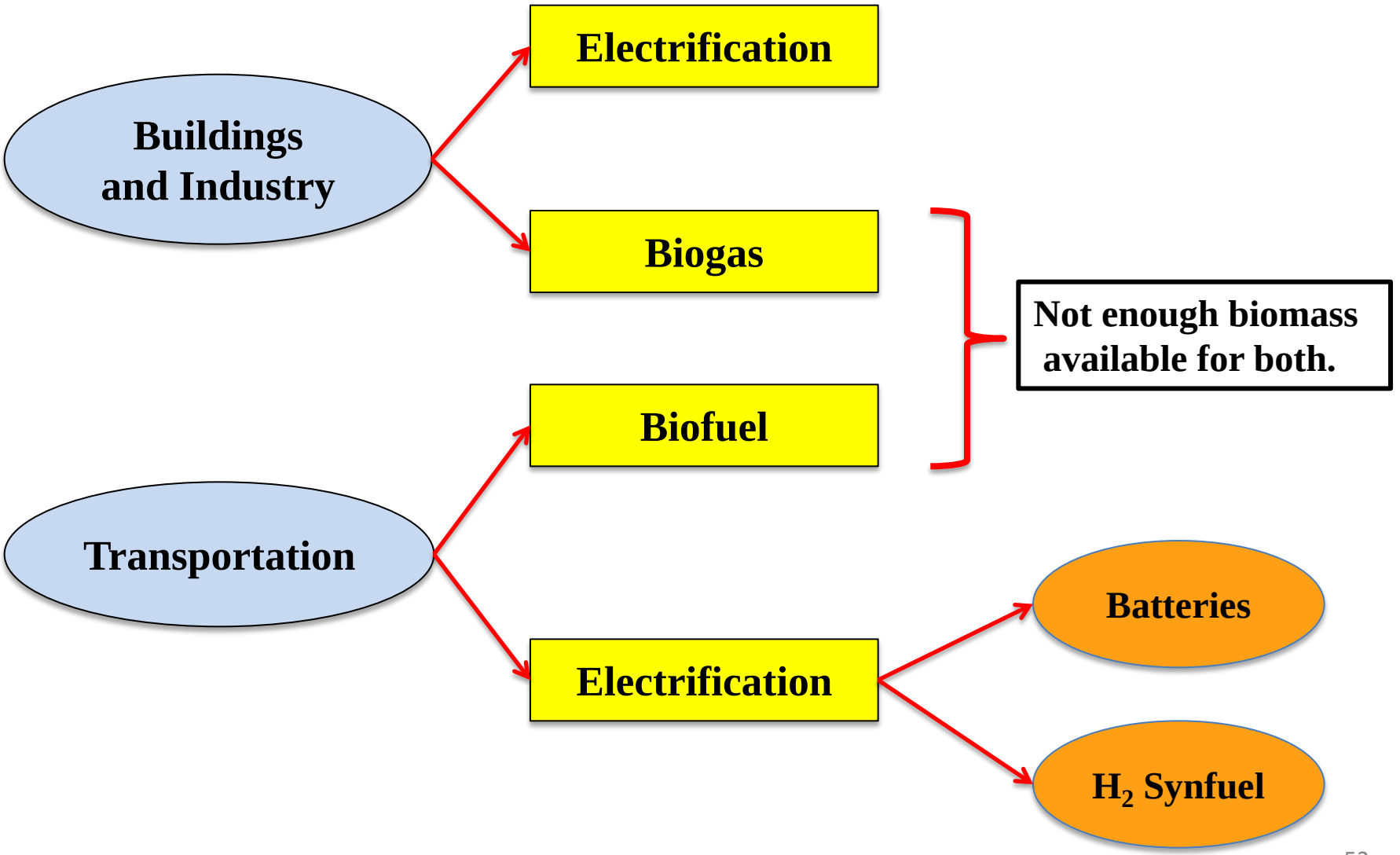
**Insufficient Biofuels:**

- **Not enough biofuels available to decarbonize *both* the transportation and building & industry sectors.**

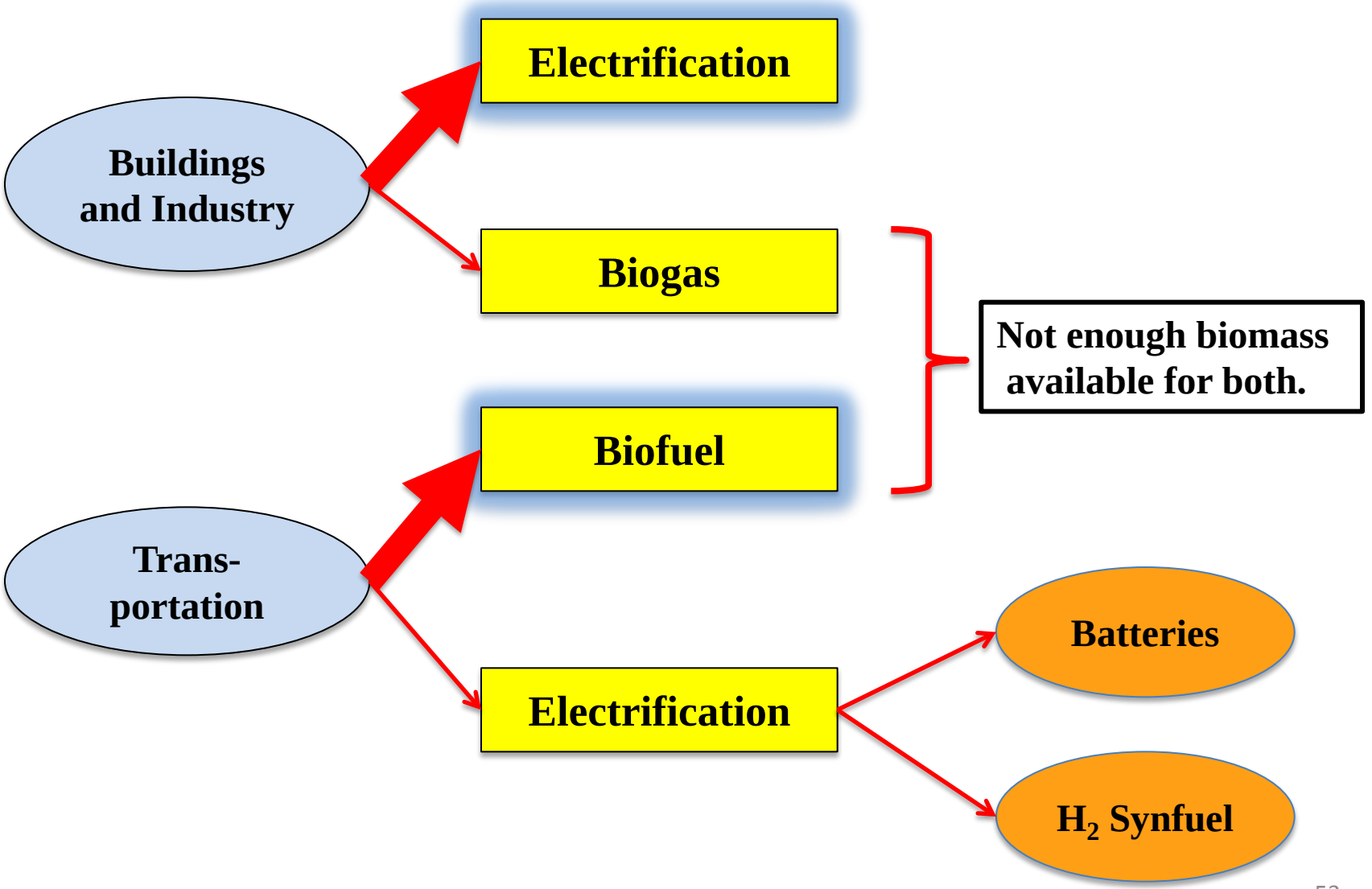
**Renewable Electricity "Overgeneration":**

- **Substantial increases in renewable power generation will create system "overgeneration" problems that can be dealt with through either:**
  - **Long-term storage (likely batteries)**
  - **Producing $H_2$ synfuel by hydrolysis**

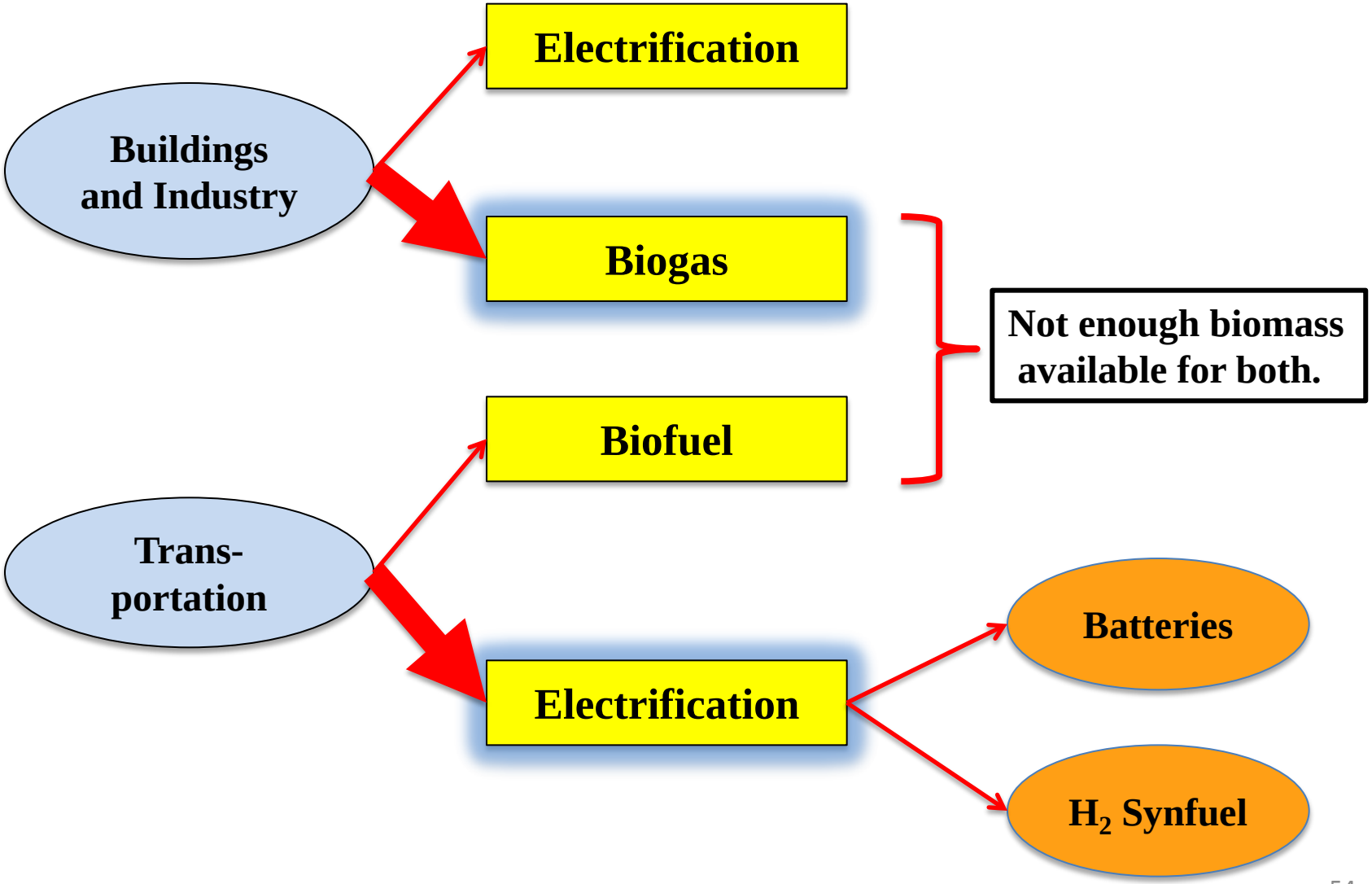
# Basic Decarbonization Choices



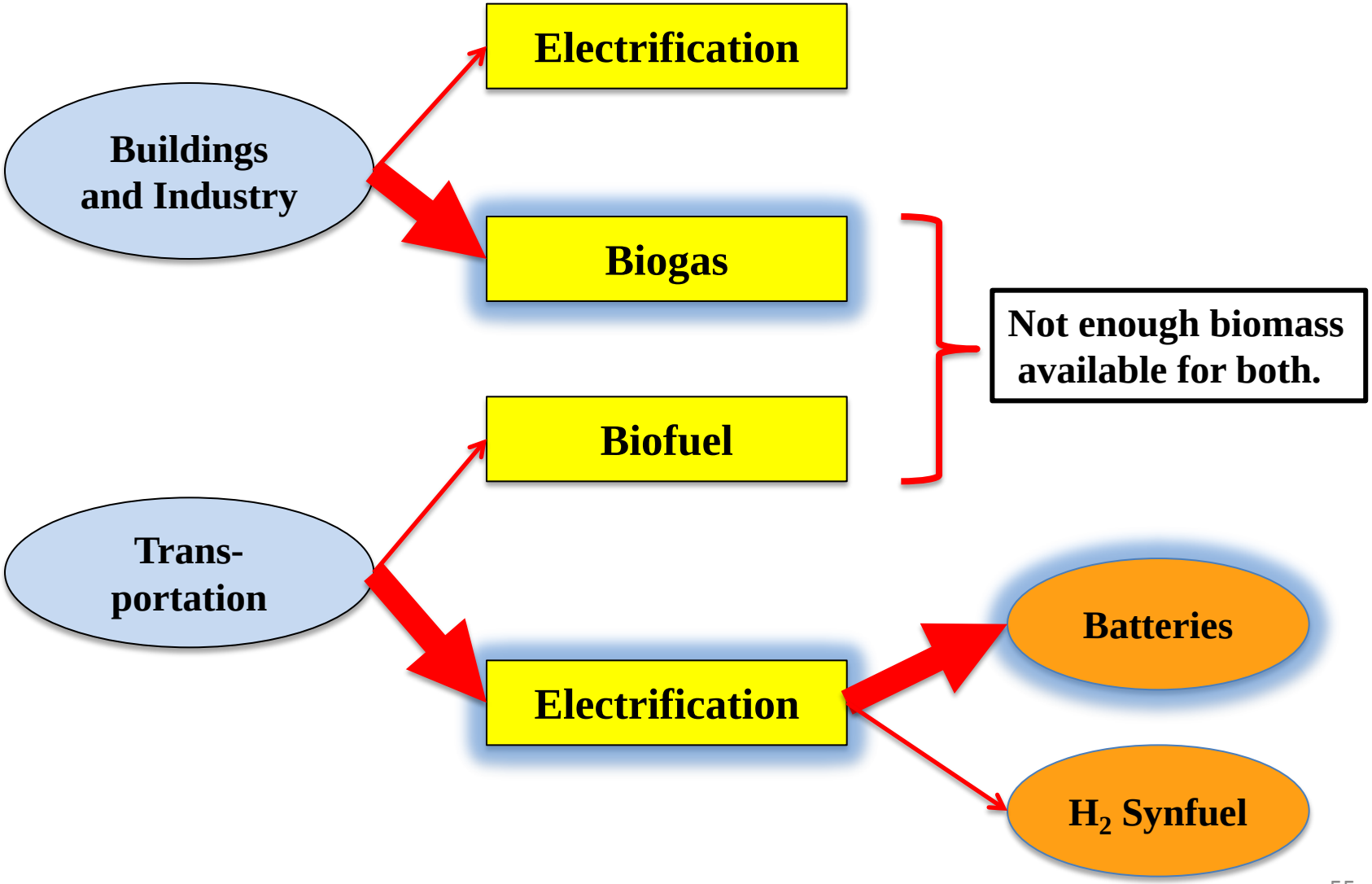
# Strategy 1: Electrify Buildings and Use Biofuels for Transportation



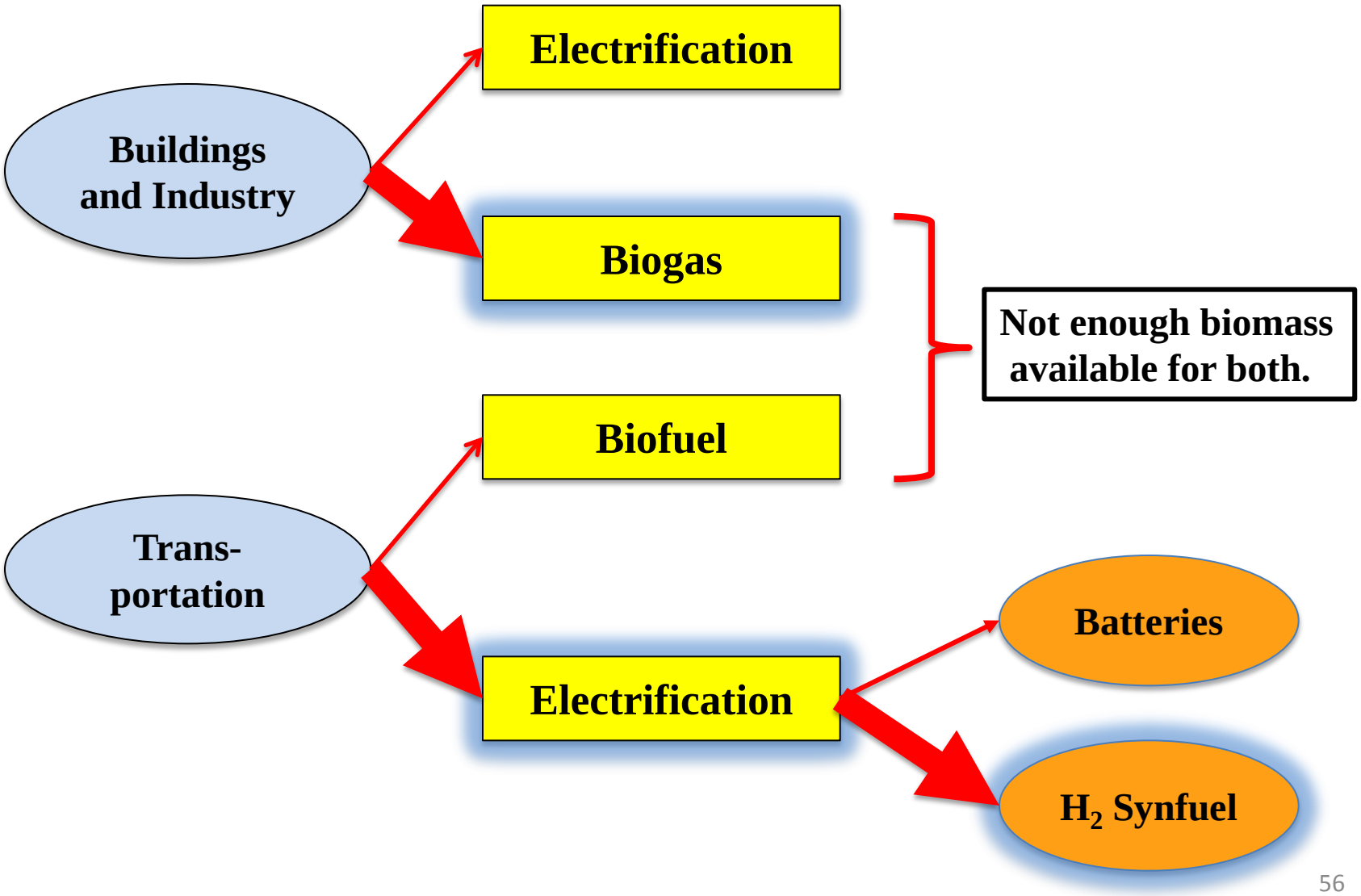
# Strategy 2: Use Available Biomass for Biogas to Buildings, and Electrify Transportation



# Strategy 2A: Need Substantial Amounts of System Electricity Storage with BEVs



# Strategy 2B: Little or No System Storage Needed under $H_2$ Hydrolysis and Synfuels



# Thank You

# Any Questions?