AN HISTORIC OPPORTUNITY

EPA 111(d)

ADVANCED ENERGY ECONOMY

ENERGY SERVICES COALITION MEETING
ST. PAUL MINNESOTA

EPA HAS BEEN MOVING THROUGH CARBON EMISSION SECTORS SINCE 2007

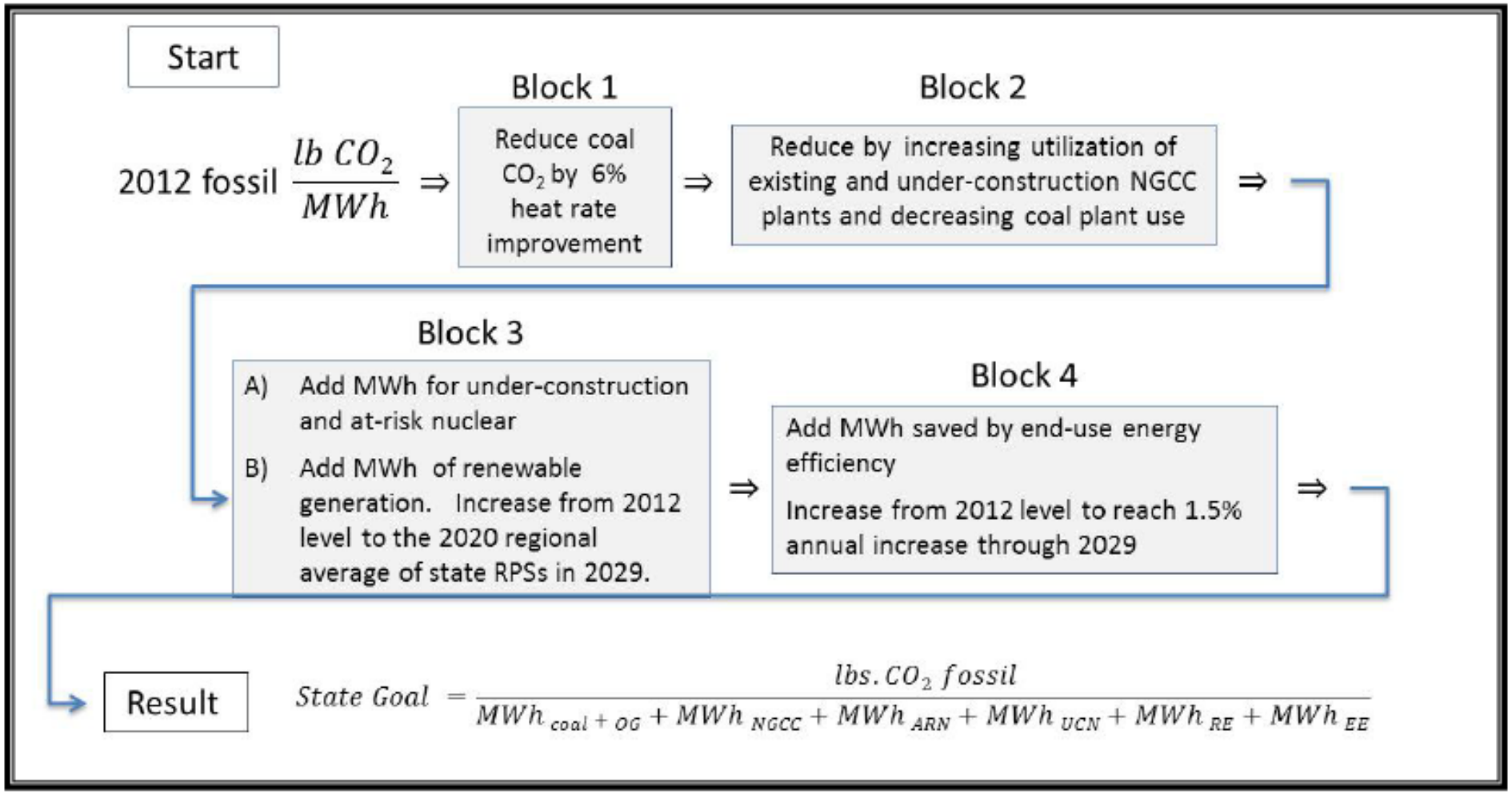
2007	*Mass. v. EPA*: Supreme Court finds CO_2 is an air pollutant.
2009	EPA finds 6 GHGs threaten public health & welfare.
2010	EPA proposes mobile source carbon standards. EPA issues Tailoring Rule to prepare for power sector.
2011	*AEP v. CT*: S. Court affirms EPA's CO_2 role.
2012	EPA proposes new plants rule under CAA § 111b.
2013	President announces Climate Change Plan in June. EPA re-proposes new plants rule Sept 20.
2014	*UARG v. EPA*: S. Court nixes tailoring. Affirms EPA's CO_2 role. EPA proposes existing plants rule under CAA § 111d June 2.

ADVANCED ENERGY ECONOMY

EPA GREENHOUSE GAS REGULATIONS

- Draft Rules were released on June, 2 2014
- Each state received a “rate based” number as a target for meeting EPA standards.
- Rate based target numbers were derived by applying the Best System of Emissions Reductions (BSER) as determined by applying four “pillars” of emissions reductions
- Rate based targets may be converted to a mass based target

CALCULATING THE GOAL



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HOW BSER IS USED TO CALCULATE THE GOAL FOR EACH STATE

Start → 2012 lbs CO_2/MWh from fossil plants

Block 1 Reduce CO_2 with 6% heat rate increase for coal plants

\+ **Block 2** Reduce CO_2 by increasing existing/under-construction NGCC use to decrease coal use

\+ **Block 3**

A. Add MWh for nuclear under-construction and at-risk (6% of existing fleet)
B. Add MWh of RE: Use 2012 actual for 2017 target and regional average RPS in 2020 for 2030

\+ **Block 4** Add MWh saved by EE: Use 2012 actual for 2017 target rising over time to 1.5%/yr through 2030

Result →

$$\text{Adjusted Emissions Rate} = \frac{\text{Emissions from EGUs}}{\text{Generation from EGUs + RE Generation + Nuclear Generation + EE Adjustment}}$$

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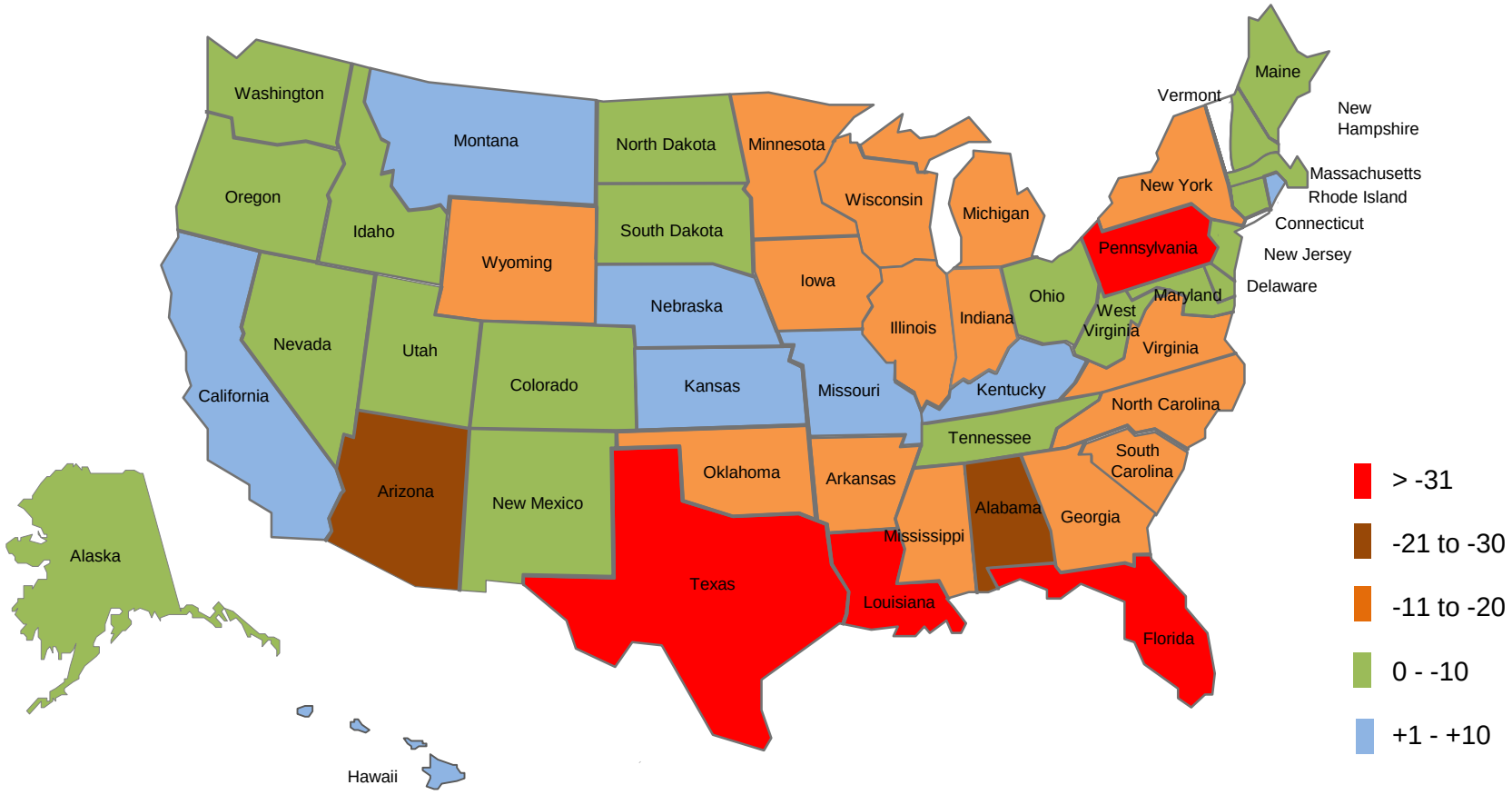
RESULTING EMISSION RATES PRODUCE DIFFERENT AMOUNTS OF REDUCTION

ESTIMATED ANNUAL MTCO2 REDUCTIONS 2012-2030



SOURCE: BNEF

EPA GREENHOUSE GAS REGULATIONS

- Advanced Energy Economy believes this is an historic opportunity for states to:
  - Reduce risk and cost of energy systems
  - Attract investment from Advanced Energy Industries
  - Modernize the utility business model and aging infrastructure
- EPA has stressed in the draft rules that they are giving states a tremendous level of “flexibility”

HOW FLEXIBLE?

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“INSIDE THE FENCELINE” VS “OUTSIDE THE FENCELINE”

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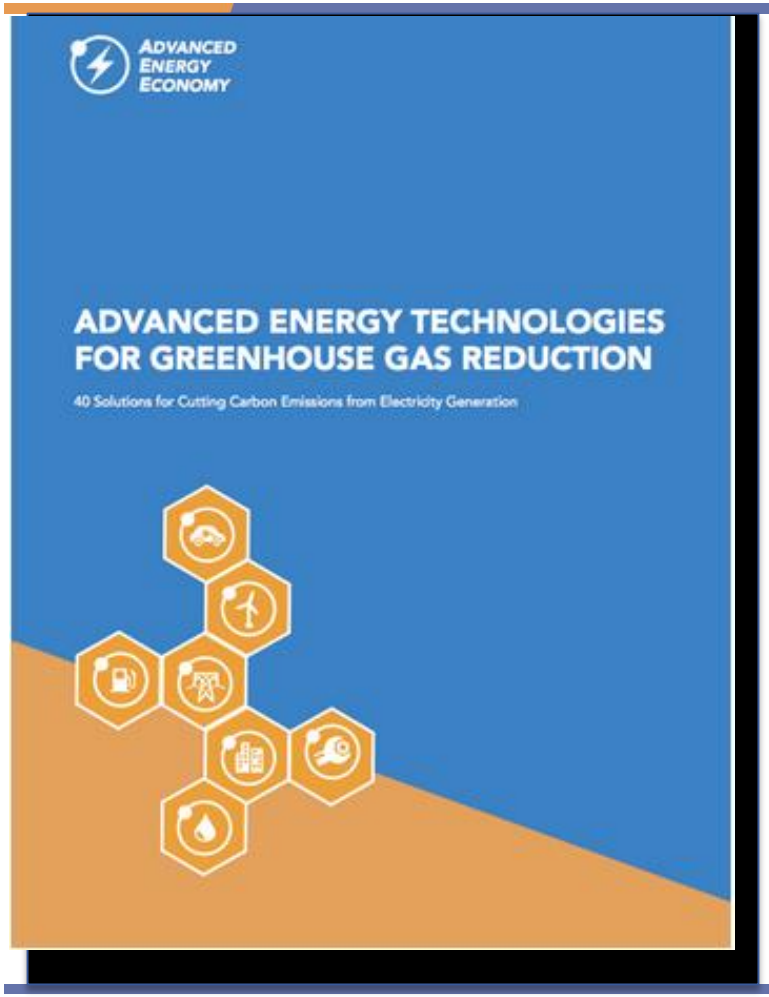
"FLEXIBILITY" IS OUTSIDE THE FENCELINE

- This means states have an opportunity to employ a "portfolio" approach to addressing GHG reductions
- EPA has employed a "systems approach" including technologies that reduce the overall demand for electricity as compliance pathways.
- The Advanced Energy Industry includes a suite of technologies that are able to assist states in meeting these objectives

POSSIBLE TECHNOLOGIES TO HELP STATES MEET 111(D)



Advanced Energy Economy has released a new report that describes 40 different technology approaches to reduce greenhouse gas emissions in order to achieve compliance with 111(d)

You can download the report at *www.aee.net*

ADVANCED ENERGY ECONOMY

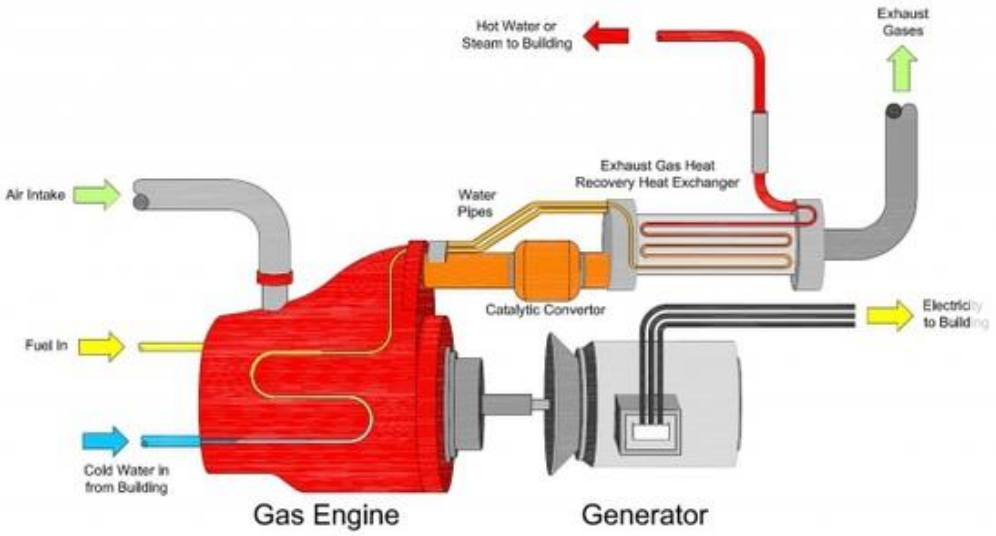
BEHAVIORAL ENERGY EFFICIENCY

- Messaging grounded in behavioral science to produce simple, actionable messages that are relevant to customers and motivate them to save energy

BUILDING ENERGY MANAGEMENT SYSTEMS (BEMS)

- An integrated system of hardware, software and services that controls energy use through information and communication technology
- Adoption of cloud technology has expanded BEMS from traditional energy visualization and analytics to include demand response and property management.

COMBINED HEAT AND POWER



- In the US, the average power plant efficiency is about 34%
- Utilizing waste heat, CHP plants can achieve efficiencies of 85%

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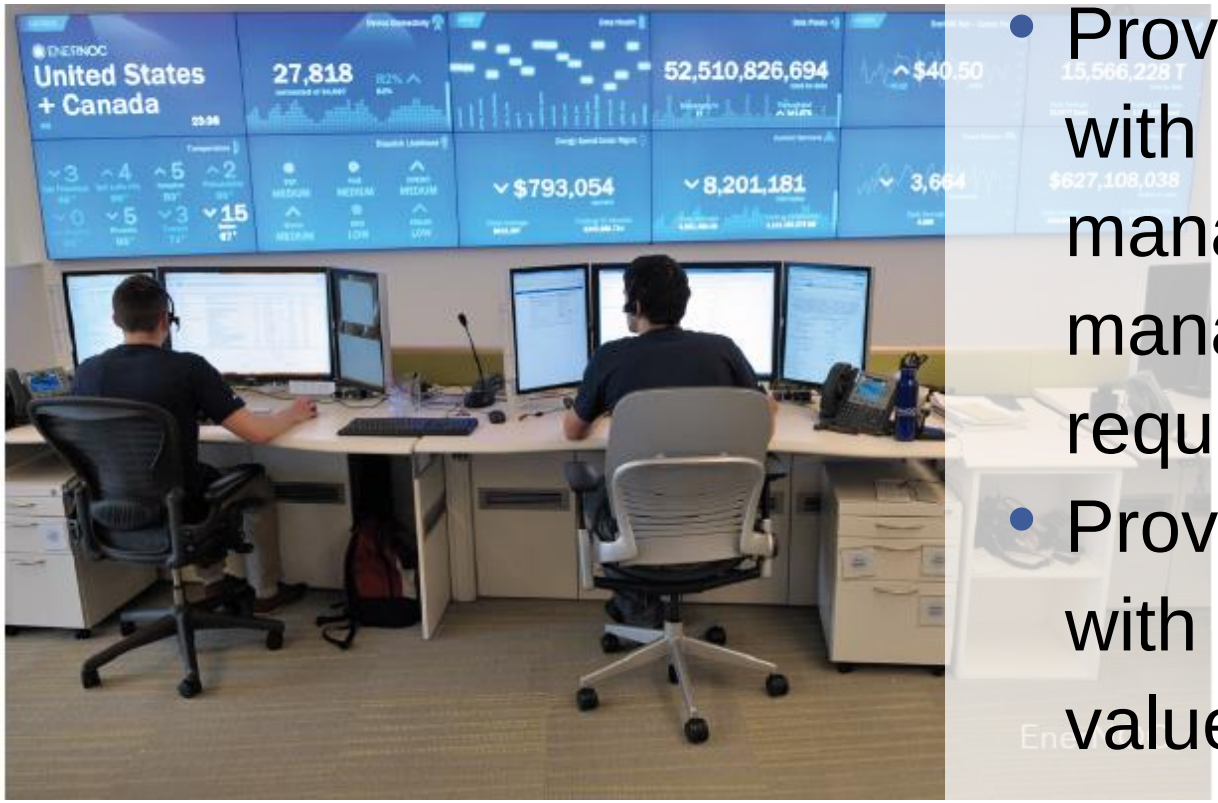
DEMAND RESPONSE



- Provide grid operators with demand management tools to manage generation requirements
- Provide customers with tools to leverage value of their energy consumption

ADVANCED ENERGY ECONOMY

ENERGY ANALYTICS

- Energy Analytics use the power of cloud computing to evaluate building operations and recommend retrofits and operational changes
- Identify energy savings and target buildings with best potential for savings across a portfolio

EFFICIENT LIGHTING AND INTELLIGENT CONTROL SYSTEMS

- Solid state lighting is up to six times more efficient than incandescent and 1.5x more efficient than CFLs
- Intelligent lighting controls use environmental information to manage lighting at each fixture to digitally adjust lighting levels and save energy

FUEL CELLS

- Operating at efficiencies approaching 90%
- Fuel Cells can run on a range of fuels with hydrogen as the primary fuel and water the primary byproduct
- Very popular for data centers and other high reliability requirements
- Can be used in micro-gridding environments

ADVANCED METERING INFRASTRUCTURE

- A foundational technology of a smart grid
- Result in operational savings for utilities
- Enable consumer sided operational savings

Echelon NES meter family

POSSIBLE TECHNOLOGIES TO HELP STATES MEET 111(D)

- **Buildings and Industry**
  - Behavioral Energy Efficiency
  - Building Energy Management Systems
  - Efficient Building Envelope
  - Combined Heating and Power (CHP)
  - Industrial CHP
  - Demand Response
  - District Energy
  - Energy Analytics
  - Energy Service Company (ESCO) Services
  - Ground-Source and Air-Source Heat Pumps
  - Efficient Heating, Ventilation and Air Conditioning (HVAC) Efficient Building Insulation
  - Efficient Lighting and Intelligent Lighting Controls Residential Energy Efficiency Improvements
  - Waste Energy Recovery
  - Efficient Water Heaters

POSSIBLE TECHNOLOGIES TO HELP STATES MEET 111(D)

- **Electricity Generation**
  - Biomass Power
  - Biomass Co-firing
  - Fuel Cells
  - Gas Turbines (Simple Cycle and Combined Cycle) Geothermal Power
  - Hydroelectric Power
  - Marine Power
  - Modular Nuclear Power
  - Utility-scale Nuclear Power
  - Residential and Commercial Building Solar Power Utility-scale Solar Power
  - Onshore Wind Power
  - Offshore Wind Power
  - Waste-to-Energy
  - Organic Waste-to-Energy (Anaerobic Digestion)

POSSIBLE TECHNOLOGIES TO HELP STATES MEET 111(D)

- **Electricity Delivery and Grid Management**
  - Advanced Metering Infrastructure (AMI)
  - Distribution Automation and Network Efficiency
  - Electric Vehicles
  - Energy Storage
  - High Temperature Superconducting (HTS)
  - Transmission High-Voltage Direct Current
  - Transmission
  - Microgrids
  - Smart Grid Data Management and Analytics
  - Voltage-Volt-Ampere Reactive (VAR) Optimization

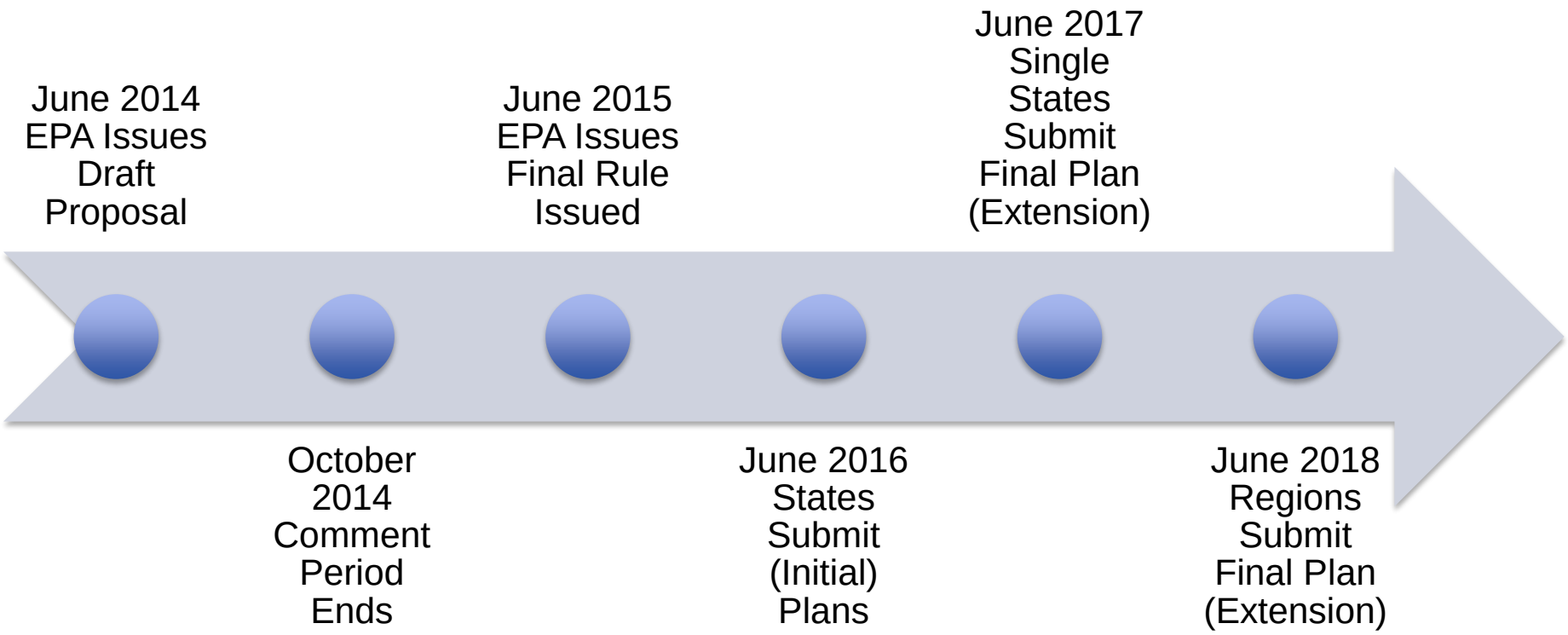
PROCESS

- For a Successful 111(d) Plan
  - Detailed analytics
  - Stakeholder engagement
  - Monitoring and Verification strategies
  - Utility, Regulator and Industry involvement

AN OPPORTUNITY FOR STATES TO ATTRACT INVESTMENT

- Creating a long term strategy for grid modernization under 111(d) will attract innovation and investment from the Advanced Energy Industry
  - Construction
  - Labor
  - RD&D
- Companies are looking for access to markets

COMPLIANCE TIMELINE



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AN OPPORTUNITY FOR STATES TO MODERNIZE THE UTILITY SYSTEM

- In the past year:
  - The Massachusetts PUC has passed a **"Grid Modernization Order"**
  - New York has issued a comprehensive "**Draft Energy Plan"** to modernize the utility system
  - The Hawaii PUC has issued **"Inclinations on the future of Hawaii's Electric Utilities"**

AN OPPORTUNITY FOR STATES TO MODERNIZE THE UTILITY SYSTEM

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the business voice of advanced energy

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