A Deeper Dive into EPA Clean Power Plan:

What Does it Really Mean for IDEA Members?

International District Energy Association (IDEA)

Workshop

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Outline

- Final Clean Power Plan Rule
- Overview of Opportunities for CHP
- Proposed Federal Plan & Model Trading Rule
- IDEA Comments on the FP & MTR
- Potential Impact on CHP Projects

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Clean Power Plan: Overall Structure

Goals

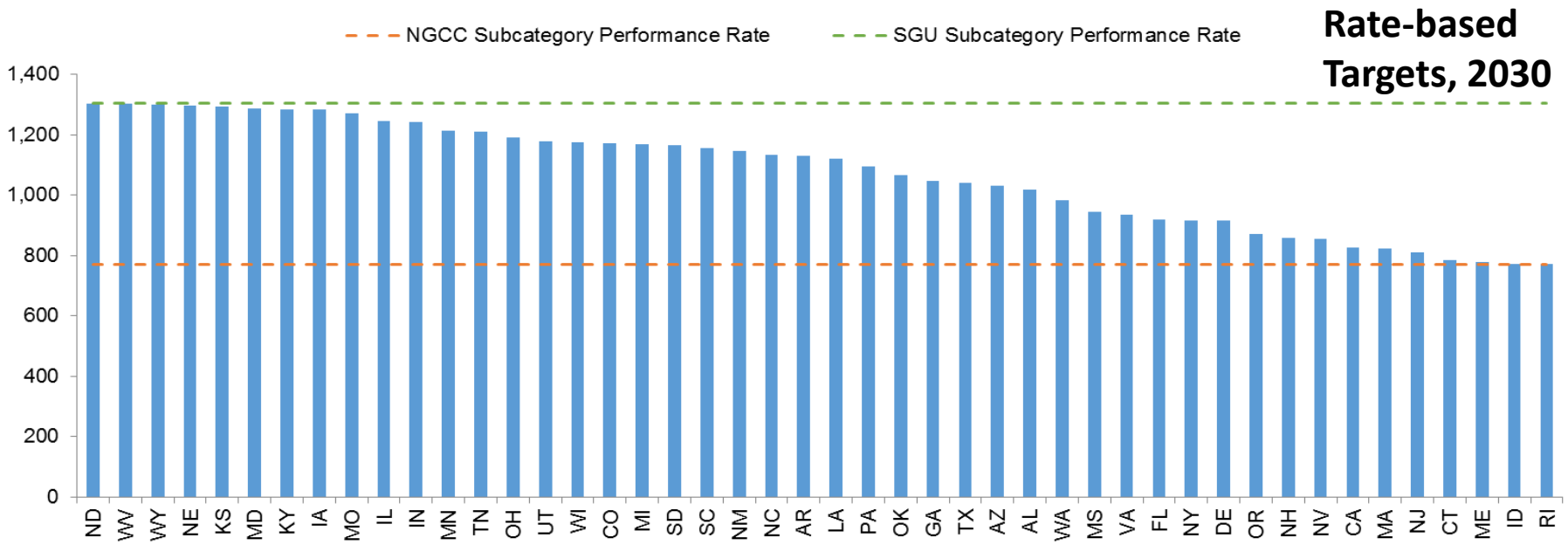
- EPA develops **emission rate limits** (lbs. CO_2 / MWh) for 2 subcategories: SGU & CT
- Gives states "equivalent" compliance options:
  - State-wide **rate goal**
  - State-wide **mass goals**
- Each option has an Interim Period (2022-2029) target and a Final Period (2030+) target

Plans

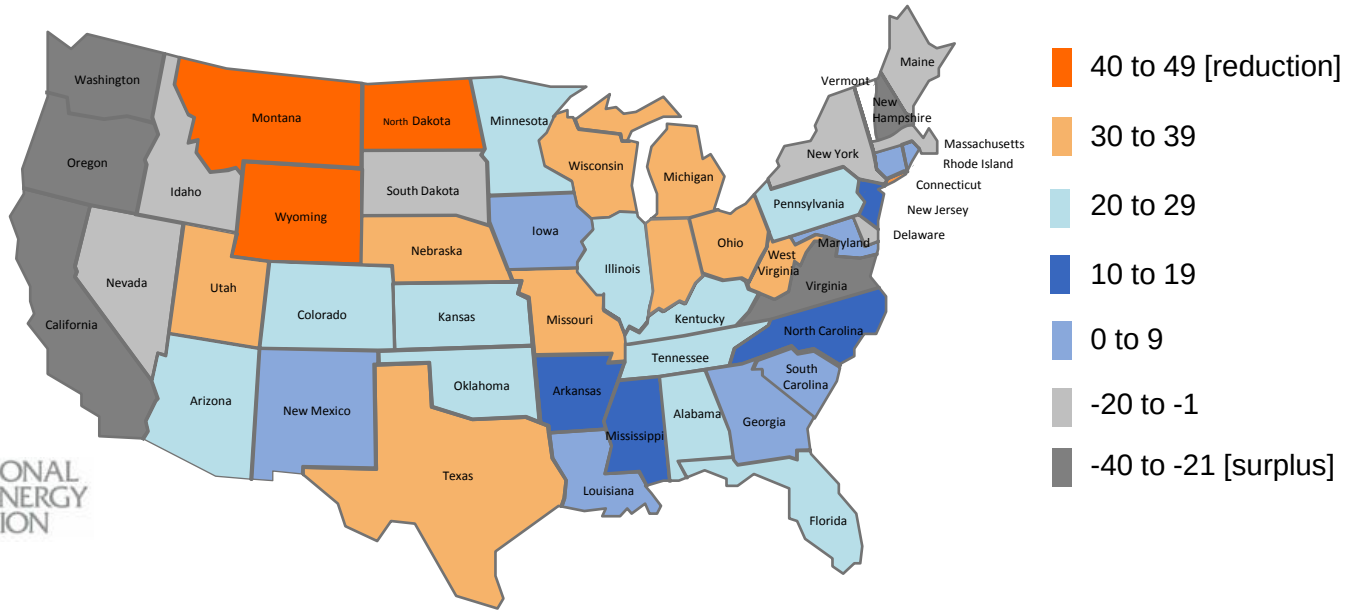
- State develops plan
  - Choose type of requirement each affected EGU will face
  - Establish "standard of performance" for each "affected EGU"
- Subject to EPA approval
- Backstop Federal Plan

Clean Power Plan Background

Rate-based Stringency Varies from State to State



Rate-based Targets Compared to BAU, 2030
(% reduction required)



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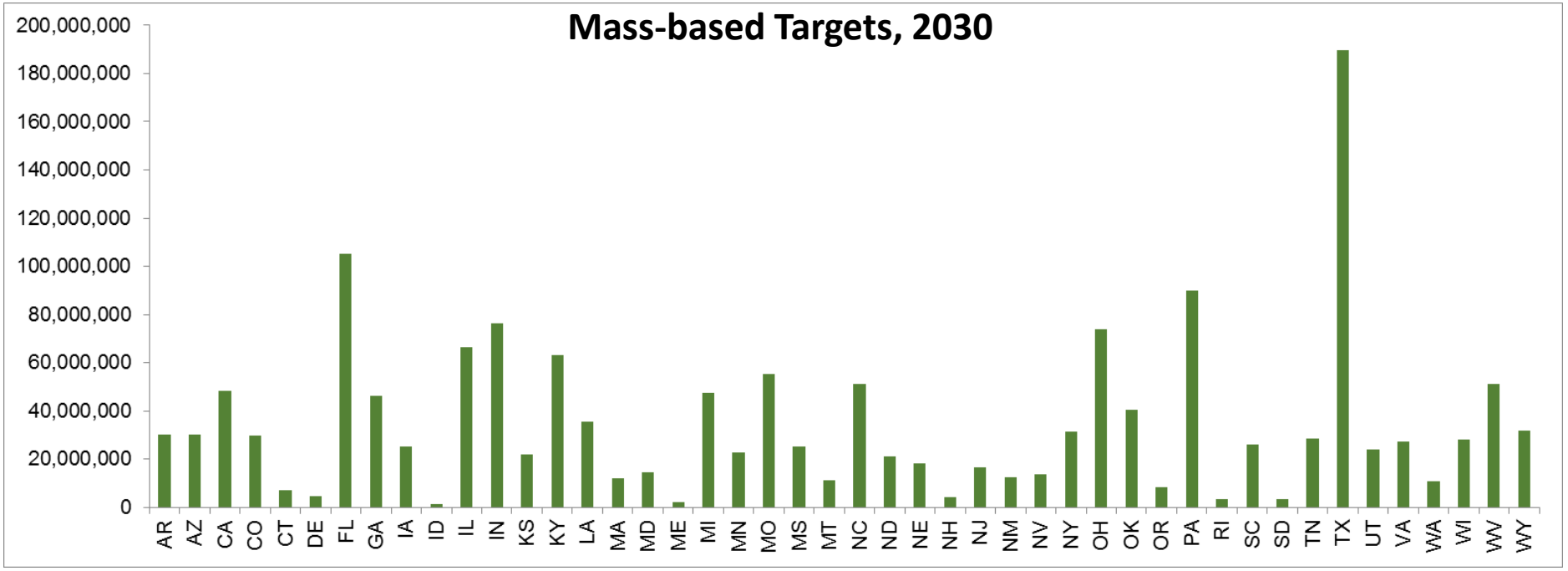
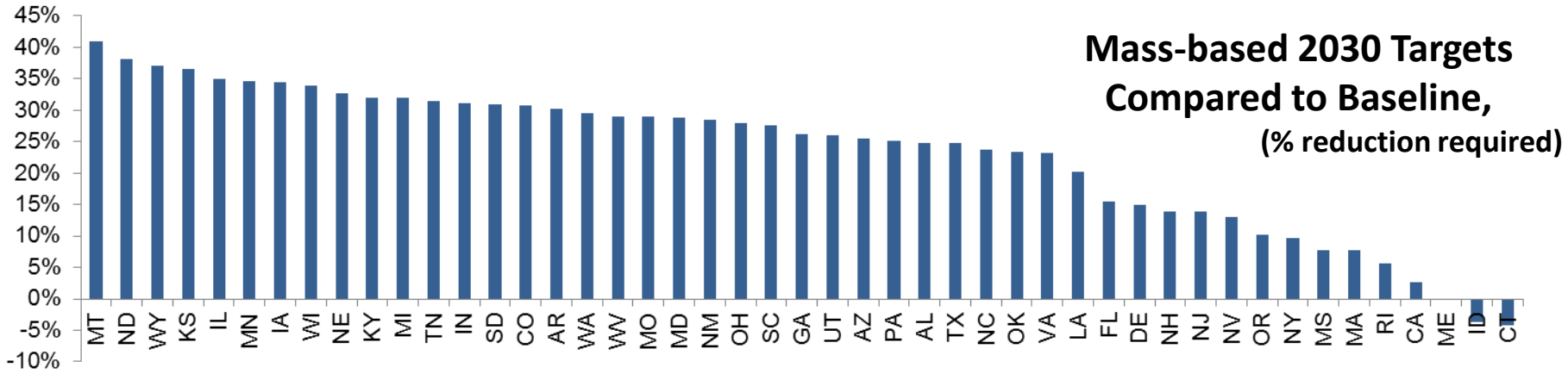
Clean Power Plan Background

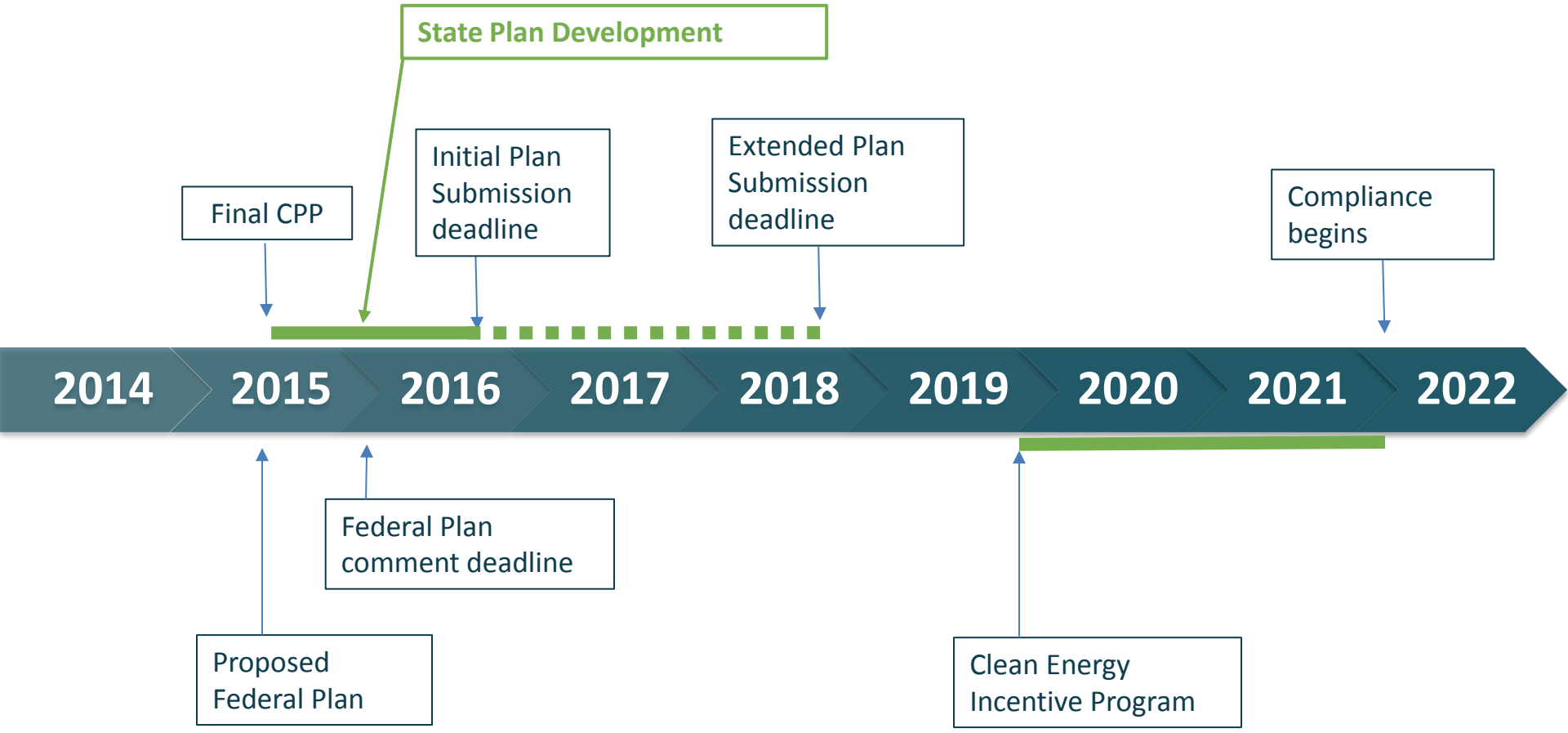
Mass-based Stringency Varies from State to State





Clean Power Plan Background

State Plan Timeline



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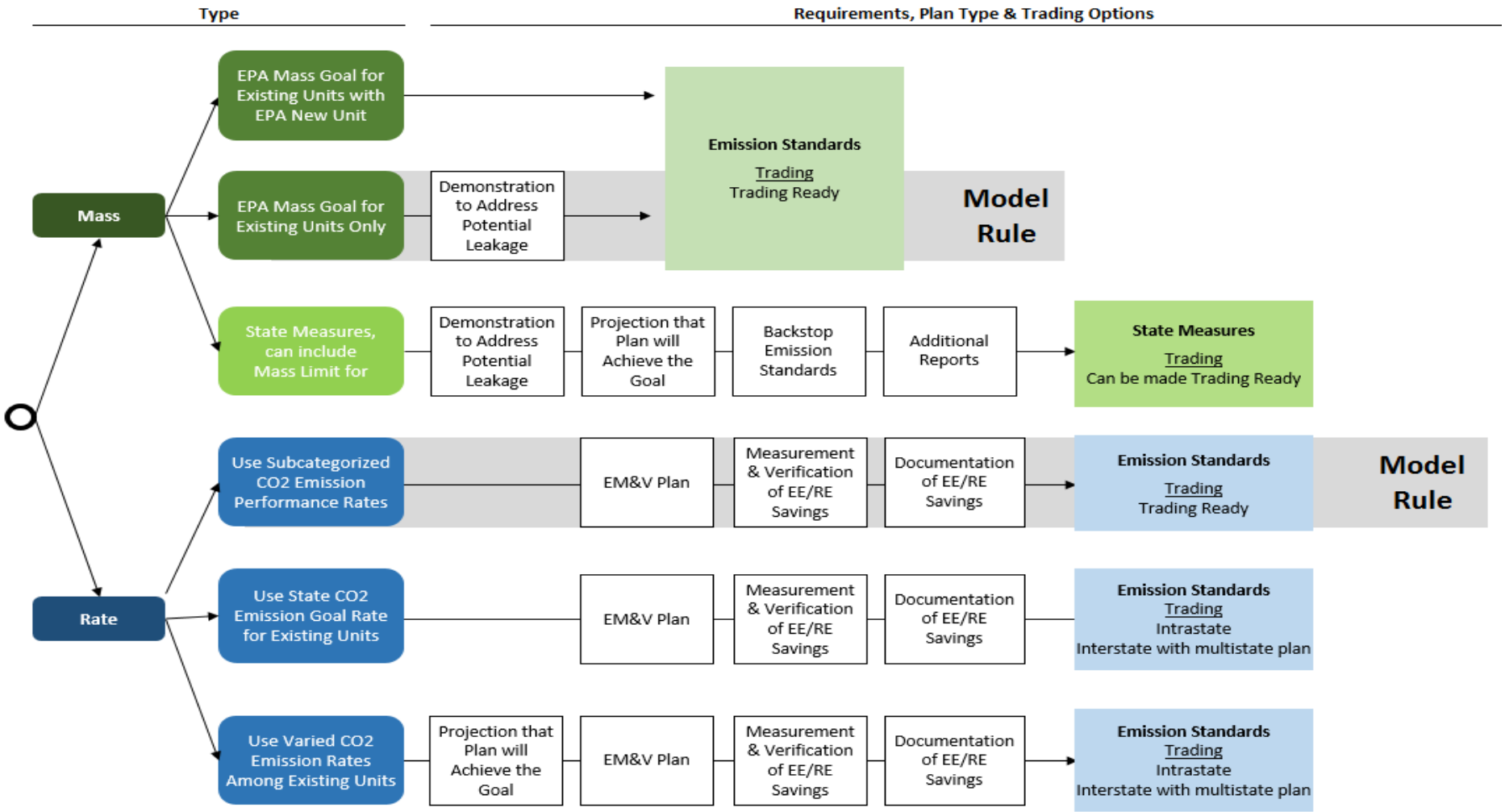
State Plans: Many Design Options and Implications



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State Plans: Three Streamlined Pathways

"Emissions Standards Plans"

Rate-based Plan

EGU Emission *Rate* Limits

Compliance through credit trading

Mass-based Plan

EGU Mass-based Emission Limits with Allowance Trading

Generally "cap-and-trade"

State Measures Plan

State-enforceable measures projected to achieve goal

+

Federally-enforceable backstop measures in case state measures fail to achieve the goal

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Proposed Federal Plan & Model Trading Rule

EPA proposed and requested comments on

- Federal plan for states that fail to submit an approvable plan
- Model trading rules for emissions trading that can be adopted by states even if they submit their own state plan rather than adopt the federal plan

Two different approaches for federal plan and model rule

- Rate-based Approach using Rate-Based Emission Standards
- Mass-based Approach using cap-and-trade

Regulatory Process

- EPA intends to finalize either or both model trading rule options by summer 2016, prior to the deadline for state plan submittals
- EPA proposed to finalize a single federal plan approach
- Comments were submitted Jan. 21, 2016

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Affected CHP or Non-Affected CHP?

- Uniquely, CHP units can either be affected or non-affected
  - **Affected CHP**
    - State must consider the EGU's emissions.
    - Will very likely have compliance obligations.
    - Regulatory benefits to being an affected CHP unit rather than a non-CHP affected EGU.
  - **Non-affected CHP**
    - No compliance obligations.
    - Depending on state plan design, may receive regulatory benefits.

What is an EGU?

- Each **generating unit** *not* each facility
- Two types:
  - **Steam Generating Units (SGU): any** furnace, **boiler,** or other non-nuclear device used for combusting fuel and producing steam **plus any integrated equipment** that provides electricity or useful thermal output to the affected facility or auxiliary equipment.
  - **Combustion Turbine (CT):** Either a combined cycle turbine or a simple cycle turbine used for CHP that is *capable of* combusting natural gas (*i.e.* hooked up to a natural gas line).

Is my CHP unit an Affected EGU?

- Is it "existing"?
- Is it connected to a generator ≥ 25 MW?
  - If multiple EGUs for each generator, use proportional share of heat input
- Does it burn fossil fuels for > 10% heat input?
- Does it primarily sell electric power?
  - Annual net sales greater than 219,000 MWh
  - Annual net sales greater than:

Potential electrical output x *design efficiency*

Example: CHP unit with 60% design efficiency can sell electricity at annual average capacity factor of 59% without being subject to CPP.

Max MWh/yr at full electric output: Base load rating design efficiency **at maximum electric production** x base load rating (in MMBtu) x MMBTu → MWh conversion factor x 8760 hrs/yr

Rated *overall* (electric plus thermal) **net efficiency** on **lower heating value** at **base load** rating at **ISO conditions** at **maximum useful thermal output.** Methodology: ASME PTC 22, ASME PTC 46, or ISO 2314

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If my EGU is regulated, how do I comply?

- Compliance emissions rate ≤ emission limit
  - Emission Limit

	Interim Period (2022-2029)	Final Period (2030+)
SGU	1534 lbs /MWh	1305 lbs /MWh
CT	832 lbs / MWh	771 lbs / MWh

  - Compliance emission rate =

$$\frac{Measured\ lbs.CO_2}{Electric\ MWh/_{0.95} + Useful\ thermal\ MWh + ERCs}$$

Avoided Line Loss Credit

100% is a change from Proposed Rule

Purchased from other entities

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Opportunities for CHP

Adding CHP at Affected EGUs

- *Adding* CHP to an existing EGU can lower its emission rate

New/Expanded CHP at Non-Affected EGU

- Can generate ERCs for use by affected EGUs
  - Built or expanded after 2012
  - Must be grid connected, some geographic limits
- Each MWh gets a *partial* ERC
  - Discount factor meant to reflect those emissions attributable to incremental electric generation
  - State plan must provide methodology for crediting
  - Presumptively approvable methodology in proposed model rule
    - Compare "incremental CHP emissions rate" of electrical output:

$$\frac{\text{Total emissions} - \text{emissions associated with useful thermal output}}{\text{total electrical generation}}$$

    - With a "reference emission rate".
      - Unclear what rate to use. State rate? Fossil steam? NGCC?
- WHP treated differently. Considered non-emitting.

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If my CHP unit is regulated, how do I comply?

- Hold “allowance” for each ton of measured emissions
- What are “measured emissions”?
  - Stack emissions (directly measured or based on fuel)
  - Potentially adjusted if co-firing biomass
  - Implication: emissions associated with useful thermal output seem to count
    - Disadvantages CHP compared to separate electric/thermal
    - IDEA submitted comments
    - Some state discretion how to handle
- EPA gives states the option to include other emission sources, such as industrial sources

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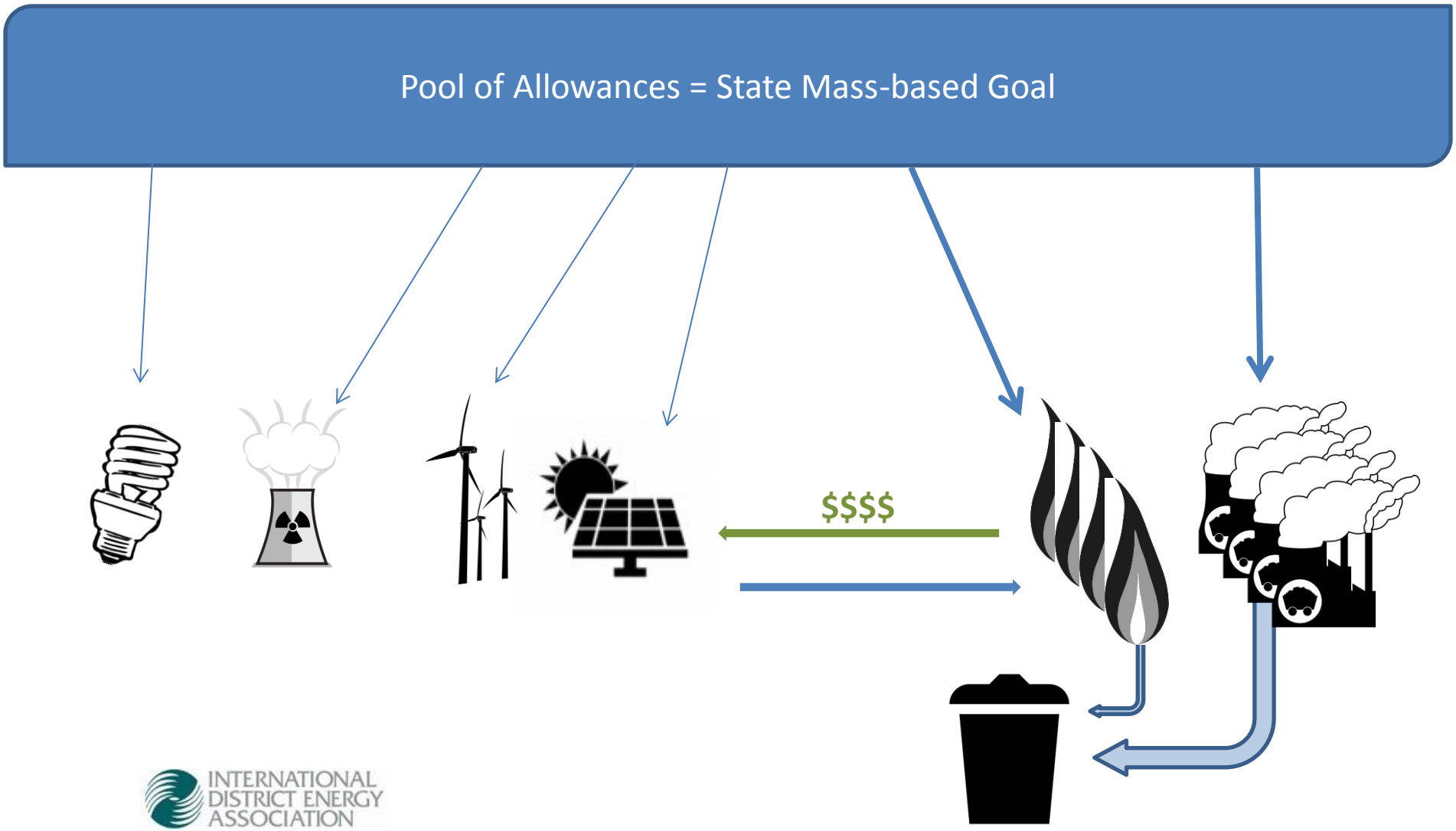
Mass-Based Plan Overview



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Requirement to Address New Unit Leakage

- Clean Power Plan only regulates *existing* EGUs
- If existing EGUs have a mass limit but new EGUs do not, may be incentive to shift generation from existing EGUs to new EGUs
- State must demonstrate its mass-based plan addresses this issue. EPA gives 3 options:
  - State law regulation subjecting new units to same requirements as existing units.
  - State allocates allowances in a way that minimizes leakage
    - EPA has proposed a presumptively approvable option that includes "set-asides" for
      - Output from new renewable energy (and potentially energy efficiency) (5% of allowances)
      - Output from existing NGCC (10-30% of allowances)
  - State demonstrates leakage will not be a problem

Opportunities for CHP

CHP at Affected EGU

- As proposed, limited. Issue to work on with EPA/states
- May want to request allowance allocation to cover thermal emissions

CHP at Non-Affected EGU

- Specific allowance allocation methodology to encourage new development.
- Incorporate CHP in allowance allocation methodology designed to discourage “new unit leakage”

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – Summary of Comments

In the rate-based Model Trading Rule, EPA proposed that new and uprated "non-affected" CHP and WHP units can generate emission rate credits (ERCs). EPA requested comment on whether CHP should be identified as an ERC-eligible measure under the Federal Plan

1. IDEA strongly supports inclusion of CHP and WHP as eligible measures that can produce ERCs in a rate-based Federal Plan
2. EPA's proposed approach to calculating ERCs lacks clarity but appears to significantly undervalue CHP
3. In addition to non-affected CHP, the FP & MTR should specifically address potential CHP applications in affected units
   - Conversion of an affected unit from power-only generation to CHP
   - Increased recovery of useful thermal energy from an existing CHP affected unit

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – Crediting Methodology

- Proposed rate-based Model Trading Rule prorates ERCs for a non-affected CHP unit's electrical output as follows:

  Prorated MWh = CHP MWh output * (1 – (*incremental CHP emissions rate / applicable affected EGU emission rate standard*))

- *Incremental CHP emissions rate* is calculated by subtracting from the measured emissions of the CHP system the emissions that would have been produced on-site to provide thermal output from a boiler. These incremental emissions are then divided by the net electric output of the CHP system:

  Incremental CHP emission rate = (annual CHP CO2 emissions – annual displaced boiler CO2 emissions) / (annual CHP electricity output)

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Rate-Based Plans – Crediting Methodology

- EPA does not define the term *applicable affected EGU emission rate standard (*which is used in the denominator of the proration formula)
- However, footnote 64 suggests this rate is “the applicable CO2 emission rate standard is in Table 6 of this preamble”

Table 6. Glide Path Interim Performance Rates (Adjusted Output-Weighted-Average Pounds of CO_2 Per Net MWh From All Affected Fossil Fuel-Fired EGUs)

Technology	2022-2024 Compliance Rate	2025-2027 Compliance Rate	2028-2029 Compliance Rate	Final Rate
SGU or IGCC	1,671	1,500	1,380	1,305
Stationary combustion turbine	877	817	784	771

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – Crediting Methodology

- Does *applicable CO2 emission rate* refer to
  - SGU or stationary combustion turbines?
  - Interim glide path performance rates or the final targets?
- Unofficial communications with EPA staff indicate that the intention is to refer to combustion turbines
- In the Final Clean Power Plant Rule the EPA sets two rates for combustion turbines
  - 832 lbs/MWh in 2022-2029
  - 771 lbs/MWh in 2030 and beyond

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – Crediting Methodology

- What is the impact of the (inferred) EPA prorating method?
- Example 7 MW_e CHP gas turbine

Example 7 MW Gas Turbine

Net Electrical Efficiency	28.9%
Total CHP Efficiency	70.4%

Emissions (lbs/MWh)

CHP emissions	1,382
Displaced boiler emissions	(717)
Net emissions	664

Prorated MWH

Interim Combustion Turbine rate	20.2%
Final Combustion Turbine rate	13.8%

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Rate-Based Plans – Crediting Methodology

- The inferred EPA approach suffers from two key flaws:
  - Compares CHP output to natural gas combined cycle rather than the generation that is most likely to be avoided due to CHP deployment
  - Compares CHP output to emission target rates, rather than real-time emissions rates
- Instead, EPA should define the reference rate using actual emissions data from affected EGUs
- IDEA proposed 3 options for EPA consideration

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Rate-Based Plans – Crediting Methodology

- Potential options for setting reference rate (EPA could allow states to use one of the first two approaches, or require all states to use the third approach)
  1. Average affected EGU emission rate for the eGRID subregion in which the CHP project is located
  2. Average affected EGU emission rate for each state
  3. Single national average affected EGU emission rate

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – Crediting Methodology

- IDEA's recommended options would significantly increase ERC credits for CHP
- Impacts vary by state

	Reference Emissions Rate (lb CO2/MWh)	% of CHP Electricity Output Credited
Inferred EPA approach: Final and Interim compliance goal for Combustion Turbines	771 -- 832	13.8% - 20.2%
Option 1: 2025 eGRID subregional EGU emission rate	980 -- 1937	32.1% - 65.7%
Option 2: State 2025 EGU emission rate	883 -- 2155	24.7% - 69.1%
Option 3: National avg 2025 EGU emission rate	1570	57.6%

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IDEA Comments on Proposed FP & MTR

Rate-Based Plans – CHP in Affected Units

- The FP & MTR should highlight the potential for implementation or expansion of CHP in an affected EGU:
  - Conversion of power-only affected unit to CHP
  - Increase in heat recovery in existing CHP affected unit
- We believe the proposed Model Trading Rule provides appropriate accounting mechanisms to generate ERCs through these affected unit CHP opportunities
- However, we recommend that the preamble language on eligible emission reduction measures for ERC generation address the potential for these CHP opportunities and how ERC crediting should occur

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IDEA Comments on Proposed FP & MTR

Mass-Based Plans – Summary of Comments

In the mass-based Model Trading Rule, EPA seeks comment on whether CHP should receive allowances under the mass-based FP & MTR

- IDEA believes there are 3 circumstances in which CHP and WHP should receive allowances under the Clean Power Plan:
  1. To hold affected CHP units harmless for emissions associated with thermal rather than electrical load if EPA does not specifically exclude such emissions from regulation
  2. To limit emissions leakage to new NGCC units
  3. As a menu of options in the Model Trading Rule to help states promote CHP and WHP projects

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IDEA Comments on Proposed FP & MTR

Mass-Based Plans – CHP in Affected Units

- EPA recognizes that emissions accounting under a mass-based plan has the potential to discriminate against CHP, because affected CHP units will have to procure emission allowances for all emissions (resulting from production of both electricity and heat)
- IDEA identified two potential options to avoid this discrimination
  1. Require affected CHP to hold allowances only for emissions associated with electric output
  2. Establish an allowance set-aside for CHP units to account for their emissions associated with useful thermal output
- We urge EPA to adopt the first option because it provides similar treatment of useful thermal output as EPA has provided under the rate-based approach

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IDEA Comments on Proposed FP & MTR

Mass-Based Plans – Set-Asides

- EPA proposes two potential allowance set-asides for the mass-based Federal Plan to prevent leakage of emissions to new non-CHP NGCC
  - 5% set-aside for new renewable energy projects (and potentially other projects including CHP) (termed the "RE set-aside")
  - Set-aside to existing NGCC units based on output ("OBA set-aside")
- IDEA urges that new CHP should be eligible for allowances from the RE set-aside and that this set-aside be increased to 10% of total allowances
- Just as with renewable energy, CHP can prevent leakage to new non-CHP NGCC by reducing costs of alternative lower-emitting generation options
- IDEA strongly recommends against an additional potential condition that would limit eligibility for this set-aside to owners of affected EGUs

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IDEA Comments on Proposed FP & MTR

Mass-Based Plans – Set-Asides

- EPA proposes an output-based allocation (OBA) set-aside which provides allowances to existing NGCC units as a means of mitigating leakage. EPA requested comment on extending the OBA set-aside to zero-emitting generators (including both renewable and nuclear generation)
- IDEA recommends
  - The OBA set-aside encourage retention of existing low-emitting affected CHP units
  - EPA should include useful thermal output in allocating allowances in this set-aside
  - Eligibility should be extended to any affected EGU, including SGUs

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IDEA Comments on Proposed FP & MTR

Mass-Based Plans – Allowance Allocation

- The process for allowance allocation is a critical aspect of a mass-based plan that can help drive emission reductions
- EPA should provide states three options in the Model Trading Rule for allowance allocation to recognize the value of CHP
  - Option A: Updating, output-based direct allocation including CHP
  - Option B: Allowance set-asides which include CHP
  - Option C: Allowance auction mechanism with a discussion of how to reinvest auction proceeds to incentivize CHP

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IDEA Comments on Proposed FP & MTR

Evaluation, Measurement & Verification (EM&V)

- EPA proposes that, in addition to CHP-specific EM&V requirements, all CHP EM&V must follow the requirements for RE EM&V
- Application of the proposed RE EM&V requirements to CHP lack clarity and could be interpreted to mean that only the CHP power output exported to the grid can be counted in the calculation of set-aside allowances or ERCs
- IDEA urges that the FP & MTR be clarified to ensure that all CHP power production is counted in calculating ERCs and set-aside allowances, not just the power exported to the grid

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IDEA Comments on Proposed FP & MTR

Accounting for T&D Line Losses

- The rate-based Model Trading Rule proposes that credit for demand-side energy efficiency programs can be increased using the smaller of 6 percent or the statewide annual average T&D loss rate
- The Model Trading Rule is not clear regarding application of the line-loss credit to CHP
  - One provision appears to limit this to CHP units smaller than 1 MW
  - We do not believe this was EPA's intent
- IDEA encourages EPA to clarify that non-affected CHP units *of any size* that serve on-site end-use electricity loads should be allowed to account for avoided T&D losses in the calculation of ERCs and allowances for allocation

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Potential Impact on CHP Projects

Key Variables

- State targets
- Has the state developed its own plan?
- Is the state plan rate- or mass-based?
- Extent of trading relationships with other states
- How has EPA decided to resolve key issues in the final Federal Plan and Model Trading Rule?
  - Accounting methodology for prorating CHP output for ERCs (rate-based plans)
  - Is CHP eligible to receive allowance allocations in the mass-based MTR?
  - Are there set-aside allowances for new CHP?
  - Is the final Federal Plan rate-based or mass-based? (This will influence trading between your state and other states)
- State plan details, particularly relative to allowance allocation and set-asides if the state adopts a mass-based plan (this will be influenced by the final Model Trading Rules)

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Potential Impact on CHP Projects

Generation of ERCs in Rate-Based Plan

Compliance rate (lbs/MWh) =

$$\frac{\text{Measured EGU CO2 emissions (lbs)}}{\text{EGU output (MWh)} + \text{ERCs (MWh)}}$$

Market value of ERCs depends on many variables including level of rate-based state target, extent of trading with other states, and costs of competitive sources of ERCs

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Potential Impact on CHP Projects

ERC Generation for Hypothetical 7.0 MW Gas Turbine CHP

Example Gas Turbine CHP Plant

Electric capacity (MW)	7.0
Net electrical efficiency	28.9%
Total CHP efficiency	70.4%
Capacity factor	0.70
Annual MWh electricity generated	42,924

Emissions & Efficiency Factors

Natural gas emissions (lbs/MMBtu)	117
Boiler efficiency	80%

CHP Emissions (lbs/MWh)

CHP emissions	1,382
Displaced boiler emissions	(717)
Net emissions	664

Calculation of credited MWh

	Inferred EPA approach (2030 CT rate)	National avg 2025 EGU emission rate
Affected EGU emission rate	771	1,570
Prorating %	13.8%	57.7%
Credited annual MWh (ERCs)	**5,939**	**24,761**

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Potential Impact on CHP Projects

Potential Value of Allowances in Mass-Based Plan

- A state could establish an affected EGU's performance standard in one of two ways:
  - As a unit-specific mass-based limit (e.g., tons/year) for each affected EGU, or
  - As a state-wide CO2 budget distributed by the state in the form of emission allowances combined with an obligation that each affected EGU surrender a one ton emission allowance for each ton emitted
- For the following calculations we will illustrate potential value of CHP mass reductions compared with projected 2025 national average EGU emission rate (1,570 lbs/MWh)

Potential Impact on CHP Projects

Potential Value of Allowances in Mass-Based Plan

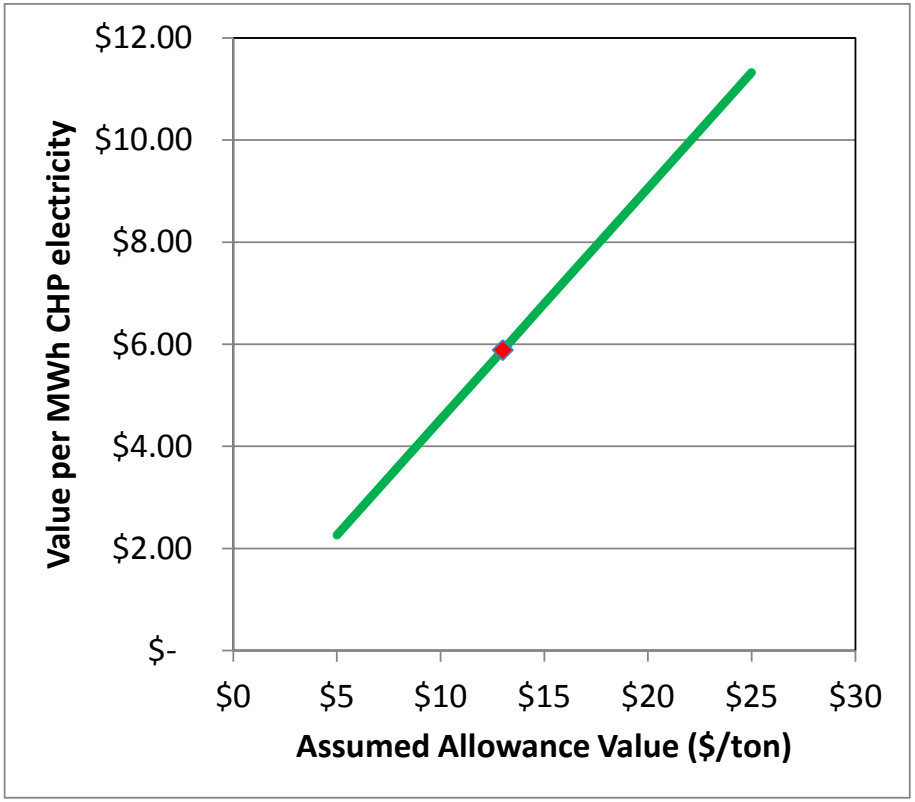
CHP

Net CHP emission (lbs/MWh)	664
Annual CHP electricity output (MWh)	42,924
Net CHP emissions (tons)	14,258

EGU generation avoided

National average 2025 EGU emission rate (lbs/MWh)	1,570
Emissions resulting from generation of same output as CHP (tons)	33,695

Emission reductions (tons) 19,437



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Conclusions

- The Clean Power Plan provides significant opportunities for CHP
- The extent to which those opportunities can be realized depends on:
  - How key issues are resolved in the Federal Plan and Model Trading Rule
  - Specific plans developed by states
- Most states will likely file for extensions for submittal of plans
- IDEA and its members will have the opportunity to work with states to encourage CHP-friendly state plans

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