

Final Clean Power Plan: Modeling Costs to Consumers

September 3, 2015

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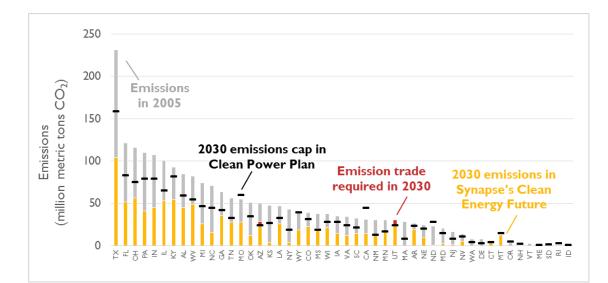
Synapse Energy Economics

- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power sector
- Staff of 30 includes experts in energy and environmental economics and environmental compliance

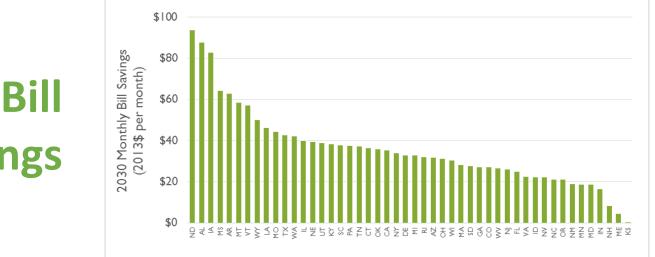
Update to Clean Energy Future Analysis

- Original analysis July 2015
 - Comparing Clean Energy Future against a Reference scenario
- Update takes the final Clean Power Plan into account
 - New analysis confirms our original conclusions
- Addressing interesting issues and potential concerns

Clean Energy Future



Lower Emissions



Bill Savings



What is the Clean Energy Future?

How Has the Final Clean Power Plan Affected the Clean Energy Future? What's new?

Designing the scenarios

How Can Greener Electricity be Cheaper?

Why Haven't We Done It Already?

Is There a Catch?

Cost trends and avoided costs

New dynamics and barriers

Is the modeling comprehensive?

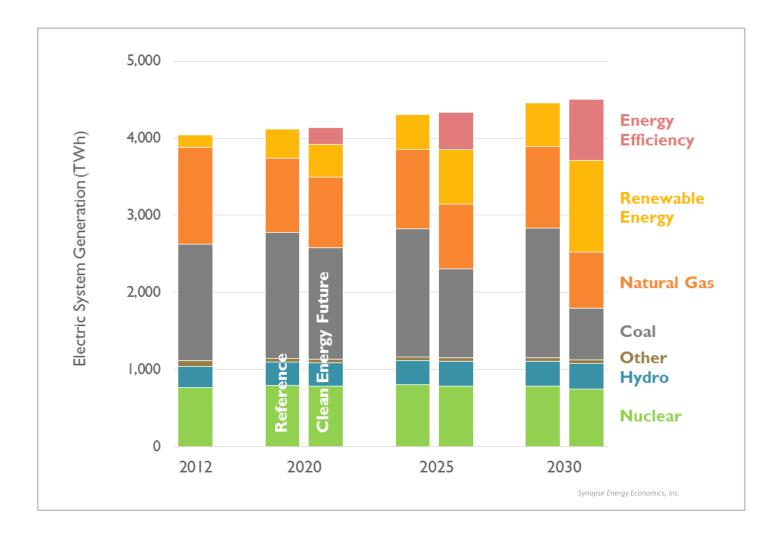
Clean Energy Future

Designing the Clean Energy Future Scenario

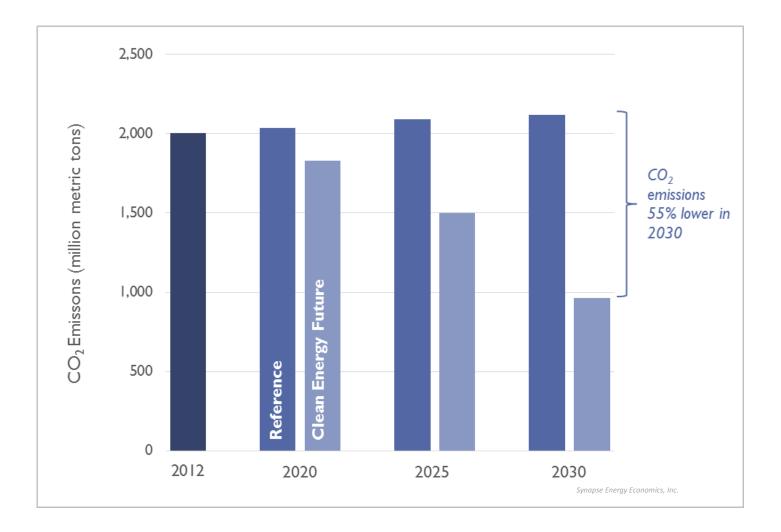
- A "no regrets" cost scenario: Costs are lower than the Reference scenario
- Assumptions based on current-day examples and reputable studies

	Reference Scenario	Clean Energy Future Scenario
Energy Efficiency	Existing federal appliance and building standards, minimal state efficiency policies	Incremental efficiency savings of 2% each year by 2029
Renewables	Renewables comply with existing state laws	70% of generation from renewable resources by 2040
Gas	Net 24 GW new gas-fired capacity built by 2040	Net 78 GW gas-fired capacity retired by 2040
Coal	Coal plant retirements limited to announcements to date	All coal plants built before 2005 retired by 2040
Other	No electric vehicles integrated as electric-grid storage	25% of cars and trucks integrated as electric-grid storage by 2040
	Demand response reaches 10% maximum sales by 2040	Demand response reaches 15% maximum sales by 2040
	13 GW new storage resources by 2040	51 GW new storage resources by 2040
Hydro	10 GW new run-of-river and improved capture of hydro resources by 2040	18 GW new run-of-river and improved capture of hydro resources by 2040
Nuclear	All nuclear units operate for 60-year lifetimes	All nuclear units operate for 60-year lifetimes

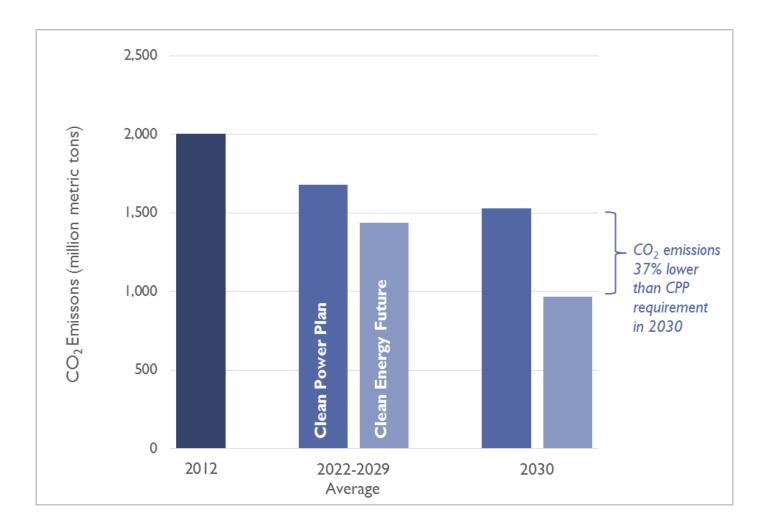
Changes in Electric Generation



Changes in CO₂ Emissions



Clean Power Plan Results



What's New in the Final Clean Power Plan?

What's New in the Final Clean Power Plan?

- The final Clean Power Plan relies on a completely different target-setting calculation
 - Calculated at the interconnection level for two different types of generators (Fossil Steam and NGCC)
 - No more energy efficiency or nuclear (in the target setting)
 - Displacement from renewables at fossil units now being accounted for
- EPA is now much more explicit about multi-state compliance, trading mechanisms, and compliance deadlines
- EPA is much more comprehensive about the different approaches states can take to meet Clean Power Plan compliance

Compliance Paths

Model Rules

R1

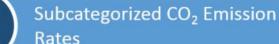
R2

R3

Rate-based Compliance

(lbs/MWh)

Mass-based Compliance (tons CO₂)



Two specific nationwide emission rate limits for coal plants and NGCC plants

CO₂ Mass Goal for Existing Units

A statewide emission cap is applied to existing fossil units. States must demonstrate that there is no "leakage" of generation to new fossil units

State CO₂ Emission Rates

Each power plants must meet the single state average (derived using the nationwide emission rate limits and the share of these resources in a given state)

Different CO₂ Emission Rates

The state allows some flexibility in individual power plant's emission rates, as long as the total rate matches the one created by EPA M2)

M1

CO₂ Mass Goal for Existing Units with New Unit Complement

A statewide emission cap is applied to all fossil units, existing or new.

мз

State Measures: CO₂ Mass Goal for Existing Units

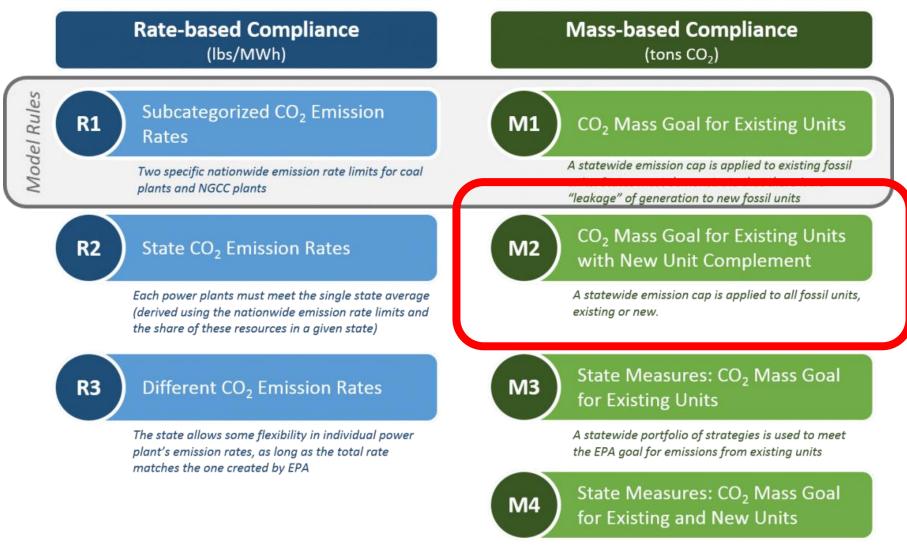
A statewide portfolio of strategies is used to meet the EPA goal for emissions from existing units

м4

State Measures: CO₂ Mass Goal for Existing and New Units

A statewide portfolio of strategies is used to meet the EPA goal for emissions from existing and new units

Compliance Path Modeled in Clean Energy Future Analysis

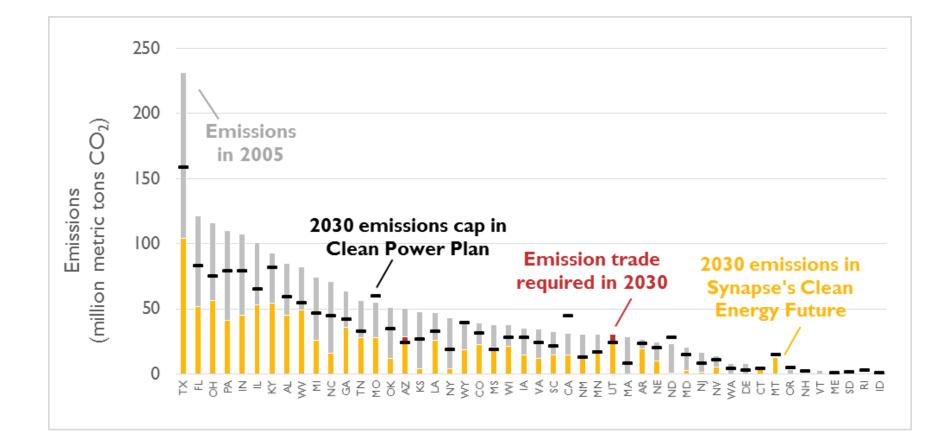


A statewide portfolio of strategies is used to meet the EPA goal for emissions from existing and new units

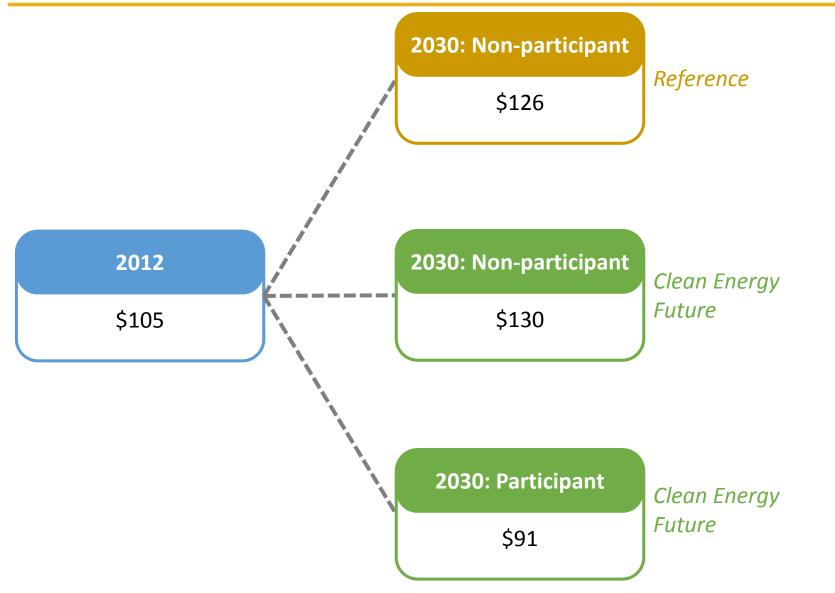
Why "M2" for All States?

- We model a compliance approach in which all states use the same pathway to compliance
- Largest number of trading partners for allowances
- Including "new sources" in state plans for compliance is likelier simpler to administer from the states' perspectives
- Our analysis looks at 2030 and the 2022-2029 period
- Again, the CEF was not designed to specifically meet Clean Power Plan compliance or to find the cheapest way to do so
- CEF is a "no regrets" scenario in terms of costs; Clean Power Plan compliance is a side benefit

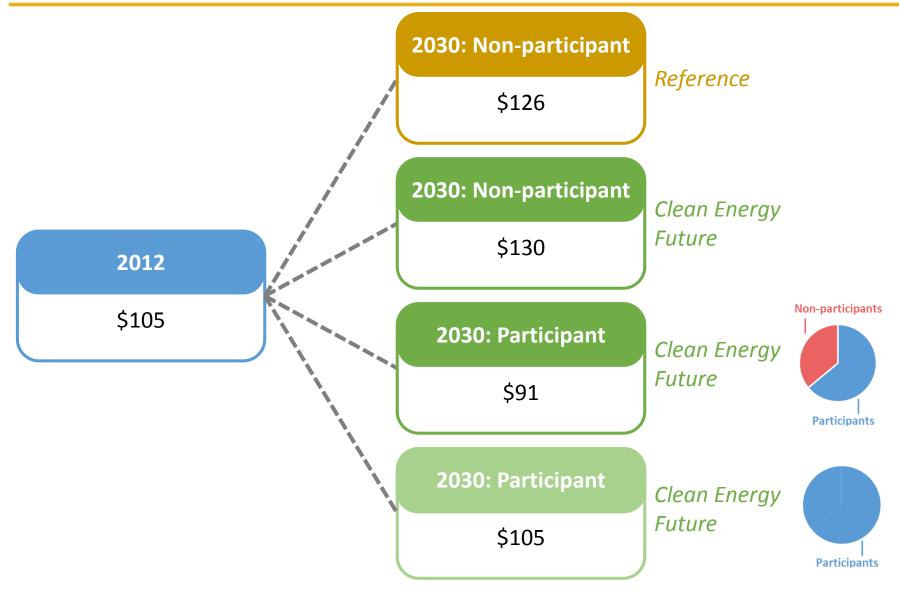
How Does the Clean Energy Future Compare to the Clean Power Plan?



How Does This Impact Monthly Bills?

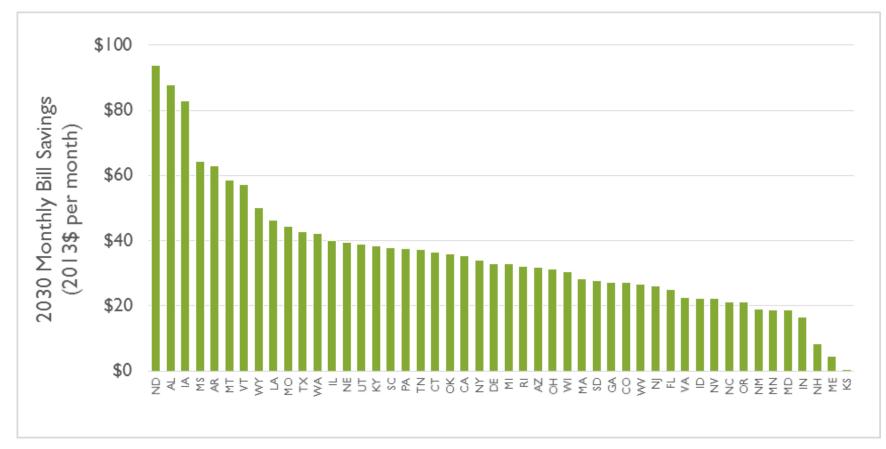


How Does This Impact Monthly Bills?



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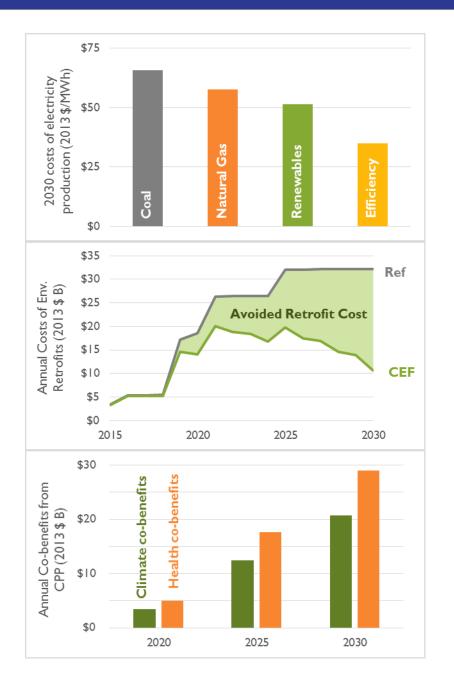
Monthly Bill Savings for Efficiency Participants



Bill savings compare Clean Energy Future EE participants versus Reference scenario

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How Can Greener Electricity Be Cheaper?



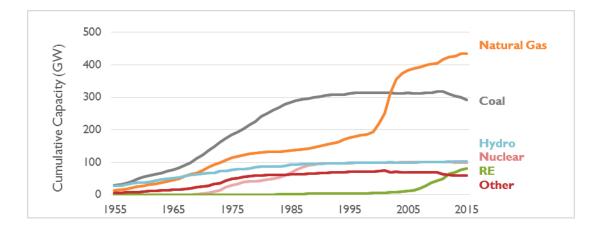
Cheaper, Green Electricity

- Cheaper renewables and energy efficiency
- Even without the Clean Power Plan, coal plants require costly upgrades and retrofits, which are avoided in the Clean Energy Future
- This doesn't even account for climate and health co-benefits, estimated to be \$50 billion in 2030 in the Clean Power Plan

Why Haven't We Done It Already?

New Price Dynamic

 While EE may be cheaper than centralized fossil generation, and renewables are getting there, the traditionally slow-moving electric sector is experiencing a lag time in responding



 As investors acclimate to the new market landscape, the shift to clean energy is likely to accelerate

Barriers to Renewable Energy

- Inconsistent policies and incentives across states and over time
 - Addressed by the Clean Power Plan
- Insufficient transmission of renewable energy from where it's produced to where it's needed
- System planners are innovating techniques for integrating variable-output renewables (like wind and solar) onto a grid dominated by inflexible traditional generation
 - Geographical distribution
 - Energy imbalance markets

Barriers to Energy Efficiency

- The Clean Energy Future models high, but not unknown, levels of energy efficiency
 - Several states, such as Massachusetts, California, Rhode Island, Vermont, and Arizona are all achieving levels of EE modeled in the Clean Energy Future, and have been doing so for several years
- Utility rate structure
 - If utilities invest in EE, sales go down, and so does utility revenue
 - Methods such as decoupling help to disconnect utility revenues from sales, although many incentives are possible

Is There a Catch?

Is the Clean Energy Future Comprehensive?

EE participation

• In the Clean Energy Future, households with strong participation can see savings up to \$35 per month on bills. Even if savings were distributed across every single household, bills would still be lower than in the Reference case by \$21 per month, on average.

First mover advantage

• We found that states who shift away from traditional generation sooner become net exporters in future years as fossil generation becomes increasingly uneconomic.

Stranded assets

- "Stranded assets," or investments made in fossil fuel plants that are made uneconomic and retire early in the Clean Energy Future, are assumed to be paid for 100 percent by ratepayers in the Clean Energy Future and the Reference case.
- It is likely that at least some of these costs would be shared between ratepayers and shareholders, reducing the costs in an actual Clean Energy Future.

Up-front payments for energy efficiency

- To better match current methods of paying for energy efficiency, we modeled the bill impacts of paying for EE as an up-front investment.
- Contrast this with annualizing costs, the typical method for comparing EE costs with traditional generation resources for planning and economic analyses

Synapse Clean Power Plan Toolkit

Synapse Clean Power Plan Toolkit EIA data Renewable target Capacity **Coal retirements** Environmental control costs estimates Demand response Nuclear lifetime Generation **Distributed PV** Carbon prices Capital & operating costs Environmental retrofit stringency **Electric vehicles Fuel prices Transmission expansion** AEO market price assumptions Emissions: CO₂, SO₂, NO_X, mercury Forward-going **CAVT** costs of coal units **Coal Asset Valuation Tool: RePRT ReEDS** Synapse **ReEDS Postliminary** Cumulative **Reporting Tool: Regional Energy Deployment System: Energy Efficiency** efficiency savings **Synapse** NREL, adapted by Synapse Cost of cumulative Formats data for **Savings Tool** savings state planning **Energy Efficiency** Capacity Savings Tool: EPA, adapted Generation by Synapse Costs **Emission rates** Rate & bills Efficiency ramp rate **OUTPUTS** Savings level target Measure life distribution **State Compliance Pathways** First-year cost of saved energy CP3T **IMPLAN®** Sales growth rate **Costs of Compliance Bill Impacts** Emissions IMPLAN[®]: Commercial model **Clean Power Plan Planning Tool:** by IMPLAN Group LLC Synapse Jobs, GDP Synapse CPP Toolkit ©2015

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Related Resources

Consumer Costs of Low-Emissions Futures Briefs and Reports: <u>http://synapse-</u> <u>energy.com/project/consumer-costs-low-emissions-futures</u>

Synapse Clean Power Plan Toolkit: http://synapse-energy.com/CleanPowerPlan

Past Clean Power Plan Webinars: <u>http://synapse-energy.com/synapse-projects-and-webinars-related-clean-power-plan</u>

Clean Power Plan Reports and Outreach for National Association of State Utility Consumer Advocates: <u>http://synapse-energy.com/project/clean-power-plan-reports-and-outreach-national-association-state-utility-consumer-advocates</u>

Synapse Blog Posts on Clean Power Plan: <u>http://synapse-</u> energy.com/tags/clean-power-plan

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