Clean Power Plan

Choices and Implications

PRESENTED TO

Wisconsin Energy Institute
2015 Energy Summit

PRESENTED BY

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THE Brattle GROUP

Final Clean Power Plan

Who: Existing Generation Units (EGUs) considered affected units under the 111(d) applicability criteria are grouped into two categories:

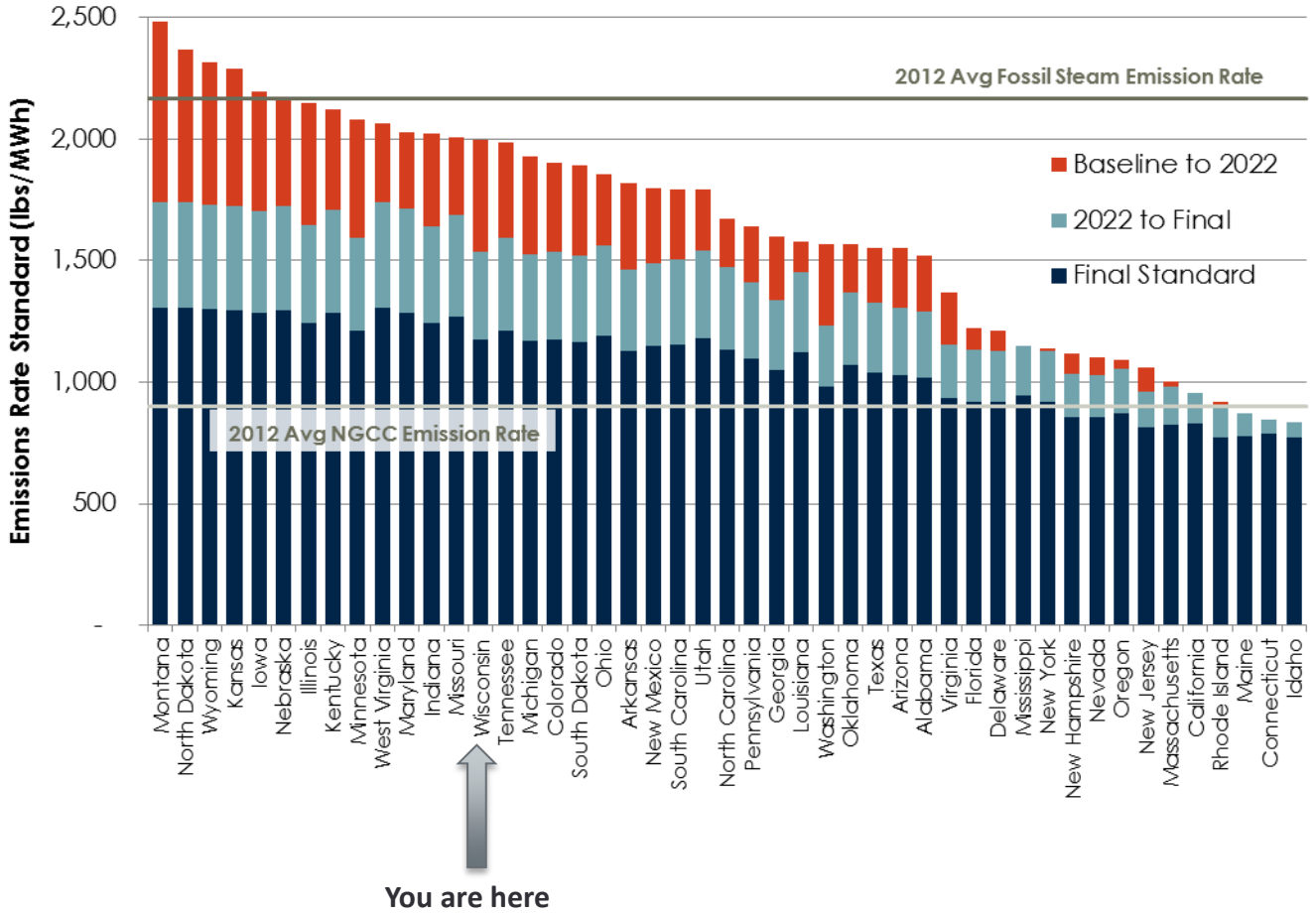
- Steam Units: Coal and oil/gas-fired steam turbine units
- NGCCs: Natural gas-fired combined cycle units
- Not Included: Simple cycle combustion turbine units

When:

- January 2016 (estimate): End of comment period on FIP and Clean Energy Incentive Program
- Sept 6, 2016: Initial submission of SIP (must request extension to 2018)
- Sept 6, 2018: Final submission of SIP
- 2022 – 2029: Annual EGU standards, with three interim compliance periods
- 2030 and beyond: Final EGU standard

State Rate Standards from 2012 Baseline to 2030 Final

Rate reductions are phased-in from 2012 Baseline to 2030 goals. The largest reductions are in MT, ND and WY, while some others such as ME, CT, ID, CA and MS are already in compliance with 2022 goals.

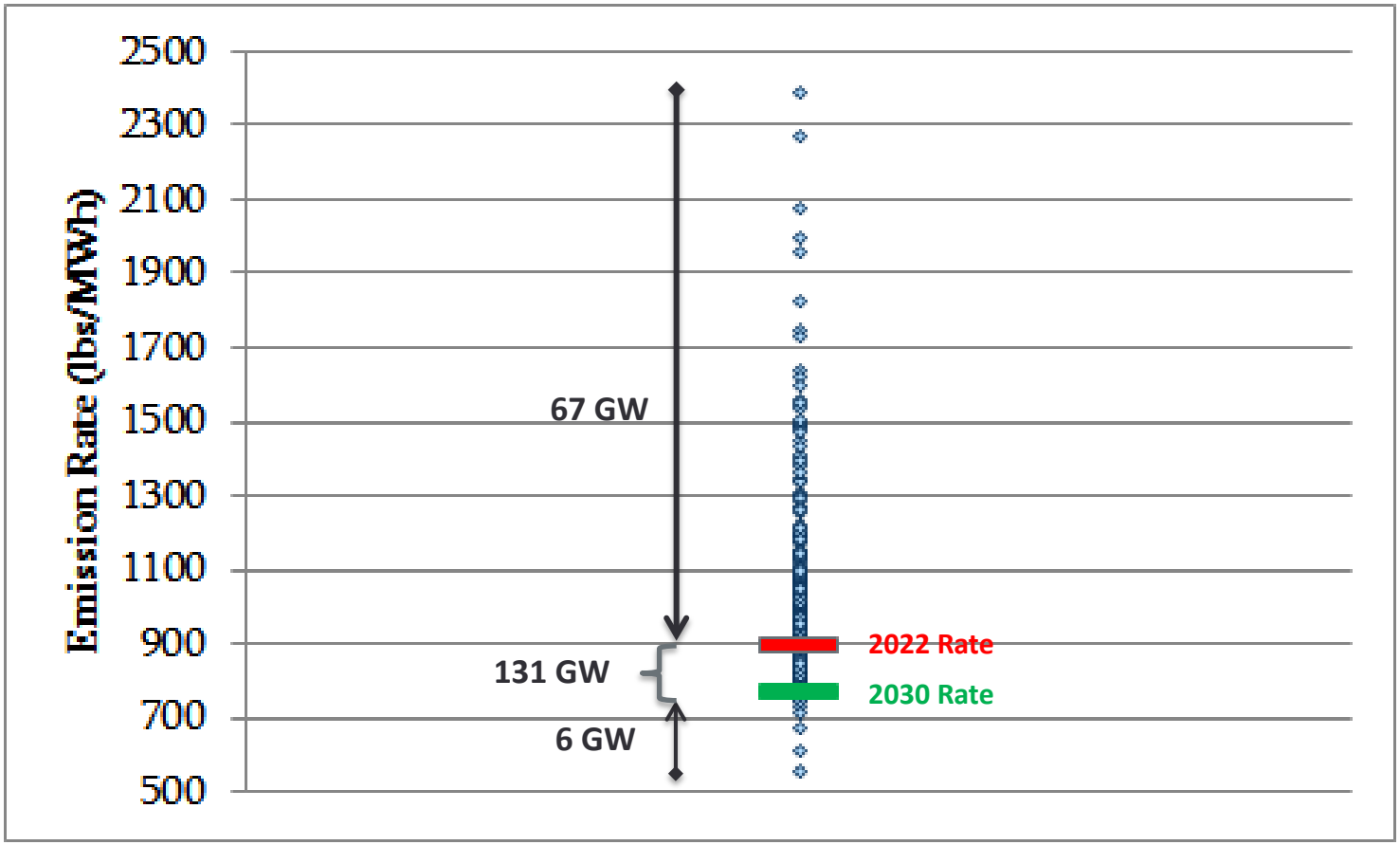


Compliance Plan Types

Plan Type	Emission Standards		State Measures (e.g., AB32, RGGI)
Enforceability	Federally-enforceable, EGU-specific requirements		Same, but also submit portfolio of non-federally enforceable emissions reduction measures, with a federally enforceable backstop
Emission Standard Type	Mass-Based	Rate-Based	Mass-Based
Covered Generators	Existing EGUs (excluding CTs), with option to include New EGUs, but not other sectors	Only Existing EGUs (excluding CTs)	Existing EGUs, with option to include New EGUs and other sectors
Tradable Compliance Instrument	Allowance, equivalent to 1 short ton CO_2	Emission Rate Credit (ERC), equivalent to 1 MWh of zero CO_2 Generation	Allowance, equivalent to 1 short ton CO_2
Compliance Formula	$CO_2\ Allowances = CO_2\ Emitted$	Submit $ERCs =$ Generation x $(\frac{\text{EGU Emission Rate}}{Reference\ Emission\ Rate} - 1)$	$CO_2\ Allowances = CO_2\ Emitted$
Plan Details Required	1. Units covered 2. Allowance allocation 3. Leakage prevention	1. Reference Emission Rate (category-specific, state average, re-defined) 2. Coordination with other states	1. Portfolio of state measures 2. Federally enforceable backstop 3. Units/sectors covered 4. Merging with other states

Existing NGCCs Relative to Subcategory Rate

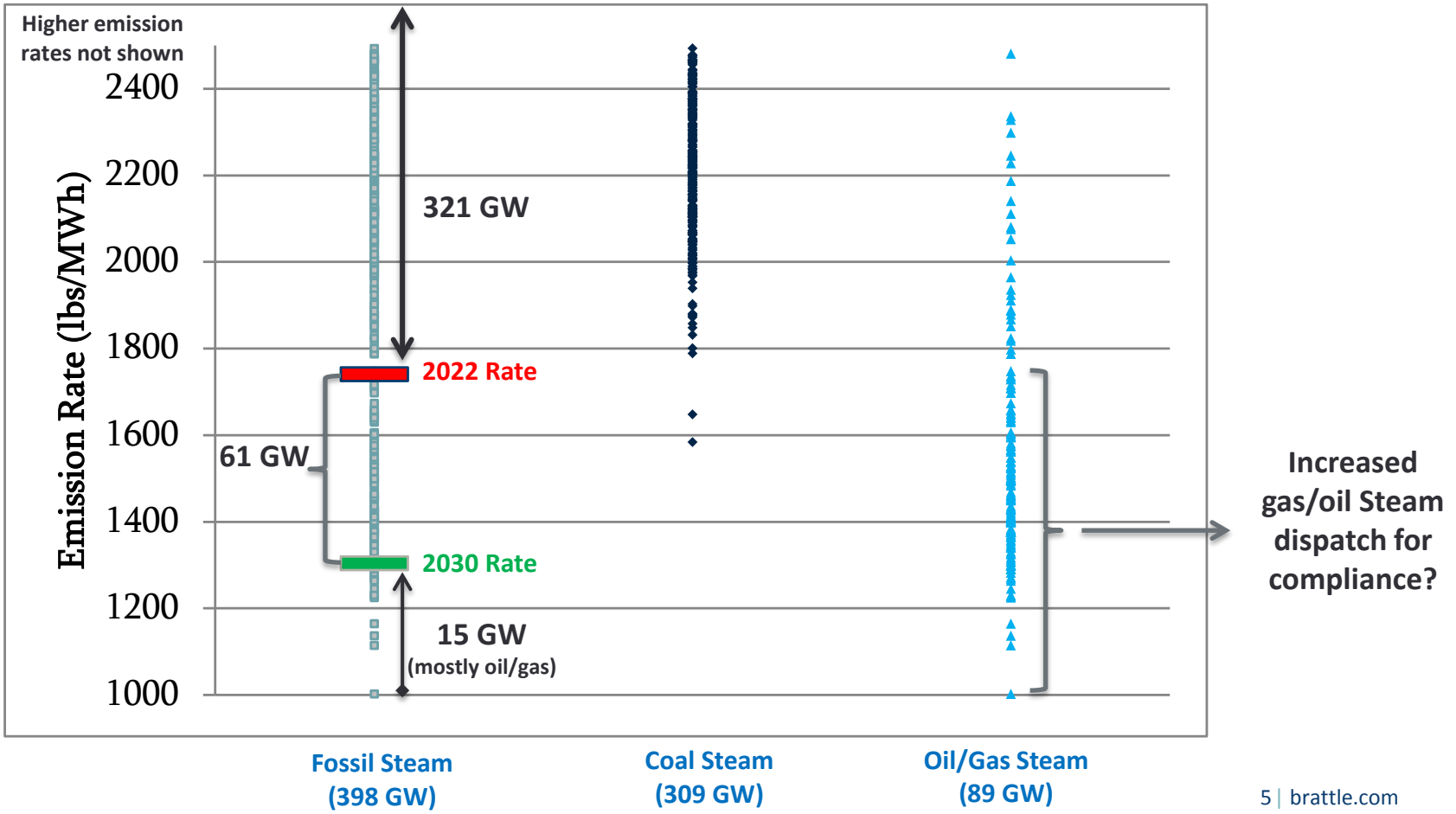
Based on EPA's 2012 data, most of the existing NGCC capacity (131 GW) have emission rates between the 2022 and 2030 rates, i.e., creating ERCs in 2022 but needing ERCs in 2030. Most of the remaining capacity will need ERCs for compliance in all years.



Source: EPA, "tsd-cpp-emission-performance-rate-goal-computation-appendix-1-5.xlsx".
Note that some of the NGCCs were reported by EPA as having emission rates substantially below 800 lbs/MWh, likely an error.

Fossil Steam Relative to Subcategory Rate

Based on EPA's 2012 data, most Fossil Steam capacity (321 GW) will need ERCs for compliance in all years, though 61 GW (mostly oil/gas steam) will be in compliance in 2022 and 15 GW will be in compliance in 2030. Therefore, 76 GW of Fossil Steam would likely create ERCs in 2022.



Coal Plant Retirements

As of September 2015, 51 GW of coal fleet has either retired or announced to retire by 2020

- 30 GW already retired since 2012 (1.5 GW in MISO)
- 10 GW announced to retire by the end of 2016 (3.5 GW in MISO)
- Another 11 GW announced to retire after 2016 (1 GW in MISO)

EPA's IPM analysis:

- about 100 GW coal retirements by 2020 with no CPP (most of it by 2016, and 15 GW in MISO)
- With CPP, an additional 15 GW by 2020 and 24-33 GW by 2030.

U.S. Actual and Announced Coal Plant Retirements

Year of Retirement	Number of Units	Capacity (MW)
Actual		
2012	88	9,085
2013	46	5,696
2014	39	3,806
2015	74	11,382
2012-2014	**247**	**29,970**
Announced		
2015	17	2,484
2016	52	7,176
2015-2016	**69**	**9,660**
2017	29	5,592
2018	16	3,165
2019	15	2,307
2020	0	0
Total 2012-2020	**302**	**50,694**

Potential Reliability Issues

Many concerns combine potentially high costs with reliability threats – these can be related but are not synonymous

Final CPP rule by itself is less likely to threaten reliability compared to the proposed rule

- compliance requirements are phased in,
- compliance starts in six years, and
- compliance options include buying ERCs and emission allowances from market (without having to cut multi-state deals)

However, retirements could be accelerated and compliance cost could go up if a state chooses to adopt a plan that blocks interstate trading of credits/allowances (e.g., state-average rate plan or customized rate standards for each type of unit under a state-measure plan).

Also, market price of ERCs and emission allowances could be volatile depending on the depth/participation in the market.

Will the Clean Power Plan challenge reliability?

Concern	Description	Challenging Factors	Mitigating Factors
Resource Adequacy	Additional coal retirements could cause shortages absent new investment	- Replacement capacity may be costly - More capacity needed if EE offers little peak reduction	- Plants can stay online for capacity purposes (at additional cost) - Purchasing in-state and out-of-state ERCs/allowances is possible - EE, DR and DG can be installed (cost/feasibility vary by region)
Transmission Security	Some coal plants are relied upon for voltage support or other aspects of transmission security	- Solutions come at a cost	- Compliance flexibility may use other reductions or ERC/allowance trading to keep critical plants online - Tx upgrades or new resources can replace critical plants
Gas / Electric Coordination	Increased reliance on gas generation may lead to pipeline constraints during cold snaps	- Limited gas-electric planning and coordination today	- Can use coal/oil units on small number of critical days - LNG and gas storage - Purchasing in-state and out-of-state ERCs/allowances is possible
Integrating Renewable Energy	High levels of variable energy resources may pose operational challenges and provide limited firm capacity	- Costlier if much higher penetrations occur than expected - Will need new Tx	- Flexible generation - Improved forecasting, scheduling, and A/S products - Emerging energy storage

Will Power Prices Increase due to CPP?

Depends on states' choice of compliance plans, participation of states in ERC/allowance trading, relative fuel prices, and deployment of EE/RE solutions

- Rate-based tend to result in lower price increase (and in some cases decrease) versus mass-based
- High participation in trading would lower ERC/allowance prices
- Continued low gas prices would reduce cost of coal-to-gas dispatch switching, though would also delay economic entry of RE/EE
- New EE/RE would decrease energy prices, but may increase capacity prices and retail rates

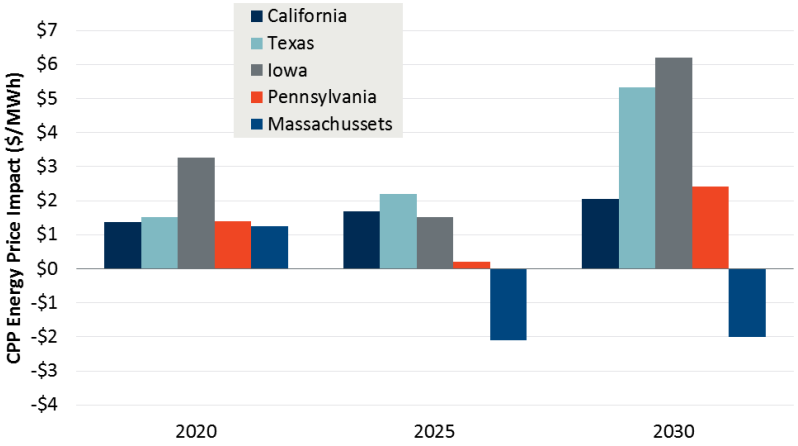
EPA's Estimates for Impact on Wholesale Energy Prices

EPA estimated energy prices generally higher under mass-based compliance relative to rate-based by 2030, but impacts differ by state and by year

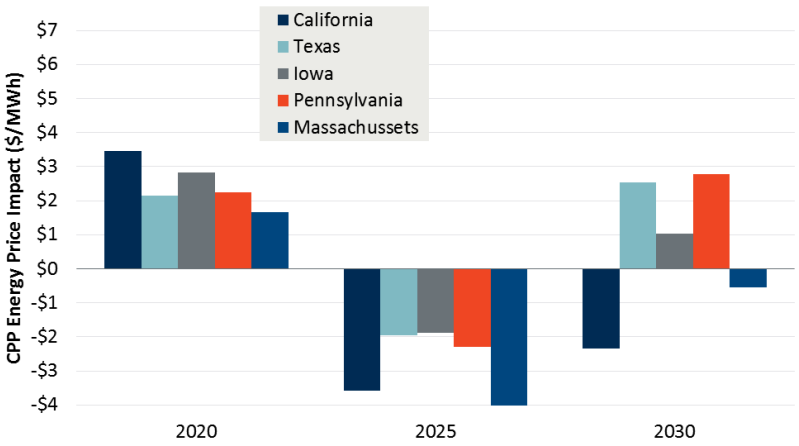
- Mass-based:+$ 5/MWh by 2030 in TX/IA; +$2-3/MWh in CA/PA, -$2/MWh in MA
- Rate-based: price decreases in CA and MA by 2030; +$1-3/MWh in TX, IA and PA

Energy Price Impact of CPP under EPA's IPM Analysis*

Mass-Based Standard



Rate-Based Standard



Note: Energy prices are the energy-weighted prices from the following IPM regions: CA - WECC_Southern California Edison; IA - MISO_Iowa-MidAmerican; PA – PJM_Western MAAC; MA– ISONE_MA, VT, NH, RI (Rest of ISO New England).

(*) The Brattle Group has not confirmed that the EPA IPM results are a valid reflection of the economic impacts of the Clean Power Plan Final Rule. These values are presented for illustrative purposes only

CPP Impacts on Dispatch Costs – Distortions?

	Rate-Based (Category-Specific)	Rate-Based (State-Specific)	Mass-Based
Existing Coal	Buy ERCs or GS-ERCs (only two coal plants have lower emission rates than the 2022 standard of 1,741 lbs/MMBtu	Buy ERCs	Buy allowances for all emissions
Existing Gas CC	Create ERCs in early years, create GS-ERCs in all years (NGCC standard decreases from 898 to 770, NGCC at 7000 heat rate emits at 819 lbs/MWh)	Buy/create ERCs depending on the plant emission rate	Buy allowances for all emissions
Existing Gas CT	No ERC creation or purchase	No ERC creation or purchase	Not covered, no allowance costs (unless state measure includes CTs)
New Gas CC	No ERC creation or purchase	No ERC creation or purchase	Buy allowances only if state cap includes new NGCCs

Some Takeaways for CPP Compliance

Ability to choose is a good thing, but only if you understand the cost of each option

- UNDERSTANDING THE RELATIVE COSTS OF EACH OPTION IS KEY

Cost of many of the options under CPP compliance depends in part on what options the other states choose (i.e., trading partners)

- NEED TO DEVELOP EXPECTATIONS OF WHAT OTHER STATES WOULD LIKELY DO
- THEN ENGAGE WITH THEM TO ASSESS BENEFITS FROM COORDINATION

Presenter Information

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Dr. Celebi provides expertise in electricity markets and analysis of environmental and climate policy. He has consulted primarily in the areas of electricity spot pricing and market design, and has experience in developing and analyzing climate policies, resource planning, power plant valuation, cost/benefit analyses for joining RTOs, LMP modeling, and merger analysis.

Dr. Celebi received his Ph.D. degree in Economics at Boston College, M.A. degree in Economics at Bilkent University, Turkey, and B.Sc. Degree in Industrial Engineering at METU, Turkey.

About Brattle

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