

November 13, 2019 | Arlington, VA

# IECA Biannual Meeting


## LOOKING AHEAD TWELVE MONTHS

### Future of US Industrial Manufacturing On the Line

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# About Andy Weissman

- Senior Counsel at Pillsbury Winthrop Shaw Pittman
  - 30+ years experience providing strategic advice at C-suite level
  - Highly regarded energy regulatory attorney and Clean Air Act expert
  - Couples legal expertise with deep industry knowledge
- Major role in transforming US energy and environmental policy
- Helped to pioneer emissions trading in United States
- CEO, EBW Analytics Group
  - Premier energy market analysis service since 2003; publishes:
    - Energy Risk Report, the only analysis designed specifically to aid energy procurement professionals
    - Energy Market Outlook, next-generation analysis of the nexus between weather and the cost of natural gas and electricity
    - Energy Flash Report, a daily analysis with the latest changes to weather and the natural gas supply/demand balance
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# Energy Flash Report

- Natural gas demand and weather changes and forecasts
- Forecasts for current and following two natural gas storage weeks
- Delivered daily before the bell

**Andy Weissman's Energy Flash Report**  
Published by EDW Analytics Group • Weather Decision Technologies

TUESDAY, MAY 1, 2018

### Bulls Could Make One More Run This Week

- This time of year, shifts in weather forecasts often have little impact on total demand for natural gas. While geography matters, both space heating demand and air conditioning demand are generally weak. Further, lower-than-normal gHDDs often correlate with above-normal CDDs and vice versa.
- Rather than focusing on day-to-day shifts in the forecast, therefore, traders concentrate primarily on cash prices (which are weakening) and the size of reported weekly injections.
- Over the next few days, the potential for a below-normal injection (the first injection of the season) could give prices a temporary boost. Forecasts for a few days of summer-like weather could also push prices higher. By next week, though, the first of a string of 100+ Bcf injections is likely and summer-like weather is expected to quickly fade. As a result, any upward blip in prices should be brief, followed by further declines.

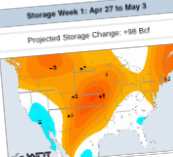
June Natural Gas Contract  
 Monday's close: \$2.763  
 Down 0.8 cents (-0.3%)

**NYMEX Front-Month Natural Gas Contract Price Trends**

Forecast Period	EDW Predicted Trend
7-10 days (June 2018 Contract)	Brief Blip Higher Than Further Decline
30-45 days (July 2018 Contract)	Prices Start to Recover Near Memorial Day

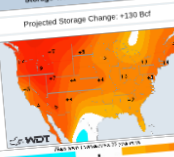
**Storage Week 1: Apr 27 to May 3**

Projected Storage Change: +98 Bcf



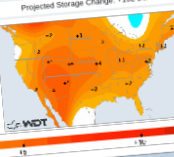
**Storage Week 2: May 4 to May 10**

Projected Storage Change: +130 Bcf



**Storage Week 3: May 11 to May 17**

Projected Storage Change: +132 Bcf



30-Year Norm	9.8
Forecast	21.8
Actual/Forecast	17.3
Anomaly	+7.5
Δ Since Yesterday	+1.4
gHDDs	49.9

30-Year Norm	13.1
Forecast	24.7
Anomaly	+8.7
Δ Since Yesterday	+1.1
gHDDs	22.0

30-Year Norm	16.9
Forecast	24.1
Anomaly	+7.8
Δ Since Yesterday	+1.6
gHDDs	16.8

30-Year Norm	29.3
Forecast	25.0
Actual/Forecast	29.3
Anomaly	-0.3
Δ Since Yesterday	-1.2
Δ Since Last Year	-1.2

30-Year Norm	29.3
Forecast	25.0
Anomaly	-0.6
Δ Since Yesterday	-0.6
Δ Since Last Year	-4.1

30-Year Norm	29.3
Forecast	24.1
Anomaly	-0.0
Δ Since Yesterday	-0.0
Δ Since Last Year	-2.9

CDDs	+4.1
Demand	-6.2 Bcf
Price Impact	-2.1c/MMBtu

CDDs	+12.6
Demand	-5.7 Bcf
Price Impact	-1.9c/MMBtu

Projected mid-November natural gas storage at Monday's strip prices: 3,578 Bcf | Coal displacement: 4.0 Bcf/day

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**Andy Weissman's Energy Flash Report**  
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TUESDAY, MAY 1, 2018

Week Ending	CDDs	Injection	Changes	vs. 2017
04/19/2018 (actual)	8.0	-18	0	-92
04/26/2018 (forecast)	7.8	60	0	-7
05/03/2018 (forecast)	17.3	98	2	53
05/10/2018 (forecast)	21.8	130	4	62
05/17/2018 (forecast)	24.7	132	0	57

Week Ending	Total Storage	vs. 2017	vs. 5-Year Avg
04/19/2018 (actual)	1,281	-897	-527
04/26/2018 (forecast)	1,341	-905	-544
05/03/2018 (forecast)	1,439	-856	-521
05/10/2018 (forecast)	1,568	-791	-481
05/17/2018 (forecast)	1,700	-733	-438

### Significant Developments

- A new report by Raymond James suggests a difficult road ahead for natural gas producers. While Raymond James leaves its 2018 forecast unchanged at \$2.75, it also contends that, over the long term, \$2.50/MMBtu should be adequate to balance supply and demand.
- While weather conditions next winter will play an important role, in our view Raymond James' \$2.25/MMBtu forecast for 2019 is a plausible scenario. At this price level, the financial pressure on some natural gas producers could be intense.
- A second report by Raymond James on energy storage takes a further negative view on future negative view on future demand for natural gas. It contends that, as partially replace 2,200 MW of older coal-fired units on its system. The coal units slated for retirement have been a core component of power sector demand for natural gas in Michigan by as much as 0.25 Bcf/d.

### What the Charts Are Telling Us

Month-over-Month Change in US Dry Gas Output by State, January v. February 2018 (Bcf/mo)



- Lower 48 onshore dry natural gas production reached 75.5 Bcf/d in February, according to EIA's latest release of monthly production data — up more than 1.4 Bcf/d vs January. Lower 48 dry gas production grew an estimated 7.7 Bcf/d since February 2017.
- Texas (recovering from January freeze-offs) and Pennsylvania accounted for 0.6 Bcf/d of the month-over-month surge, New Mexico and Oklahoma (0.21 Bcf/d), Ohio (0.16 Bcf/d) and complemented by Louisiana (0.16 Bcf/d apiece).
- With continued rig count additions in oil-drifted plays and new pipeline capacity in the Northeast expected this year, Lower 48 onshore gas production should increase at a rapid clip.
- Even so, incremental output may be needed to replenish depleted US storage inventories before next winter, reducing the bearish impact on NYMEX natural gas futures.

### Weekly Degree Days by EIA Region

Region	May 3	May 8	May 14
NG Storage Report			
EIA STEO			
EIA DPR			

Event	May 25	May 29	May 31
June Options Expire			
June Contract Expires			
EIA NG Monthly			

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# Energy Risk Report

- The only publication with *specific procurement recommendations* for large energy users
- Designed to assist buyers with optimizing timing of electricity and natural gas purchases
- Monthly issues: National, ISO-New England, MISO, ERCOT, Cal ISO, PJM and NYISO

**NATIONAL ISSUE**  
FEBRUARY 15, 2018

## Energy Risk Highlights

Electricity futures gained in most regions over the past month, reflecting an increase in perceived risk following repeated scarcity pricing in the Northeast and ERCOT. Risk premiums for winter electricity futures increased over the past month, record cold in early January and a second bout of frigid temperatures mid-month. Looking forward, however, end users may benefit from lower prices as surging natural gas production helps reduce the cost of the marginal source of supply.

Significant regulatory developments—including FERC's rejection of the DOE's NOPR and the sweeping end-of-year tax overhaul—carry important implications for the future of the electricity sector. FERC rejected DOE's proposal to grant coal and nuclear operators cost recovery plus profits and pushed the issue down to the ISOs. For their part, grid operators—led by PJM, ISO-NE, and MISO—are considering changes to capacity or energy markets that will boost prices paid by end users to help support struggling coal and nuclear units.

The tax reform overhaul may lead to lower regulated rates-of-return on existing pipeline, transmission, and distribution infrastructure—potentially yielding lower prices for end users. Lower tax rates, however, may also diminish the value of renewable tax credits and slow the growth of the low marginal cost resource.

Record cold to begin 2018 led to scarcity prices—even though monthly average temperatures are close to normal—highlighting the asymmetric price risk faced by end users. Notwithstanding periods of extreme warmth to bring January 2018 within a few pIODs of normal, prices will likely register significantly above average. The ability of prices to skyrocket during extreme grid conditions should serve as a reminder of the benefits of hedging risks for end users.

Natural gas prices rose over the past month, but the coming deluge of production gains could push prices sharply lower over the next several months. After a record-breaking 2017, natural gas production growth may set an even quicker pace in 2018. New Appalachian pipelines and strong oil pricing indicate the key drivers of surging production are likely to continue this year, potentially setting up an extremely advantageous position for end users later this year for Cal 2019.

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**Change in Wholesale Market and Natural Gas Prices for Cal 2018 Futures since December 18, 2017**

Andrew D. Weisman, Editor in Chief

**PJM REVIEW**

PJM offers competing capacity market proposals.

## OUR PROJECTIONS AND RECOMMENDATIONS

Time Period	EWB* Increment	EW/2018	Test Fuel Rate	Test Price	12 Month Range	Test Fuel Rate
Apr-Aug 2018	Portfolio	\$35.72	\$6.80	\$1.26	\$27.45-\$50.94	\$34.31
Sep-Dec 2018	Portfolio	\$34.26	\$6.58	\$1.03	\$31.09-\$54.08	\$32.84
Cal 2019	Waltz	\$35.48	\$6.55	\$6.00	\$33.33-\$56.06	---
Cal 2020	Portfolio	\$39.00	\$6.35	\$6.39	\$32.49-\$55.34	---

**Key Takeaways**

- PJM finds FirstEnergy retirements have little reliability impact.** Nuclear retirements alone may increase ISO-wide energy costs by \$1.5 billion annually, however.
- Federal intervention to help coal and nuclear units a real possibility.** Secretary Perry could declare a grid emergency to grant coal and nuclear plants full cost recovery.
- PJM submits competing capacity market reform proposals.** Both may encounter difficulty with a Commission prioritizing stakeholder support, but long-term upside risk is intact.

**FirstEnergy Retirements Won't Threaten Reliability, PJM Finds**

PJM West electricity futures trended higher in April. Summer and fall 2018 strips ticked higher by 48¢/MWh (1.2%) and 71¢ (2.2%) month-over-month, while winter 2018-2019 contracts gained 69¢ (1.4%) on average. Cal 2019 and Cal 2020 reflected near-term upward price movement, adding 71¢ (2.0%) and 21¢ (0.6%) sales over the same period.

Wholesale electricity futures may have bounded higher on (a) the growing market expectation that PJM would pass price reforms designed to increase generator compensation, and (b) FirstEnergy's retirement announcements.

Dominion South natural gas futures generally declined since late March. Balance of Cal 2018 contracts gained 1¢ (MMBtu) (0.3%) since the end of March, while Cal 2019 added 6¢ (2.7%) and Cal 2020 depreciated by 8¢ (-3.4%). That wholesale power futures trended higher month-over-month despite flat-to-declining natural gas prices underscores the impact of regulatory and retirement-related price risk on the electricity side.

PJM finds FirstEnergy's announced retirements would not impact grid reliability. FirstEnergy filed for bankruptcy in late March after petitioning Department of Energy Secretary Rick Perry to utilize his authority under the Federal Power Act (FPA) to declare a grid emergency to grant coal and nuclear plants cost-of-service treatment.

PJM initially lambasted the idea of a pending crisis and recently issued a report finding Pennsylvania and Ohio would not face reliability issues even if all of FirstEnergy's announced retirements occurred. Still, retirements could yield higher zonal capacity and energy prices. Analysis by the Brattle Group found PJM end users could pay an extra \$1.5 billion annually if FirstEnergy's three nuclear plants were closed and replaced by a 71.25 mix of gas and coal generation.

PJM's reliability finding may not prevent more aggressive federal intervention to reduce baseload retirement pressures, however. Although DOE spokespeople have previously suggested such a move was unlikely, recent public comments from Secretary Perry himself have raised concerns he is taking FirstEnergy's request seriously.

2 Energy Risk Report

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**NATURAL GAS NATIONAL OVERVIEW**

NYMEX Front-Month Natural Gas Contract (\$/MMBtu). Since 2016 Winter risk premiums have deteriorated substantially.

Gas in Storage in Second Week of January. Last Six Years (Bcf) Storage 30a Bcf below five-year average.

revised, with new pipelines entering service and strong oil market fundamentals reflected in multi-year record prices.

Given these stronger circumstances, it would not be surprising to see 2018 production growth eclipse 2017's record output gains, putting very strong downward pressure on natural gas by mid-2018 and carrying into Cal 2019.

Associated gas production has been a critical part of recent natural gas production growth, increasing ties between global oil markets and U.S. natural gas and electricity markets. Roughly half of recent production growth in 2017 came from shale basins traditionally driven more by oil economics than natural gas prices.

Currently, oil market fundamentals are strong and oil prices are hovering near multi-year highs, encouraging more oil production and increased associated gas output.

Should oil prices weaken, however, these market signals would reverse, reducing associated gas output and total natural gas supply, ultimately putting upward price pressure on both domestic gas and power markets.

The potential for seasonal LNG weakness to emerge may weigh on gas prices during the shoulder season. Dominion's Cove Point LNG facility has been delayed until late March or early April, nearly six months from the initially projected in-service date. The delay has already erased 125 Bcf of projected demand, and further delays should not be ruled out.

In addition, other prominent natural gas analysts are beginning to share our outlook that a relative lack of international storage capacity may weigh on natural gas prices, possibly sending global LNG prices below \$5.00/MMBtu and resulting in temporary U.S. capacity shut-ins.

We recommend end users take risk off the table through the end of winter—with those willing to shoulder a slightly higher-risk scenario waiting for weak fundamentals to push more attractive pricing for the balance of Cal 2018 and Cal 2019, and adopting a portfolio procurement approach for Cal 2020. Weather-driven upside price risks continue in the immediate term, with the potential for cold weather to return and send natural gas spot market prices spiking erratically.

In the medium-to-longer term, however, the natural gas supply glut appears wide open, and—although timing remains difficult to pinpoint—strong downward pressure on gas futures is likely to emerge by the back half of Cal 2018 and into Cal 2019.

By Cal 2020, however, factors driving the likely medium-term price weakness, including a strong oil market and weak global LNG dynamics, could fade and lead to a more balanced risk/reward procurement outlook.



# Looking Twelve Months Ahead

- US energy markets on cusp of far-reaching change
  - 2020 election could be gamechanger
  - Profound implications for manufacturing sector and US economy
- Climate change likely to be major priority
  - Every Democratic candidate committed to significant reductions in use of fossil fuels
- US power markets could be permanently altered
  - Equally significant implications for natural gas
- Future of energy intensive industries could hang in the balance
  - Cost-effectiveness could become a “life or death” issue
- IECA members in a position to play a critical role

A photograph of a house at night, decorated with colorful Christmas lights along the roofline. A white SUV is parked in the driveway. A person is visible near the garage entrance. The scene is overlaid with a blue tint. The text "Paradigm Shift Regarding Climate Change" is centered in white.

# Paradigm Shift Regarding Climate Change

# Terms of the Debate Have Fundamentally Changed

- Prior to last year, no sense of urgency
- Climate change previously thought to be long-term problem
  - Temperatures expected to increase gradually over extended period
  - Not thought to be a significant health issue
- Goal was to limit total increase in ambient air temperatures to 2 degrees Celsius
  - Required gradual reduction in emissions by 2050

# Facts Matter

- These beliefs have been shattered
- As recently as two to three years ago, no one anticipated the frequency and severity of extreme weather events
  - Global phenomenon
  - Deadly wildfires, massive droughts, extreme flooding, killer heat-waves, rapid disintegration of glaciers
- Fundamentally alters public perceptions and support for sweeping action
- Simultaneously, a flurry of new reports by United Nations IPCC and others have punctured previous assumptions
  - Reports conclude that to avoid catastrophic harm, temperature increase must be limited to 1.5°C
  - Requires drastic emissions reductions over next ten years
  - Intensifies commitment to action by many political leaders



# October 2018 U.N. IPCC Special Report

- Addresses potential impact of increases in ambient air temperatures greater than 1.5°C
- Conclusions:
  - Limiting temperature increases to 2°C not adequate
    - Warming above 1.5°C will lead to severe harm
  - Time is running out
  - Requires rapid decreases in annual Greenhouse Gas emissions over the next twelve years
    - Absent immediate action, large-scale negative emissions measures will be essential
      - Not yet demonstrated
      - Estimated cost of \$600/ton of CO<sub>2</sub> removed

# Potential Harm if 1.5°C Threshold Exceeded

- Potential impacts include:
  - Major increases in drought, intense heat episodes, wildfires, torrential rains, and massive floods
  - 50% increase in amount of land mass fundamentally transformed
    - Up to one fifth of Earth's surface
  - 420 million more people exposed regularly to extended periods of deadly
  - Major water shortages
  - Several hundred million people exposed to climate-induced famine
  - Virus mutation rate accelerates exponentially while immune system suppressed
  - Massive releases of methane from permafrost
    - Affected land about the size of Mexico

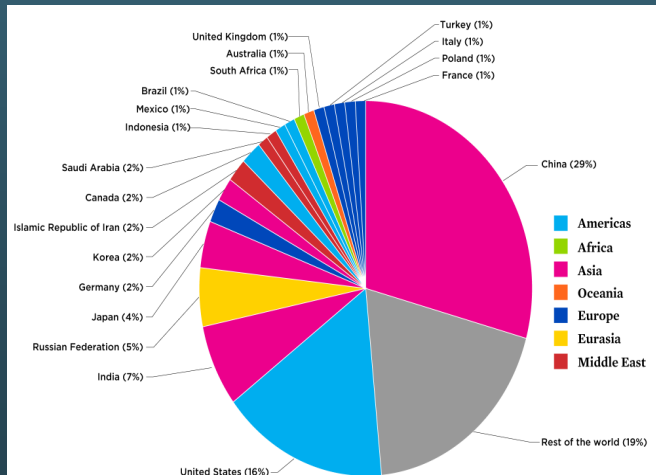
# No Longer Possible to Prevent Increases Above 1.5°C

- Requires 45% reduction in carbon emissions by 2030
- Needed actions include:
  - Phase out of two-thirds of global coal use by 2030
  - Rapid phase shift to all-electric vehicles
    - Eliminate all gasoline- and diesel-fired vehicles by 2050
  - Shift to near-zero carbon emissions for all electric generation globally
- Not plausible
  - But provides insight into extent of reductions that may be needed

# US Remains Major Source of Emissions

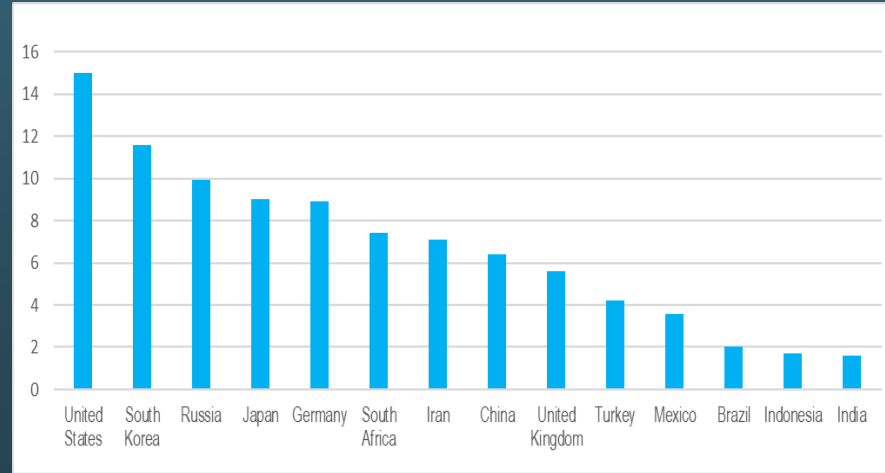
- While US has achieved major reductions in emissions, it remains the second largest emitter (behind China)
  - On a *per capita* basis, stands out even further

Each Country's Share of CO2 Emissions



Source: Union of Concerned Scientists

CO2 Emissions Per Capita from Fuel Combustion in 2016



Source: Union of Concerned Scientists

A large tree is the central focus, split vertically down the middle. The left half of the tree is lush and green, with a full canopy of leaves. The right half is bare, with only skeletal branches and a trunk that appears to be growing out of cracked, dry earth. The background is also split: the left side shows a bright blue sky with white clouds and several birds in flight, while the right side shows a hazy, orange and yellow sky with a few dark, smoky clouds. The ground is split horizontally, with a vibrant green field on the left and parched, cracked brown soil on the right.

Impact

# Implications for US and Global Energy Market

- Enormous shifts coming soon
  - Steep increase in demand for LNG
  - Electrification of economy
  - Explosive growth in intermittent resources, energy storage and demand response
  - Steep decline in utilization rate for gas-fired generating units
  - Off-the-charts increase in demand volatility
  - Huge barriers to building infrastructure (especially in US)
  - Rise of synthetic gas

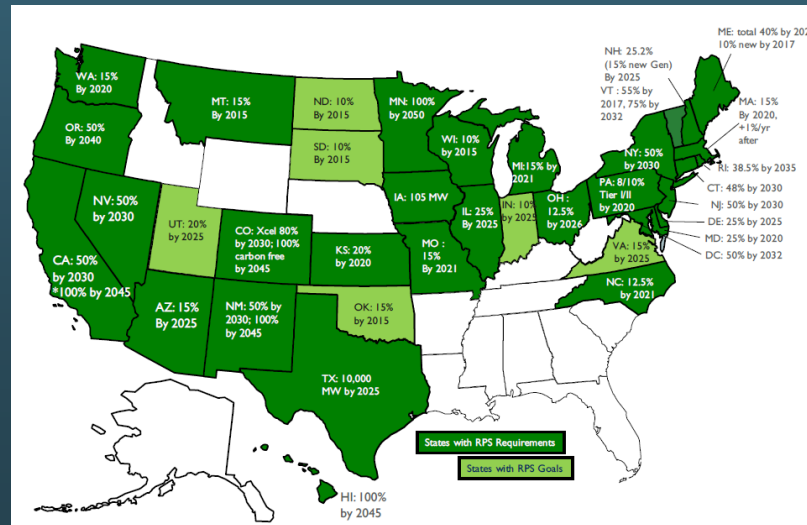
# Costs to Meet IECA 2030 Goals Would Be Huge

- WoodMac estimates \$4.5 trillion
  - More than cost of Iraq War or annual defense budget
- Three major components
  - 1,600 MW of new renewable generation (12.3 X current levels): \$1.5 trillion
  - 900 GW of energy storage: \$2.5 trillion
  - 200,000 miles of high voltage transmission: \$900 million

# Sweeping Changes in US Power Sector Already Underway

- Far reaching changes already occurring state-by-state, utility –by-utility and through corporate-sponsored projects
  - Not yet reflected in EIA data

US Renewable Portfolio Standard Requirements and Goals



Source: INGAA





# Democratic Agenda

# Support for Sweeping Action Building

- Many major Democratic candidates endorse:
  - Some form of “leave it in the ground”
  - Requirement for 100% renewable energy by 2030
  - Severe restrictions on use of hydraulic fracturing
- Support for ban on new gas-fired generation also growing

# Top Ten List

**Potential new initiatives by a new Democratic Administration in first 90 days after taking office include:**

1. Accelerated war against coal
2. National Clean Energy Standard/path towards 100% renewables
3. Build out of nationwide transmission network
4. Potential ban on construction of new gas-fired generation
5. Ban on new federal oil and gas leasing/restricted drilling of existing leases
  - Both onshore and offshore

## Top Ten List (cont'd)

6. Greatly intensified war against new oil and gas pipelines
  - Construction could come to a total halt for 2-3 years
7. New pipeline safety requirements that could greatly increase costs
8. Federal ban on flaring
9. Aggressive restrictions on fugitive methane emissions
10. Drilling bans in non-attainment areas for ozone and NOx
  - Net effect could be to bring investment in new gas-fired generation and new natural gas infrastructure to a near total halt

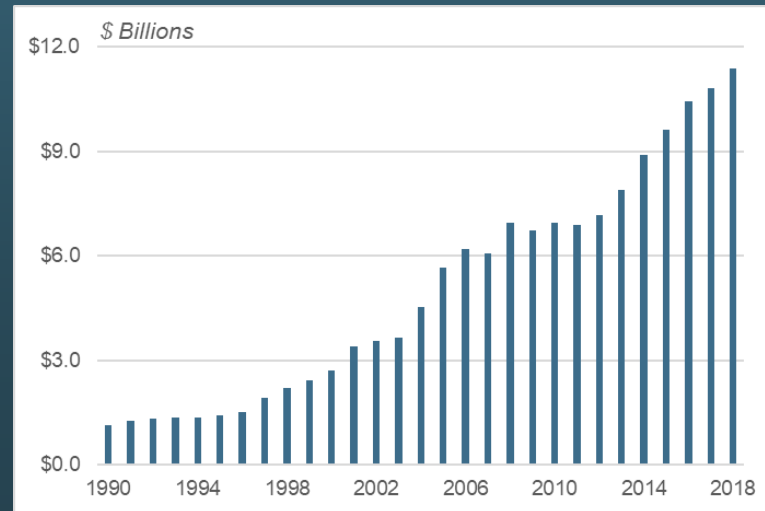


# Key Issues

# Essential to Find a Least-Cost Path

- While many manufacturing companies support further emissions reductions, critical to develop cost effective strategy
- Experience with transmission during the past decade illustrates need for industrial sector to bring adequate expertise and resources to bear
  - No rigorous demonstration that benefits outweighed the cost

Annual Investor-Owned Utility Transmission Spending, 1990-2018 (\$ Billions)

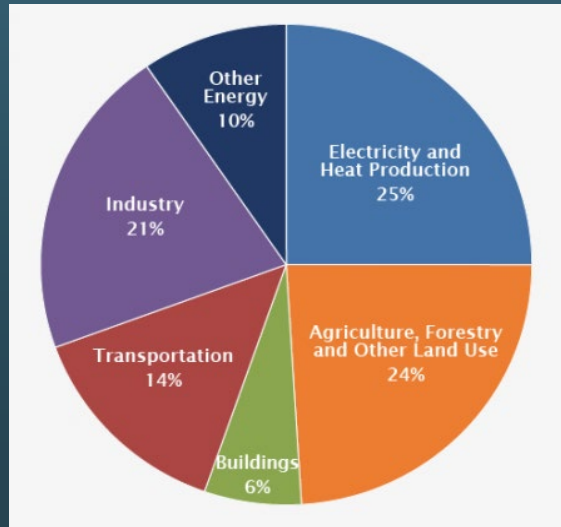


Source: EIA Electric Power Annual

# Solution in Part to Focus on Reductions in Other Sectors

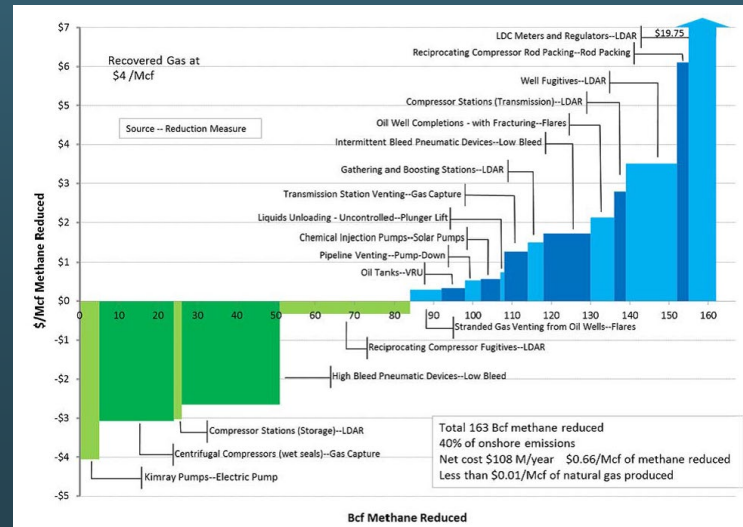
- Politically expedient to put all of the burden on power
  - But lower cost solutions often are available

Global Greenhouse Emissions by Economic Sector



Source: IPCC 2014

Marginal Abatement Cost Curve for Methane Reductions by Source

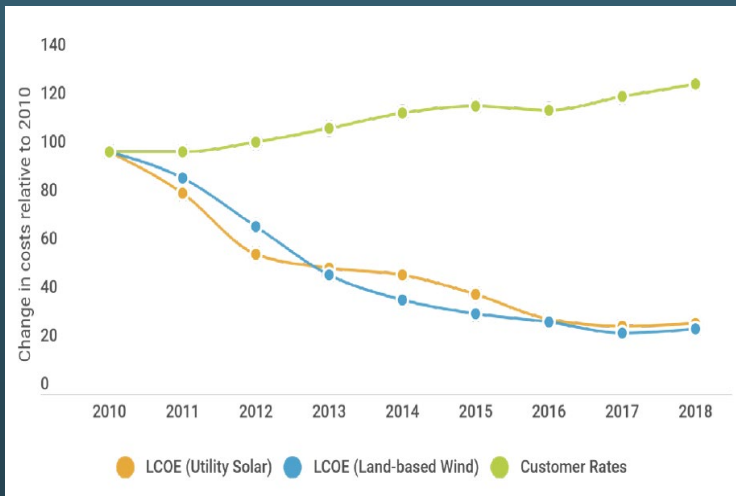


Source: Environmental Defense Fund

# California Experience Sobering

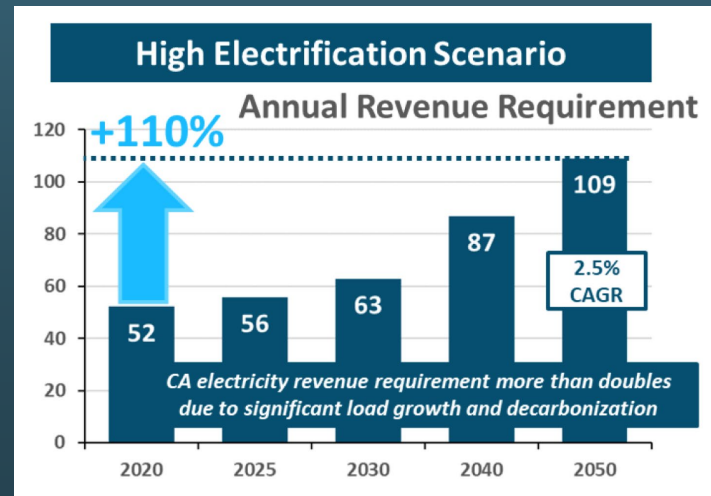
- While renewable energy costs have plunged, in a state in which resource availability is high, electricity costs have escalated sharply
  - Costs to achieve long-term goals could crush state economy

### Transitions Costs vs Levelized Costs of Renewables



Source: Wood Mackenzie

### California Electricity System Costs More than Double (\$2016)



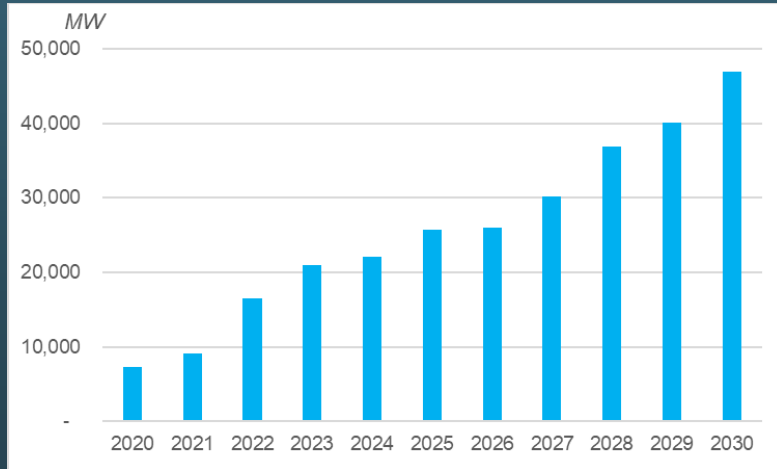
Source: E3



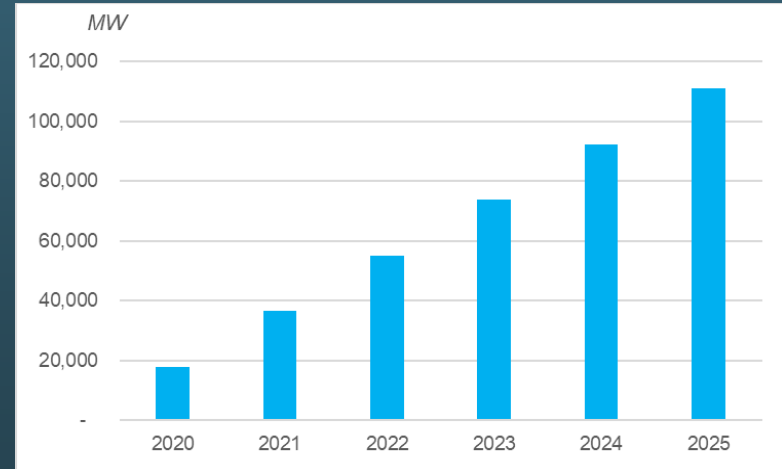
# Fossil Fuel Fleet Could Shrink Sharply

- Most coal-fired plants could be shut down, with few new gas-fired plants to replace

Currently Scheduled Coal Retirements Through 2030,  
With Increasing Announcements Likely



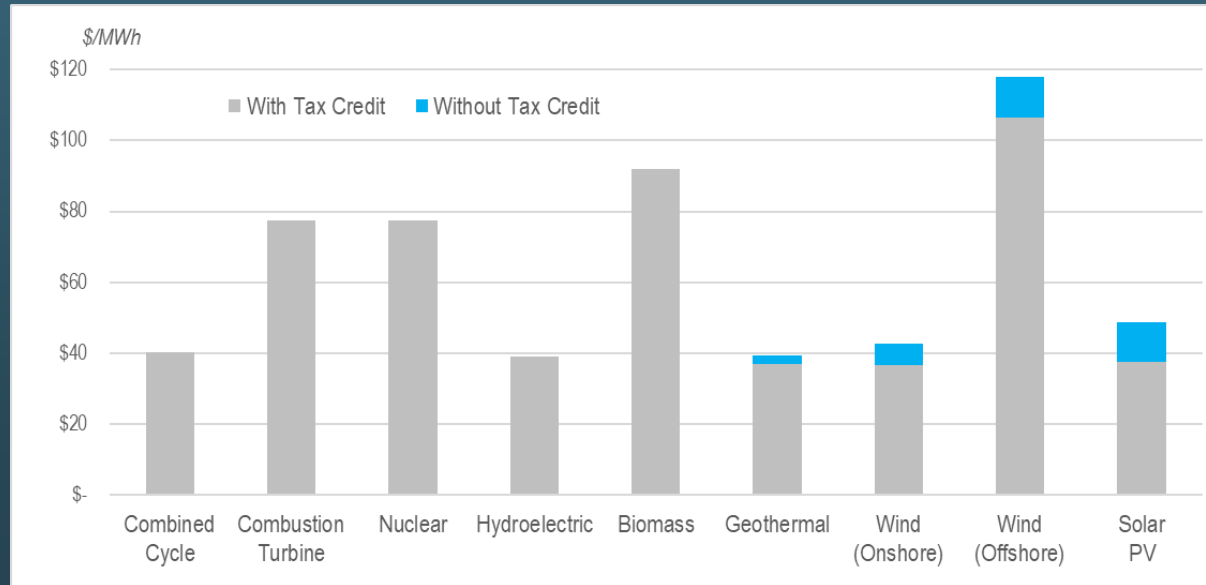
Projected New Combined Cycle Capacity in Various  
Stages of Development, 2020-2025



# Developing Best Solution Complex Exercise

- Comparisons of levelized cost not enough
  - System-wide solution essential

EIA Levelized Cost of Electricity for New Generation Resources  
Entering Service in 2023 (\$/MWh)

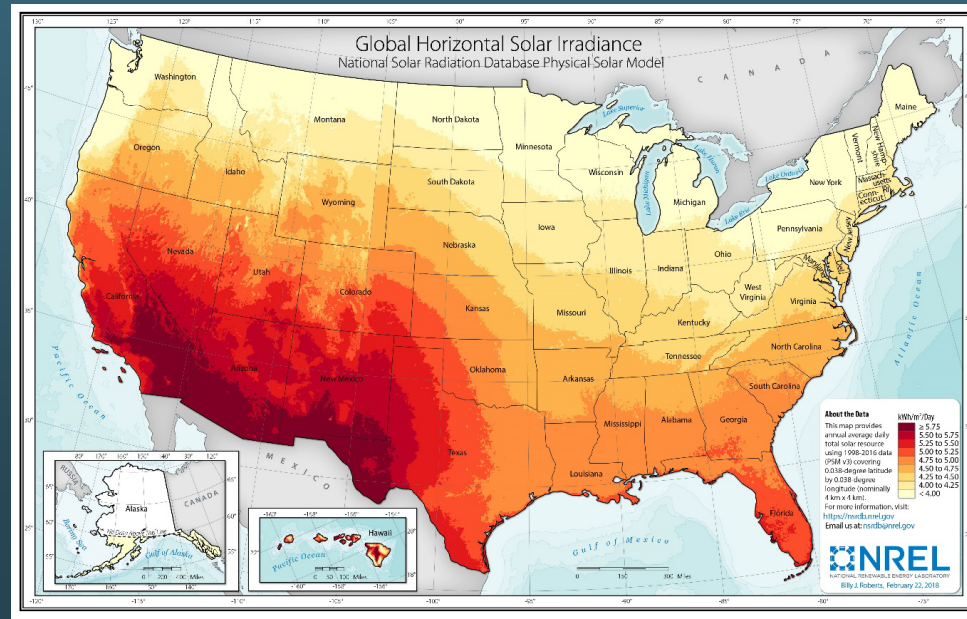


Source: EIA, EBW Analytics

# Major Role for Renewables But Not Complete Solution

- Cost effectiveness varies by region

Global Horizontal Solar Irradiance

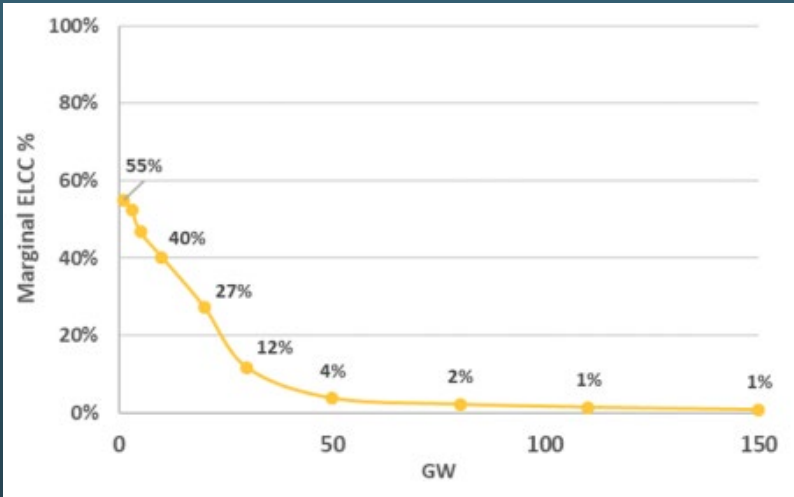


Source: NREL

# Cost Effectiveness Declines Once Penetration Rate Reaches High Levels

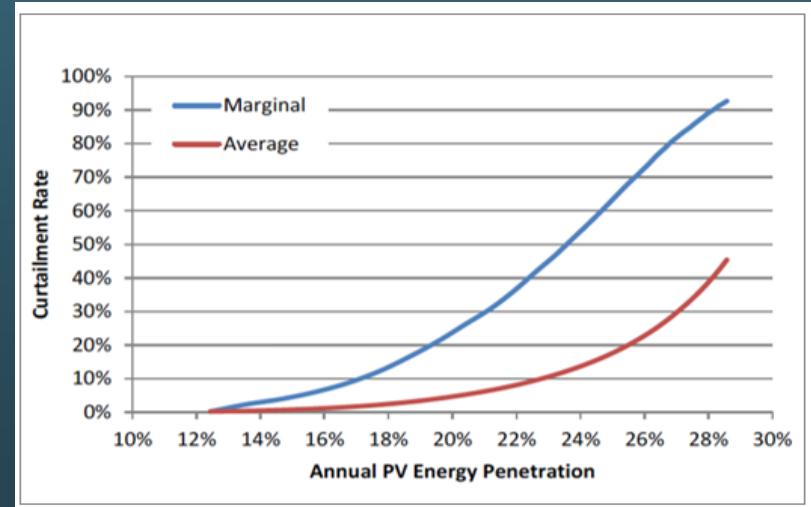
- At high penetration rates, additional renewables increasingly displace other renewables
- While energy storage is likely to play an increasingly important role, can only bridge short-term gaps

California Solar Effective Load Carrying Capacity in 2050



Source: E3

Average and Marginal PV Curtailment in Base Scenario



# Recommendations

- Stakes for energy intensive industries couldn't be higher
  - No one else is likely to protect industry's interests
  - Actions taken by IECA members will be critical
- Scale of effort should not be underestimated
  - Will require most intensive effort IECA members have ever undertaken
    - White House, Capital Hill, numerous federal agencies and state PUCs in key industrial states
- Key is to develop a cost-effectiveness standard and insist that it be met

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The Pillsbury logo, featuring the word "pillsbury" in a lowercase, sans-serif font. The letters are a reddish-brown color. The logo is set against a white rectangular background.