VISUAL PRIMER SERIES

ENERGY SECRETARY'S GRID RELIABILITY STUDY

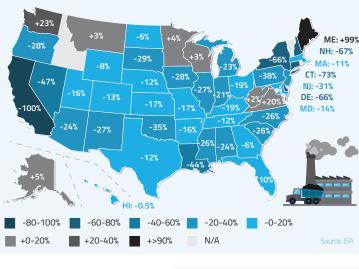
DOE Grid Reliability Study to Examine Impact of Renewables on Baseload Generation

June 27, 2017

Low Natural Gas Prices Main Reason for Recent Coal and Nuclear Plant Retirements

Energy Secretary Rick Perry's upcoming grid reliability study is examining whether renewables are accelerating coal and nuclear retirements, while the trend is primarily driven by low natural gas prices **and slow growth in electricity demand**. Beginning April 19, the 60-day review will examine the impacts of current markets, regulations, and policies on baseload power and grid reliability. The study comes at a time when several states are considering measures to subsidize baseload generation, particularly nuclear plants, that are unable to compete with cheap natural gas in wholesale electricity markets.

Coal and nuclear in decline Change in net electricity generation from coal, % (2012-2016) U.S. coal production is under a dramatic



downturn primarily due to its decline in the electric power sector, the major market for coal. Surging natural gas production has caused natural gas prices to plummet, replacing coal in the U.S. power generation mix. The coal downturn is also attributed to an aging coal fleet and enhanced emission-control

requirements at coal plants. Change in net electricity generation from nuclear, % (2012-2016) NH: +31% MA: -8% NI: -10% MD: +9%

-10-15% -5-10%

+10-15% +15-30% >+30%

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where nuclear has replaced some part of coal as baseload generation.

Cheap natural gas has

electricity prices squeezing the margins of nuclear plants, too.

risk of premature closure due to their inability to compete with natural gas plants. This has created

pushed down wholesale

Consequently, a number of nuclear plants have

found themselves at the

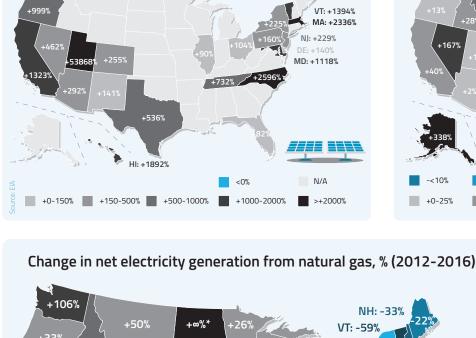
reliability risks in states

long-term prospects of solar and wind as they provide the balancing power needed to address the intermittency of these renewables.

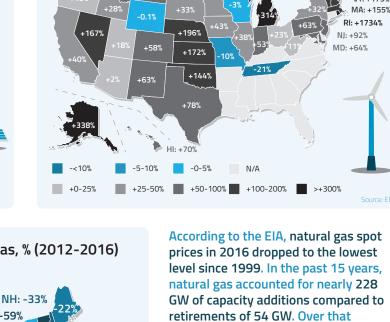
Renewables and natural gas on the rise

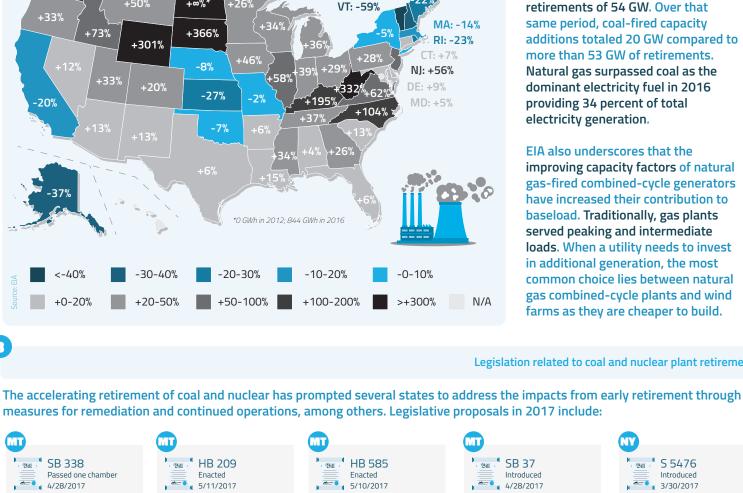
Change in net electricity generation from wind, % (2012-2016) Change in net electricity generation from utility-scale solar, % (2012-2016) NH: +114% VT: +175%

Renewable energy is continuing to gain market share, increasingly driven by declining costs, increasing efficiency, and economies of scale. Solar and wind made up the largest share of utility-scale capacity additions in 2016. Low natural gas prices increase the



+0-5%





Temporarily increases the coal severance

tax allocation to the coal natural resource

account; establishing the increase until

June 30, 2019

Wold revise laws related to closure of

certain coal-fired generation to mitigate

coal-fired generating unit across the state

the effects of the retirement of a

additions totaled 20 GW compared to more than 53 GW of retirements. Natural gas surpassed coal as the dominant electricity fuel in 2016 providing 34 percent of total electricity generation. EIA also underscores that the improving capacity factors of natural gas-fired combined-cycle generators have increased their contribution to baseload. Traditionally, gas plants served peaking and intermediate loads. When a utility needs to invest

same period, coal-fired capacity

common choice lies between natural gas combined-cycle plants and wind farms as they are cheaper to build. Legislation related to coal and nuclear plant retirements ." SB 37 ." S 5476 Introduced Introduced

3/30/2017

Would authorize a certain school district

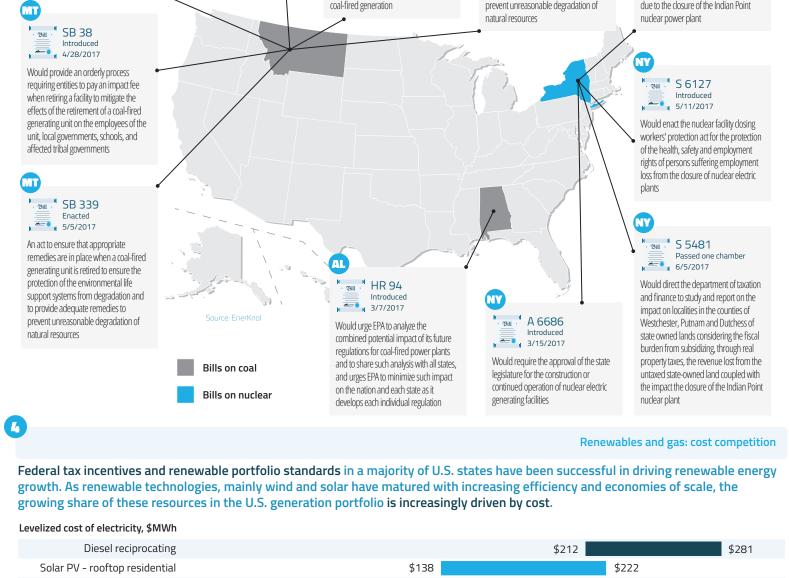
to establish an energy system tax

in additional generation, the most

generating unit in Montana from the for the protection of the environmental stabilization reserve fund to lessen or Montana permanent coal tax trust fund life support system from degradation prevent increases real property tax levies resulting from the decrease in revenue to facilitate the continued operation of and provide adequate remedies to due to the closure of the Indian Point prevent unreasonable degradation of

Would establish coal-fired generating

unit decommissioning remediation act



Allows the Board of Investments to make

loans to an owner of a coal-fired

company to procure or provide specified energy efficiency and conservation

programs and services to its electricity

customers on a specified savings

trajectory for the duration of the

HB 1106

by 2022 to 25 percent by 2020

Increases the state's renewable portfolio

standard from the previous 20 percent

Sources: EnerKnol, EIA, Lazard

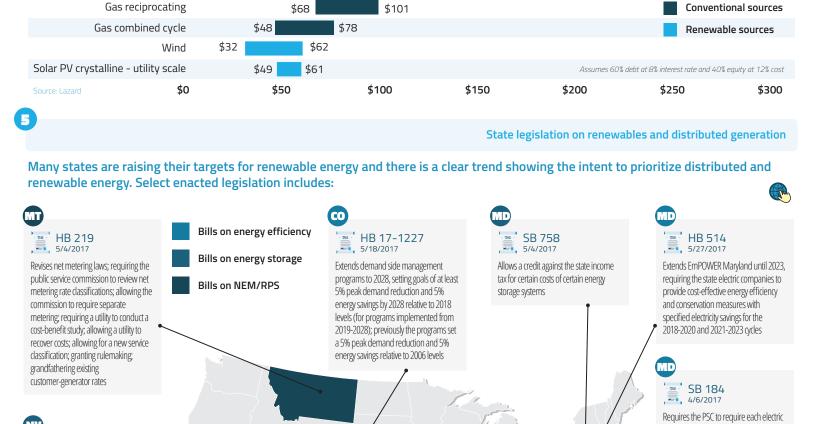
4/11/2016

cycles, among others

MD

2018-2020 and 2021-2023 program

\$217



HB 2303/SB 1394

Requires the Commission to establish a

customer-generators the opportunity to

participate in net energy metering, and a

customers of investor-owned utilities and

cooperatives, to afford eligible agricultural

customer-generators the opportunity to

participate in net energy metering

by July 1, 2015, for customers of electric

program, to begin by July 1, 2014, for

3/16/2017

program that affords eligible

\$94

\$60

\$78

\$165

\$143

\$135

AB 405 6/15/2017

SB 204

Requires the PUC to investigate and

establish a requirement for certain

systems under certain circumstances

Reinstates net metering, establishing a

tiered system to reimburse customers at

electricity, and allow customers to lock in

and more recently, energy storage.

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slightly less than the retail rate of

their rates for 20 years, ensuring

long-term certainty

electric utilities to procure energy storage

5/31/2017

Gas peaking

Solar PV - community

IGCC

Coal Nuclear

BOTTOM LINE Tech Benefits Advances in grid management techniques are enabling grid operators to manage a higher share of wind and solar generation without compromising reliability. In addition, demand management is also facilitating dynamic control of supply and demand while enabling consumers to better manage their energy use and costs.

Reliability benefits of advanced technologies have drawn increased attention to

flexible resources including natural gas generation, demand side management,

Triumph of Gas Some senators from the Energy and Natural Resources

benefit the environment

** HB 1565

Allows localities to establish green

and facilities deemed to be energy

development zones, providing special

taxing and zoning treatment for buildings

efficient or manufacturing products that

2/17/2017

VA

coal and nuclear plants that have retired or announced retirements are located in regions with higher natural gas and lower renewable generation levels. As long as natural gas prices remain so low coal-fired power plants will hardly be able to survive in the long term.

Committee have pointed out that the vast majority of

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