The Ever Shifting Generation Mix

Indiana Energy Conference

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Electric Energy Sources

In 2007

	U. S.	Indiana
Coal	49 %	94 %
Nuclear	19 %	0 %
Natural Gas	22 %	3 %
Petroleum	2 %	0.1 %
Renewables	8 %	0.5 %

In 2017

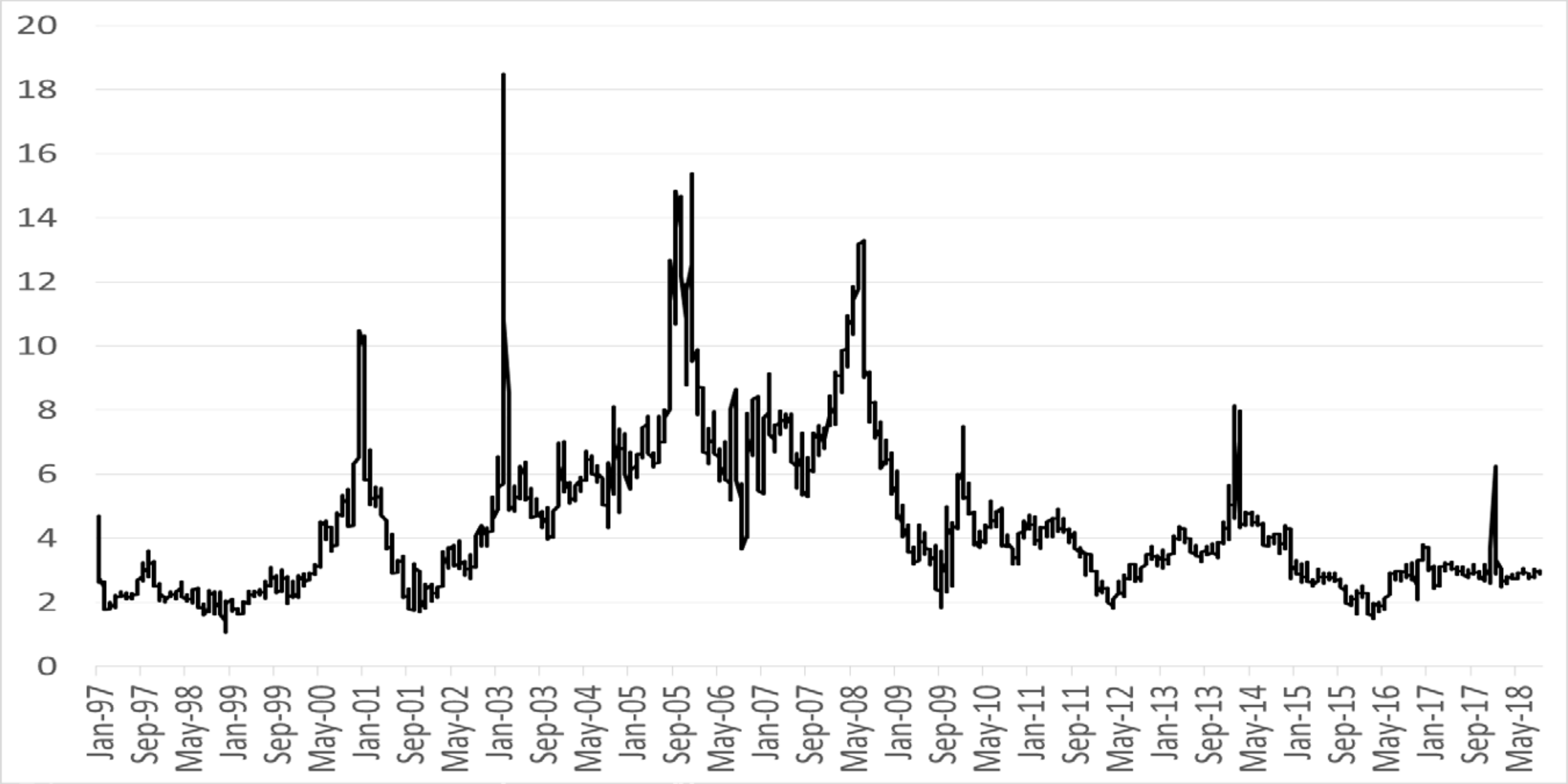
	U. S.	Indiana
Coal	30 %	73 %
Nuclear	20 %	0 %
Natural Gas	32 %	18 %
Petroleum	0.5 %	0.1 %
Renewables	17 %	6 %

Data source: Energy Information Administration (EIA)
Indiana numbers do not include out-of-state generators that serve Indiana customers

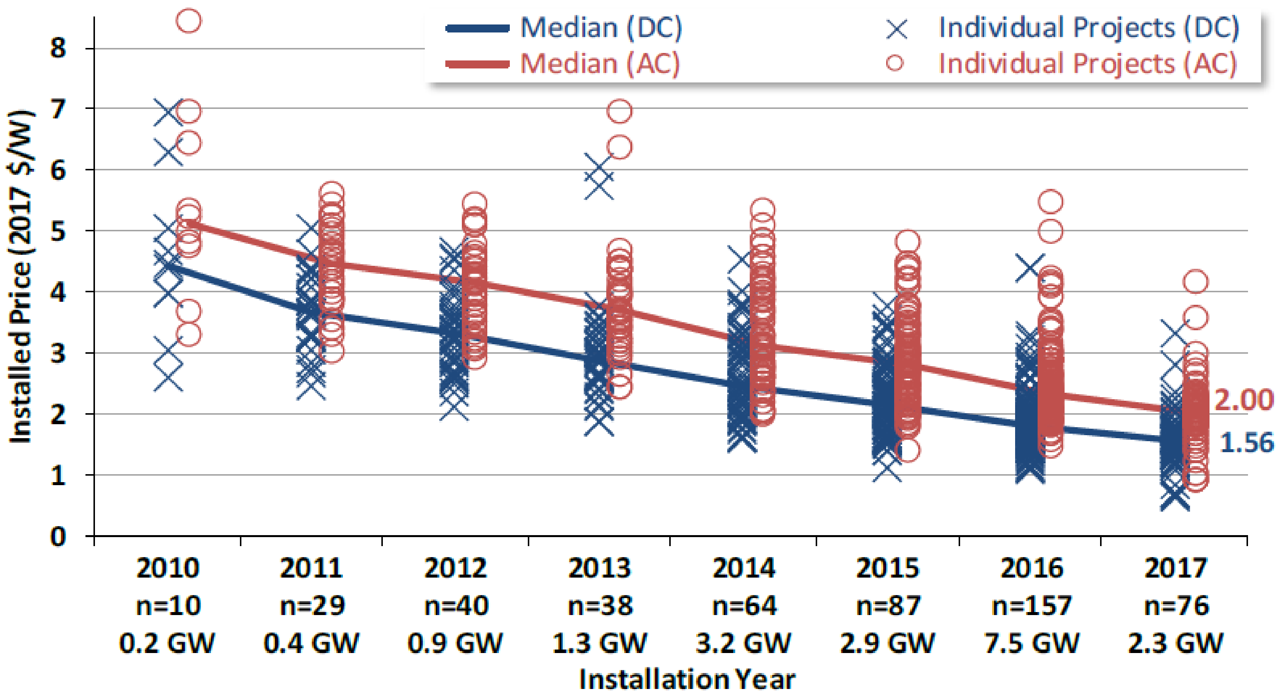
What Caused the Change?

- Low, stable natural gas prices due to hydrofracturing and horizontal drilling
- Significant declines in the cost of wind and solar, plus tax incentives
- Age of the existing coal fleet
- Environmental regulations

Henry Hub Natural Gas Spot Prices (nominal $/mmBtu)



Installed Price of Utility-Scale PV Systems over Time



Source

Berkeley Lab, Utility-scale solar, empirical trends in project technology, cost, Performance, and PP pricing in the United States – 2018 edition
https://emp.lbl.gov/utility-scale-solar

Coal-fired Generating Capacity by Decade Installed

In 2008

	# of units	MW
1940s	1	45
1950s	20	1,847
1960s	12	2,275
1970s	17	6,938
1980s	9	5,736
1990s	2	289
Total	**61**	**17,130**

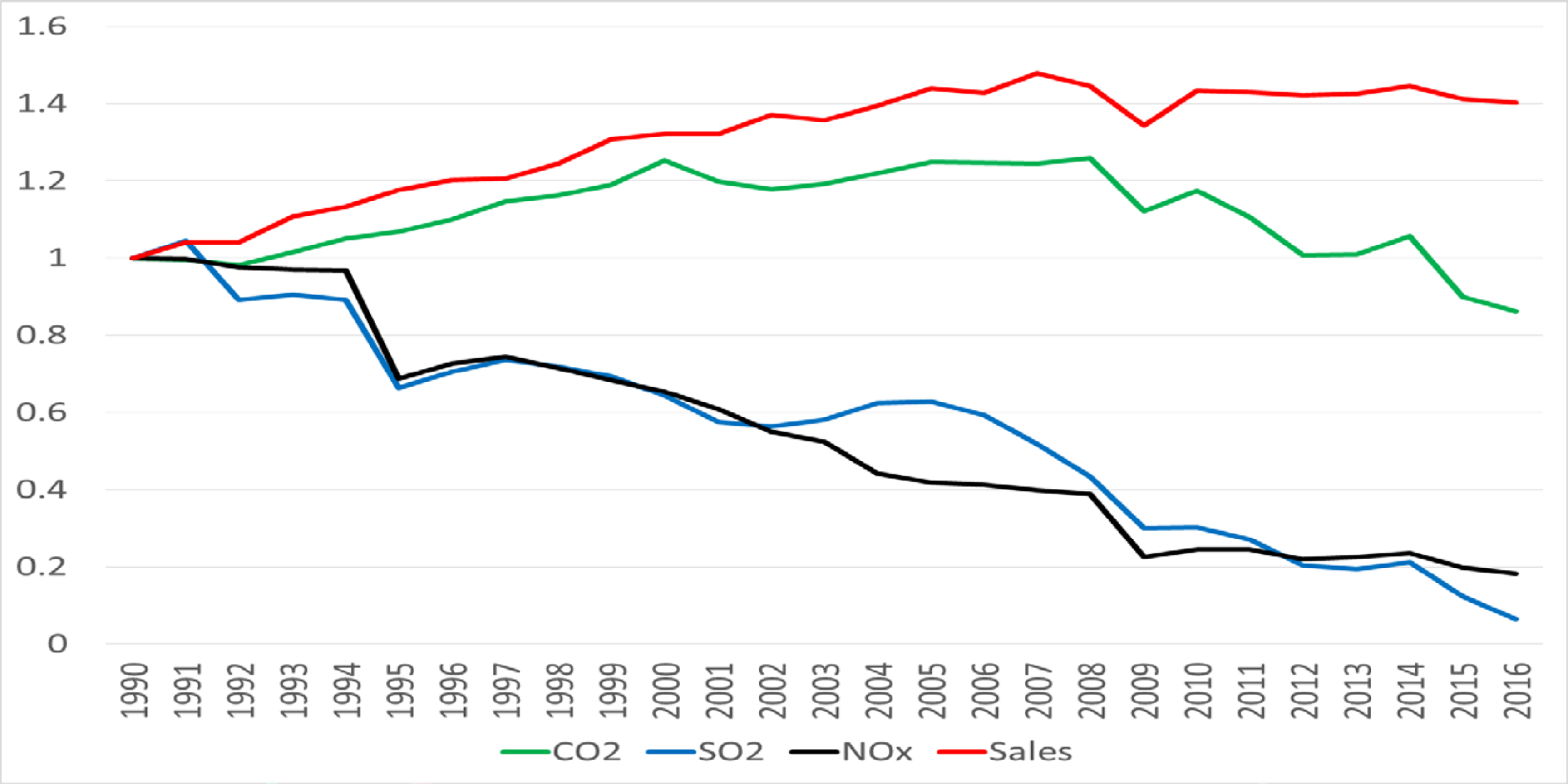
In 2018

	# of units	MW
1940s	0	0
1950s	1	140
1960s	4	897
1970s	13	5,804
1980s	9	5,736
1990s	0	0
2010s	1	618
Total	**28**	**13,195**

What is the Impact?

- Air emissions are down
- Electricity prices are up
- Economic impacts are mixed, with some areas likely seeing a positive impact and others seeing a negative one

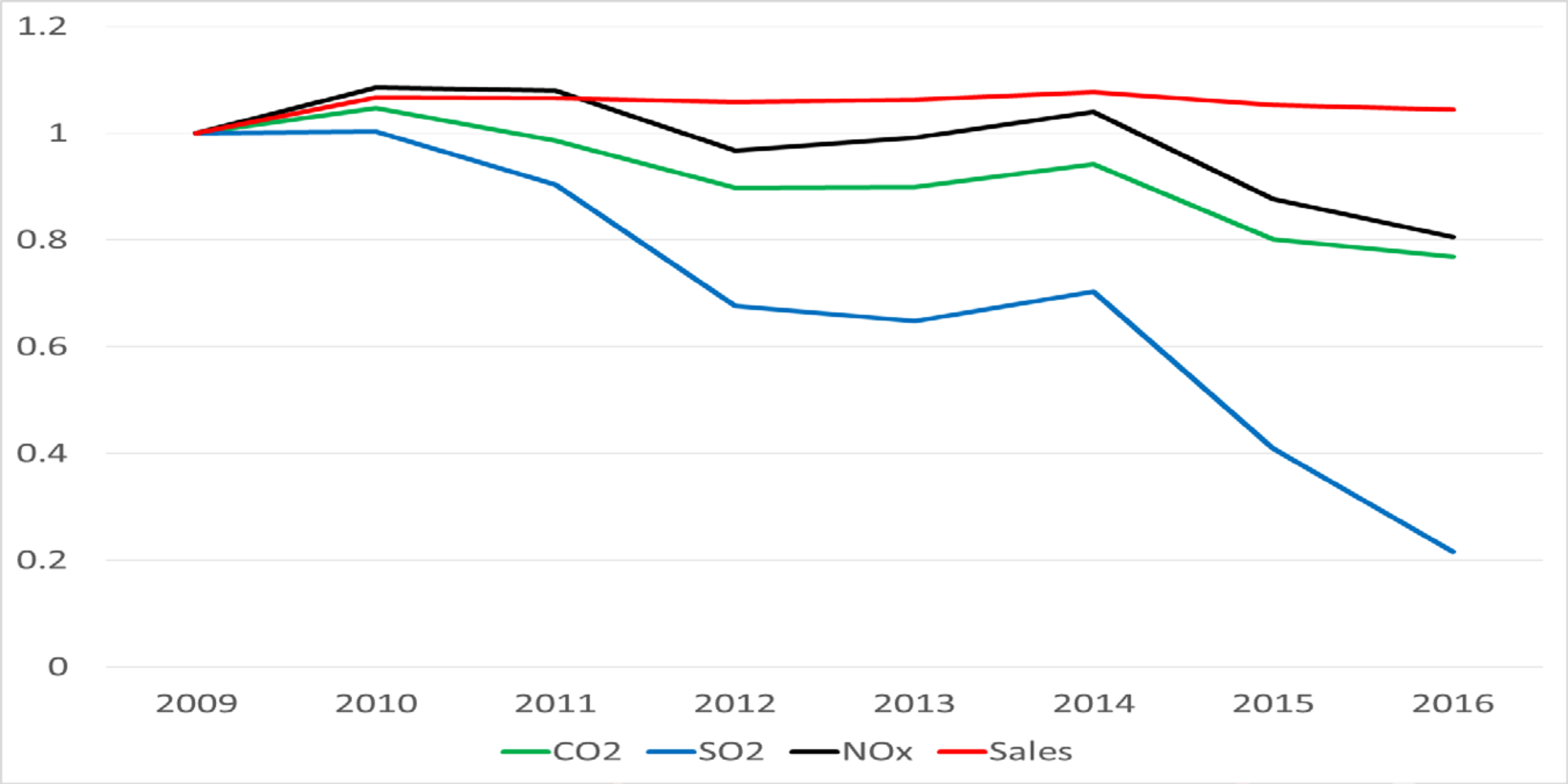
Indiana Emissions (Normalized to 1990 levels)



Emissions Reductions

- The emissions levels on the previous slide can be viewed in two separate periods.
- Up until the late 2000s, reductions in SO2 and NOx were driven by environmental regulations, while CO2 tracks with overall generation
- More recently, SO2 and CO2 have dropped, while NOx has been more constant
  - both have been impacted by the reduction in coal usage, SO2 was also impacted by MATS

Indiana Emissions (Normalized to 2009 levels)



CO_2 Emissions

- CO_2 emissions from Indiana's utility sector dropped 30% from 2005 to 2016
- 2016 emissions (about 92M short tons) is near the Clean Power Plan's Interim Step 1 goal (2022-2024) of about 90M short tons

Real Electricity Prices (2016 cents/kWh)

In 2006

	Price	U.S. rank
Residential	9.79	13
Commercial	8.58	17
Industrial	5.89	16
All Sector	7.69	10

In 2016

	Price	U.S. rank
Residential	11.79	24
Commercial	10.01	29
Industrial	6.97	29
All Sector	9.22	21

Note: U.S. rank is from lowest to highest

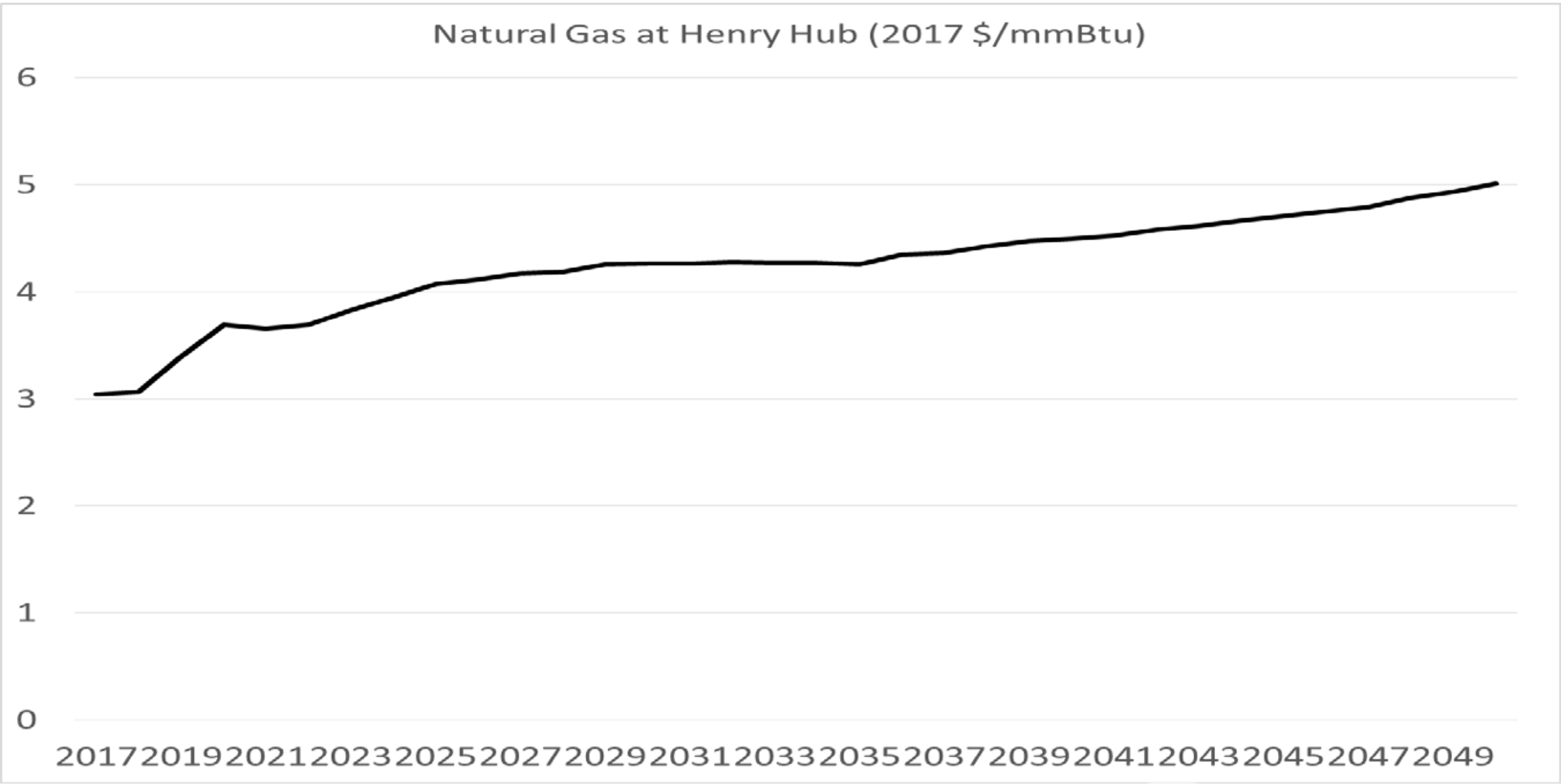
Indiana Jobs

- Publicly available information at the state level is limited
  - St. Louis Federal Reserve Bank data for the “mining and logging” sector indicate a drop of 500-700 jobs in the last ten years
  - American Wind Energy Association estimates 2k-3k jobs in the wind industry
  - Solar Job Census 2017 indicates 2,775 solar jobs
- Does not account for multiplier effects and local tax revenue impacts

Will it Continue?

- Natural gas price forecasts show continued low prices
- Capital costs of wind and solar will likely continue to fall
- Indiana utilities indicate additional retirements of coal-fired units in their Integrated Resource Plans (IRPs)
- Trump administration relaxing environmental regulations

EIA Annual Energy Outlook 2018 Forecast (Reference Case)



Wind & Solar in Utility IRPs

- Currently filed IRPs include 2,146 MW of new solar capacity and 3,125 MW of new wind capacity in the preferred plans
  - this does not include additional resources that may be included in IRPs currently under development (e.g., NIPSCO announcement on 9/19)

Unit Retirements in IRPs

In 2018

	# of units	MW
1950s	1	140
1960s	4	897
1970s	13	5,804
1980s	9	5,736
2010s	1	618
Total	**28**	**13,195**

In 2024*

	# of units	MW
1950s	0	0
1960s	2	667
1970s	11	5,259
1980s	6	4,729
2010s	1	618
Total	**20**	**11,273**

* Currently filed IRPs; does not reflect IRPs currently under development

Further Information

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- https://www.purdue.edu/discoverypark/sufg/