Impacts of Announced Nuclear Retirements in Ohio & Pennsylvania

PRESENTED TO

Nuclear Energy Caucus
of the Pennsylvania General Assembly

PRESENTED BY

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THE Brattle GROUP

Agenda

- Context
- Key Findings
- Environmental Impacts
  - Relating to Renewables
- Electricity Price Effects

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Four Announced Nuclear Retirements

- FirstEnergy Plants: Davis-Besse, Perry, Beaver Valley (2 units)
- Exelon Plant: Three Mile Island

- Creates immediate need to understand impacts of nuclear
  - Environmental impact – avoids emissions from fossil generation
    - CO_2, NO_X, SO_2, particulates
  - Electricity price impact
    - Keeps electricity prices lower
  - Economic impacts
    - Enhance state economic activity (GDP)
    - Maintain jobs – both direct and secondary

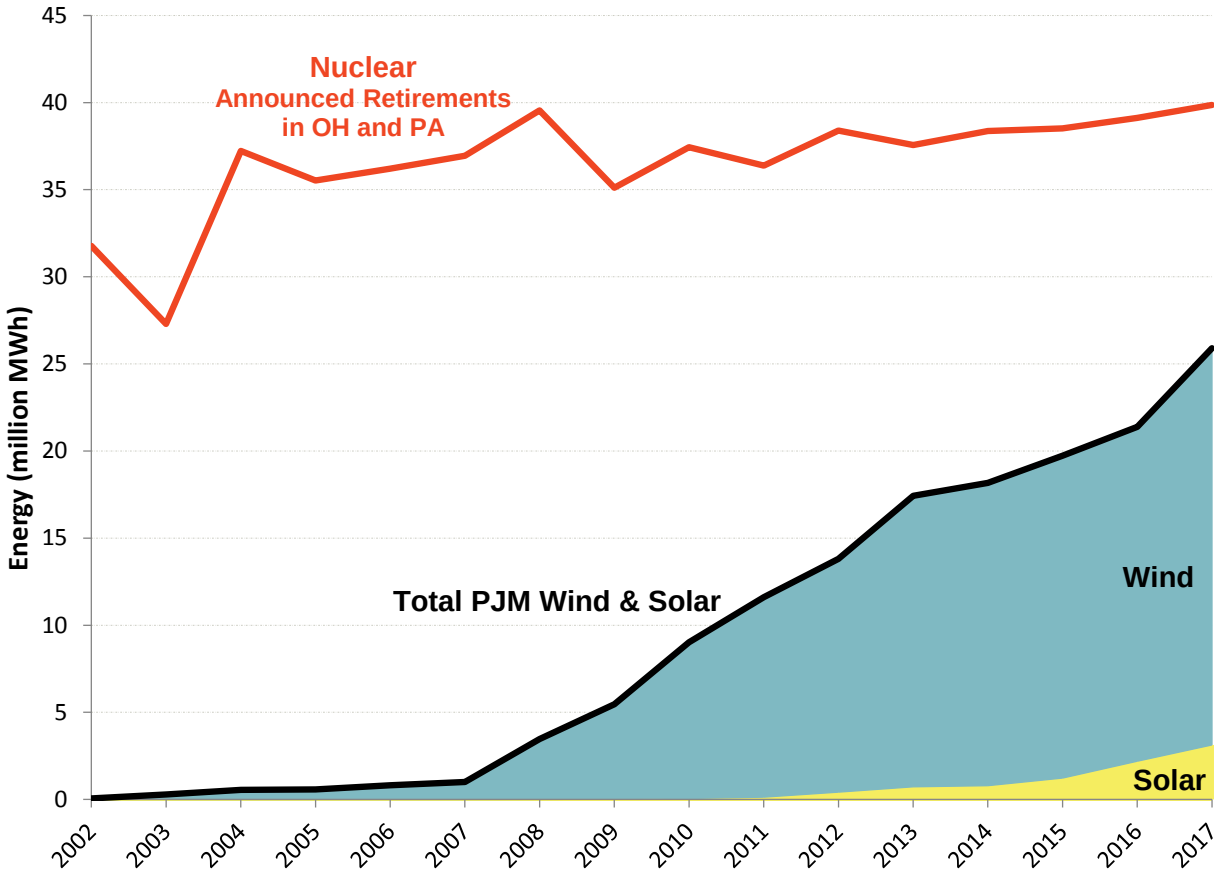
- Retirement is irreversible

Key Findings – Loss of these 4 nuclear plants:

- **Increases air pollutants by increasing fossil generation**
  - **21 million tons of CO_2** emissions per year; over $900 million/year
  - **30,000 tons criteria pollutants** (SO_2, NO_X, PM_{10}, $PM_{2.5}$); $170 million
- **Sets back environmental goals**
  - **These four retiring nuclear plants produce 1.5x more zero-emissions energy than all the wind and solar generation in the entire PJM region**
  - **Their loss reverses 25 years of progress with renewables**
- **Allows electricity prices to rise (gross effect)**
  - Costs PA customers up to $285 million more per year; $1.5 billion in PJM
  - **This causes additional economic impacts**
    - 3,000 full-time direct jobs; plants support many more secondary jobs
    - Significant negative impact on GDP, and state and local tax revenues

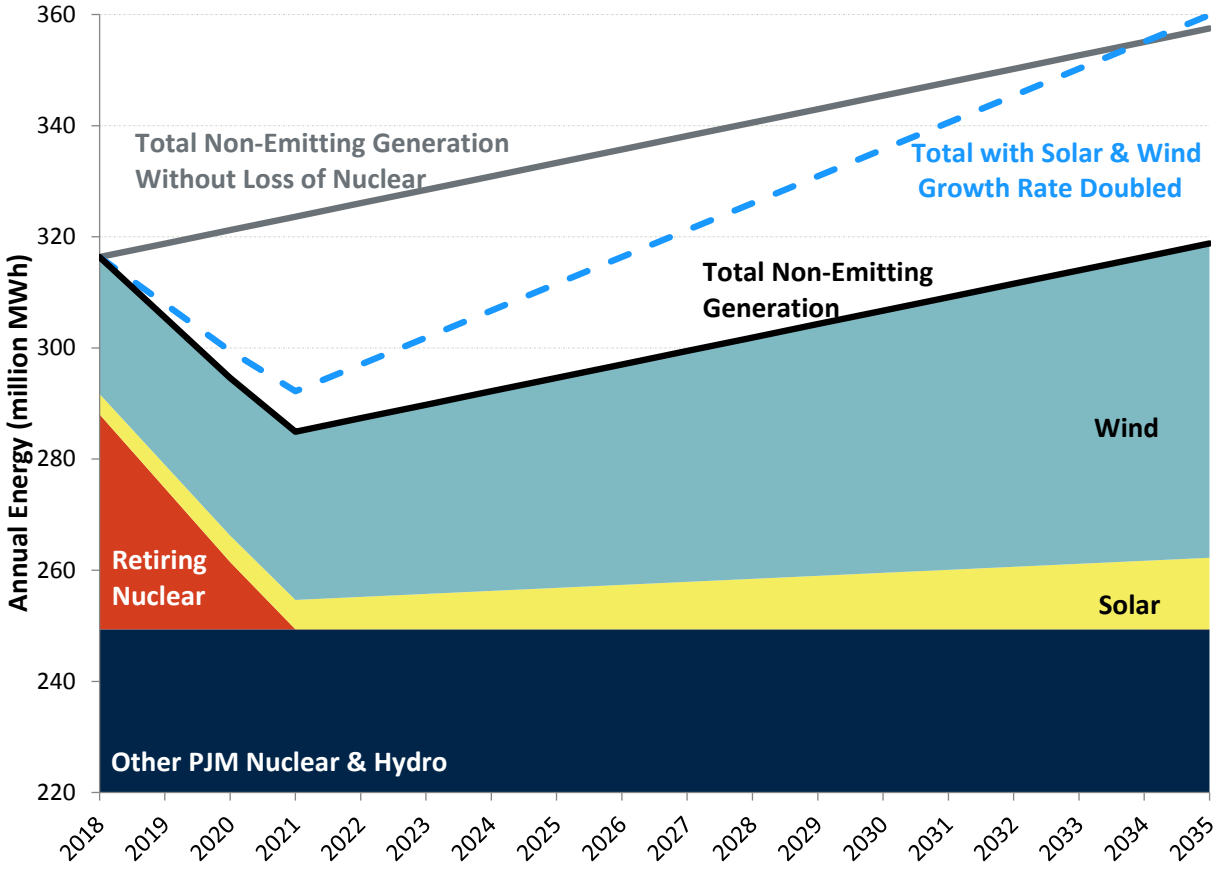
Lost Nuclear Undoes Renewable Progress

- **25 years of renewable progress would be wiped out**
  - **Zero-emissions energy would be lower than if no renewables had ever been built**



Renewables Cannot Replace Lost Nuclear

- At current renewable growth, regain 2017 zero-emission levels in 2032
- But to replace lost output, renewables must grow faster than otherwise
  - If doubled, not until 2034 (with higher emissions in intervening years)



Nuclear Plants Keep Power Prices Lower

- **Power markets don't necessarily allow nuclear plants to recover full costs**
  - **This is the cause of their financial challenge**
    - Failure to compensate environmental attributes contributes to this

- **But when nuclear retires, prices rise – by the law of supply and demand**
  - **Energy price is set by short-term costs only**
  - **Nuclear has $0 short-term cost; fixed costs not recovered from market**

Electricity Cost Impact of Ohio and Pennsylvania Nuclear Plants with Four Announced Retirements

	Power Price Change without Nuclear ($/MWh)	Electricity Consumption (millions of MWh)	Annual Electricity Cost Change (2018 $Millions)
Ohio	2.43	165	401
Pennsylvania	1.77	162	285
PJM	1.84	825	1,519

Questions?

Presenter Information

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Dr. Murphy is an economist with a background in engineering. He has expertise in energy economics, competitive and regulatory economics and finance, as well as quantitative modeling and risk analysis. His work centers on the electric industry, encompassing issues such as resource and investment planning (including power and fuel price forecasting), valuation for contract disputes and asset transactions, climate change policy and analysis, competitive industry structure and market behavior, and market rules and mechanics. He has addressed these issues in the context of business planning and strategy, regulatory hearings and compliance filings, litigation and arbitration. Dr. Murphy has examined these matters from the perspectives of investor-owned and public electric utilities, independent producers and investors, industry groups, regulators, system operators, and consumers.

Dr. Murphy holds a Ph.D. in Industrial Engineering and Engineering Management and an M.S. in Engineering-Economic Systems, both from Stanford University, and a B.E.S. in Materials Science and Engineering from the Johns Hopkins University. Prior to joining The Brattle Group in 1995, Dr. Murphy worked as an associate with Applied Decision Analysis, Inc.

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