Benefits of Offshore Wind in New England

Commissioned by the Sierra Club

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Synapse Energy Economics

- Founded in 1996
- Leader for public interest and government clients in providing rigorous analysis of the electric power and natural gas sectors
- Staff of 40+ includes experts in energy, economic, and environmental topics

Introduction

New England is heavily reliant on natural gas for power generation and home heating. Natural gas prices are extremely volatile, which leaves the region vulnerable to spikes in electricity and gas bills.

New England states are targeting ~9,000 MW of offshore wind by 2030

Sierra Club retained Synapse to quantify:

- Impacts on customer electricity bills
- Reductions in regional spending on natural gas fuel
- Avoided greenhouse gas emissions
- Health benefits from reducing NO_x, SO_2, and $PM_{2.5}$

Key Findings

- Reduce New England electricity customers' bills by $2.79/month under mid-case future natural gas prices, and $4.61/month under a high gas price scenario.
- Reduce ISO New England's CO_2 emissions from electricity generation by 42%.
- Halve the amount of money New England spends on natural gas for power generation (currently ~$3 billion annually). New England would retain approximately $1.57 billion that would have otherwise flowed out of the region.
- Provide $362 million in annual public health benefits by reducing NO_X, SO_2, and $PM_{2.5}$ emissions each year.
- Improve energy security by reducing the region's reliance on natural gas pipelines, which often reach their maximum capacities in the winter.

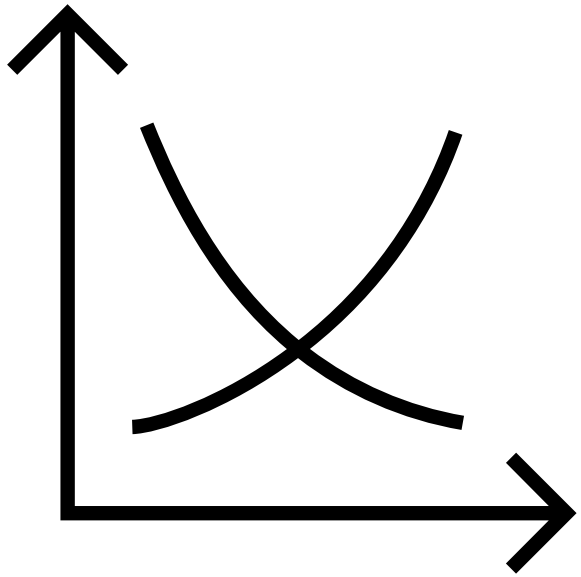
Electricity Customer Bill Savings

Approach

- Synapse modeled a total of 9 GW of offshore wind by 2030
- Conducted regression analysis to determine relationship between natural gas prices, demand, and electricity market prices
- Offshore wind contract prices based on executed contracts (Vineyard Wind, Revolution Wind), and recent NYSERDA procurements

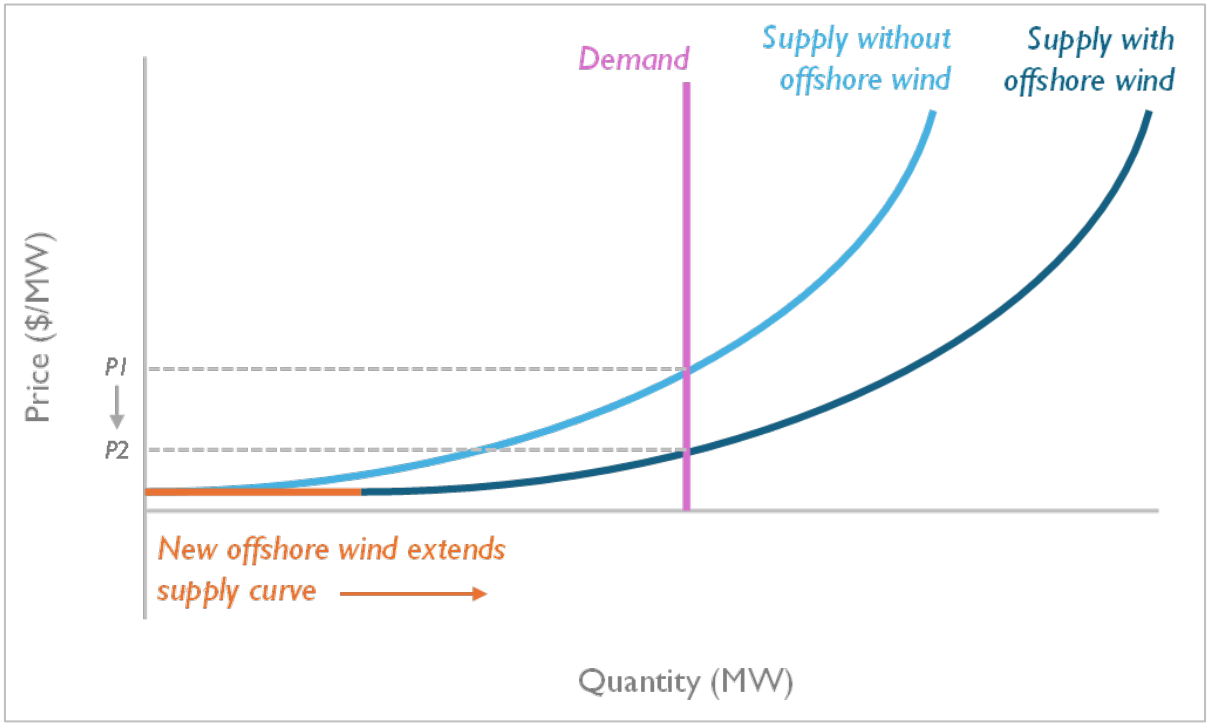
Natural Gas and Electricity Prices

- Customers' electricity bills fluctuate with prices in the wholesale electricity markets.
- The market price is set by the most expensive unit generating. Most of the time, this is a natural gas power plant.
- The bid price of a natural gas power plant includes the cost of fuel.
- The market clearing price therefore depends greatly on the current price of natural gas.



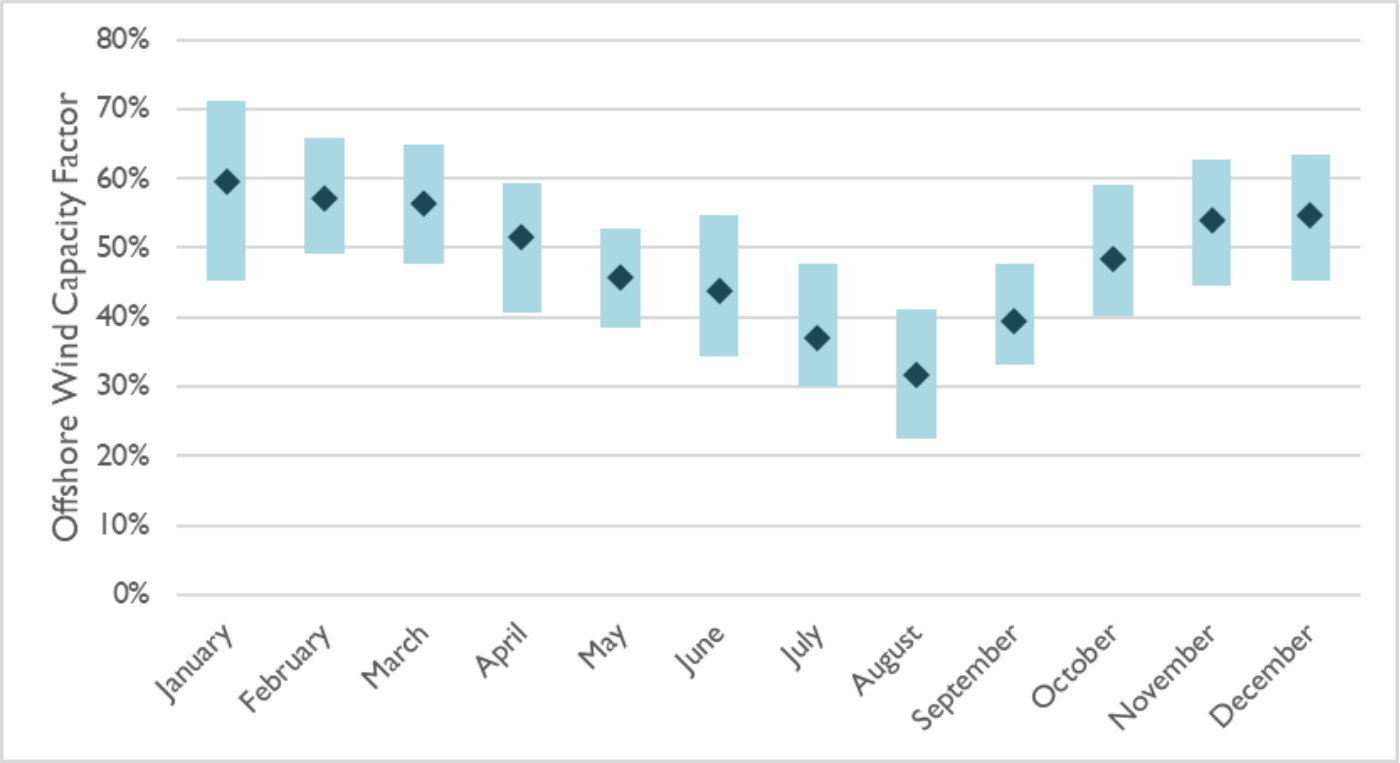
Shifting the Supply Curve

- Renewable resources have very low operating costs (no fuel), so they bid into the wholesale electricity market at a price near zero
- Adding 9,000 MW of renewable resources shifts the wholesale electricity supply curve outward significantly



OSW Capacity Factors

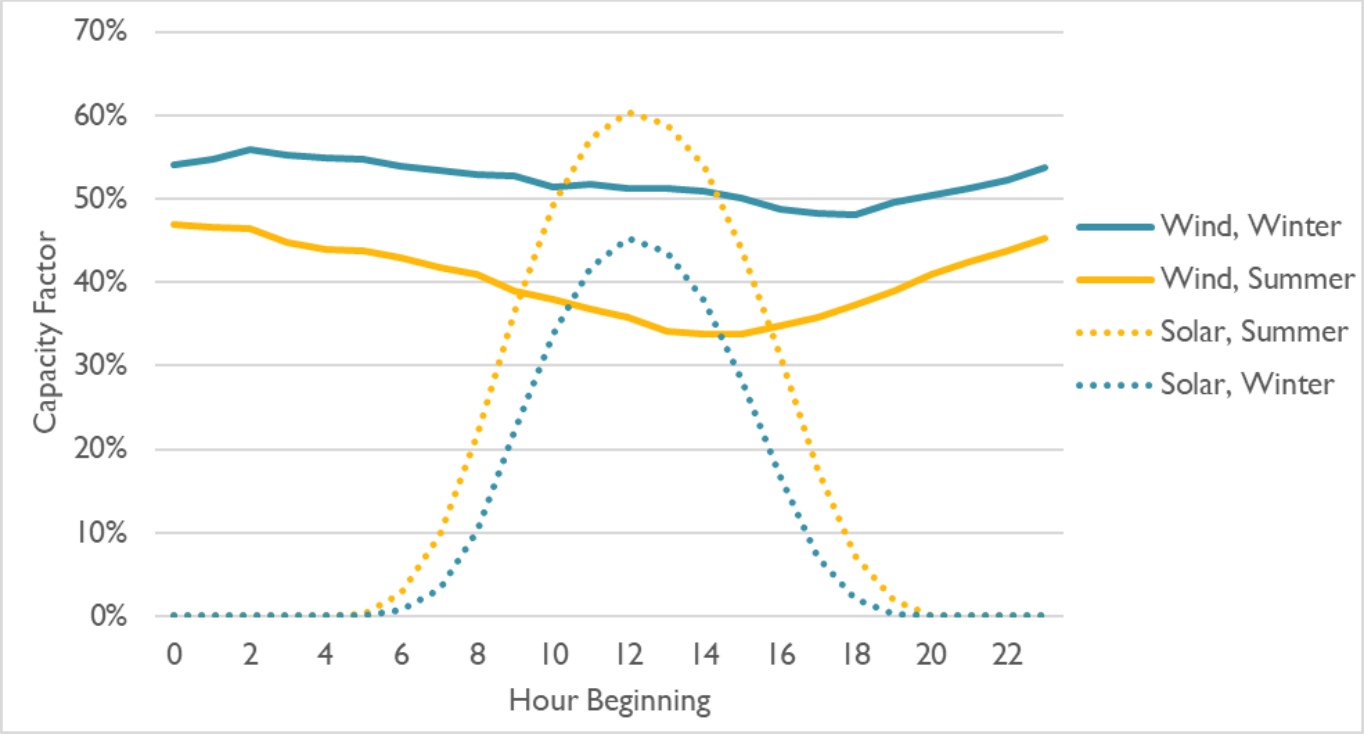
- Offshore wind has highest capacity factors during winter months



Source: ISO-New England Variable Energy Resource dataset for weather years 2000-2022

Complementary Generation Profile

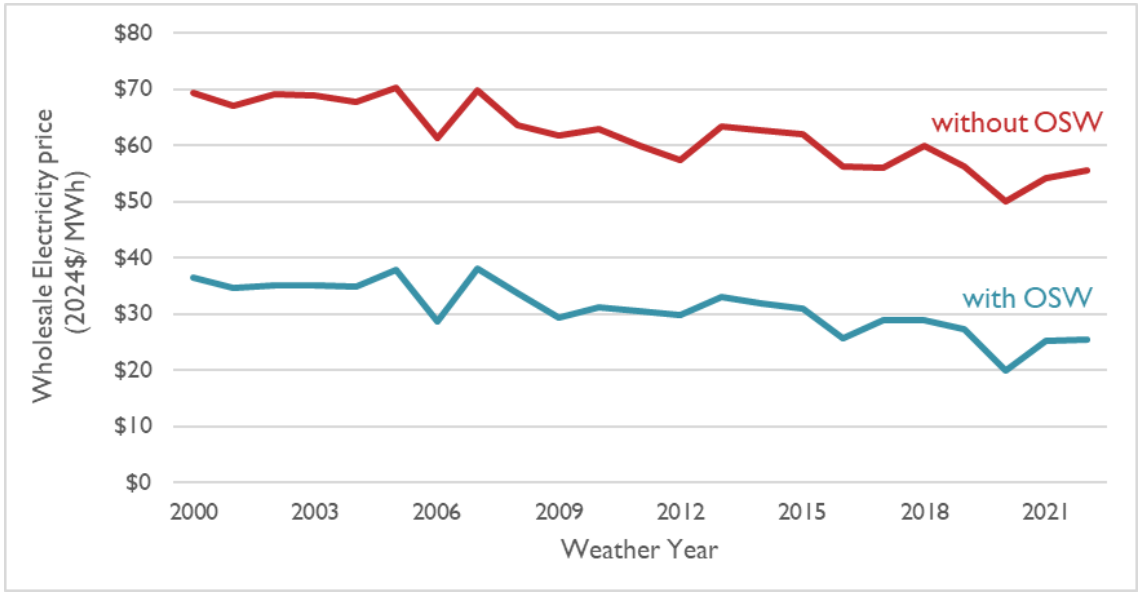
- Offshore wind's generation profile is complimentary with solar



Source: ISO-New England Variable Energy Resource dataset for weather years 2000-2022.

OSW reduces electricity supply costs

- We modeled the impact on the supply curve by quantifying the historical relationship between natural gas prices, electricity demand, and wholesale electricity prices
  - We used 23 historical weather years to capture a range of weather patterns and prices
- **Results:** Reduction in wholesale electricity market prices ranges from 45% - 60%
  - Plus benefit of avoiding REC purchases



Accounting for Wind Contract Costs

- We used the weighted average of existing New England offshore wind contracts (Vineyard Wind and Revolution Wind) and newly-announced offshore wind contracts in New York.
- We assumed future OSW contracts would be contracted at $150.15/MWh, even though industry experts expect that offshore wind costs will decline in the future.
- Note:
  - These contract prices include the full cost of constructing the projects and of delivering power to the grid.
  - Customers do not start paying these costs until offshore wind is generating power.

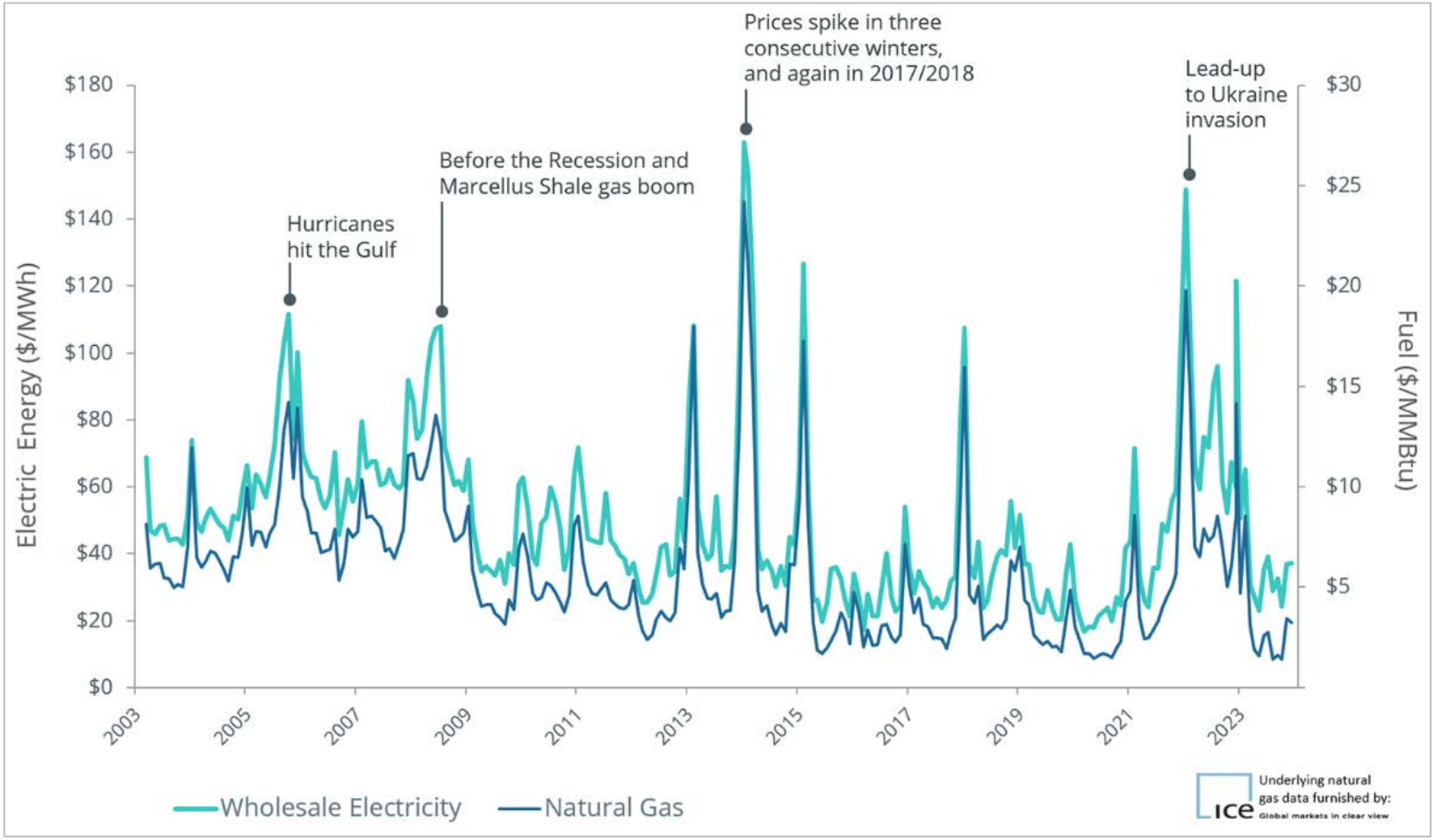
Net Savings for Customers

Net Results on Customer Bills:

- Net annual electricity cost savings for the region averaging **$630 million**, (in some years surpassing $1.3 billion) under a mid-case natural gas price.
  - This equates to $2.79/month for the average residential customer
- Under high natural gas prices, the average annual savings to electricity customers would exceed **$1 billion**, (in some years exceeding $1.7 billion).
  - This equates to $4.61/month for the average residential customer

Reducing Electricity Price Volatility and Keeping Money in New England

Natural Gas Price Volatility

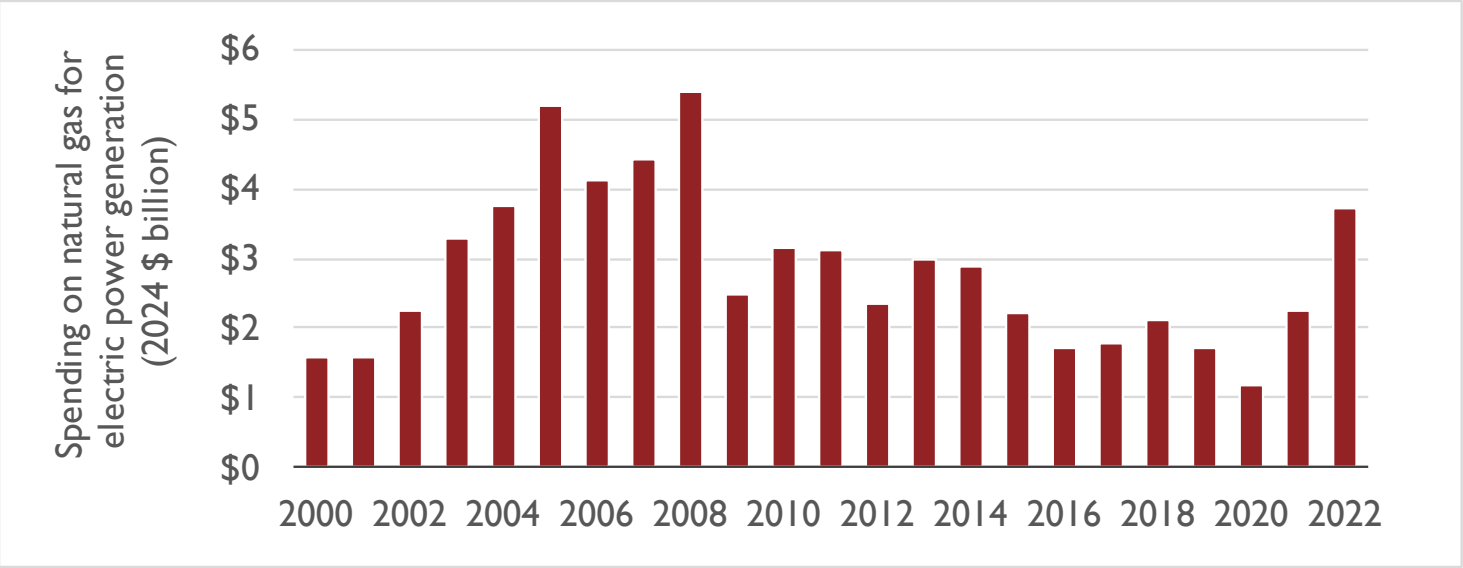


Source: ISO New England, Key Grid and Market Stats, April 2024. Available at https://www.iso-ne.com/about/key-stats/markets

Keeping Money in the Region

- Each year, New England spends about $3 billion on natural gas for electricity generation (sometimes much more)
- Adding 9,000 MW of offshore wind would reduce this by $1.57 billion

Annual New England natural gas expenditures for electricity generation



Source: U.S. Energy Information Administration. State Energy Data System (SEDS)

Emissions and Public Health Benefits

Benefits from Avoided Emissions

- The electricity from the new offshore wind would avoid 238 trillion Btu of natural gas burn in 2030 (equivalent to all the natural gas delivered to natural gas-fired power plants operating in Connecticut and Massachusetts in an average year).

- **Avoided CO_2 :**
  - 9 GW of offshore wind would avoid 14 million short tons of CO2 emissions annually, equivalent to reducing the New England power grid's current emissions by 42%.
  - Social cost of carbon value of $3.5 billion

- **Avoided NO_x, SO_2, and $PM_{2.5}$**
  - Health benefits of $362 million

Questions?

Modeling Electricity Prices

- For modeling purposes, we netted offshore wind from the demand curve, which has the same effect as adding it as a zero-cost resource to the supply curve.
- A small reduction in demand (e.g., from offshore wind) can result in a substantial reduction in the market clearing price

Relationship between demand and energy market clearing price – 2018 non-summer months