Filling the Gap in New England's Decarbonization Plans: A New View of the Electric Grid

Leonard Rodberg, PhD
Professor Emeritus of Urban Studies, Queens College/CUNY

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lrodberg@gmail.com

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Project report available at https://www.nuclearny.org/wp-content/uploads/2026/04/Filling_the_Gap_in_New%20England's_Decarbonization_Plans-L_Rodberg-2026.pdf

“nuclear power, a pillar of New England’s electric system.”[1]

STATE OF CONNECTICUT

GOVERNOR NED LAMONT

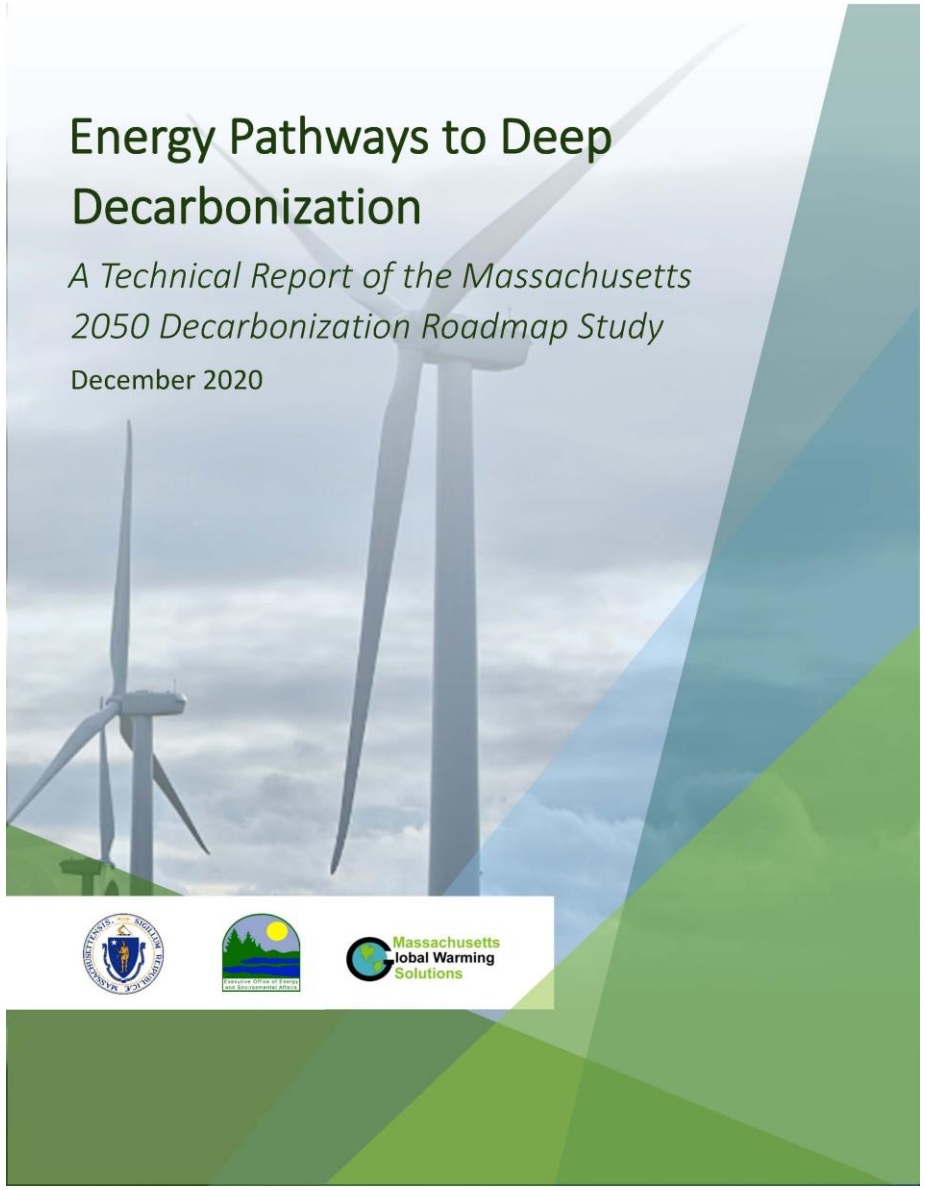
New England Governors Announce Commitment To Explore Advanced Nuclear Energy

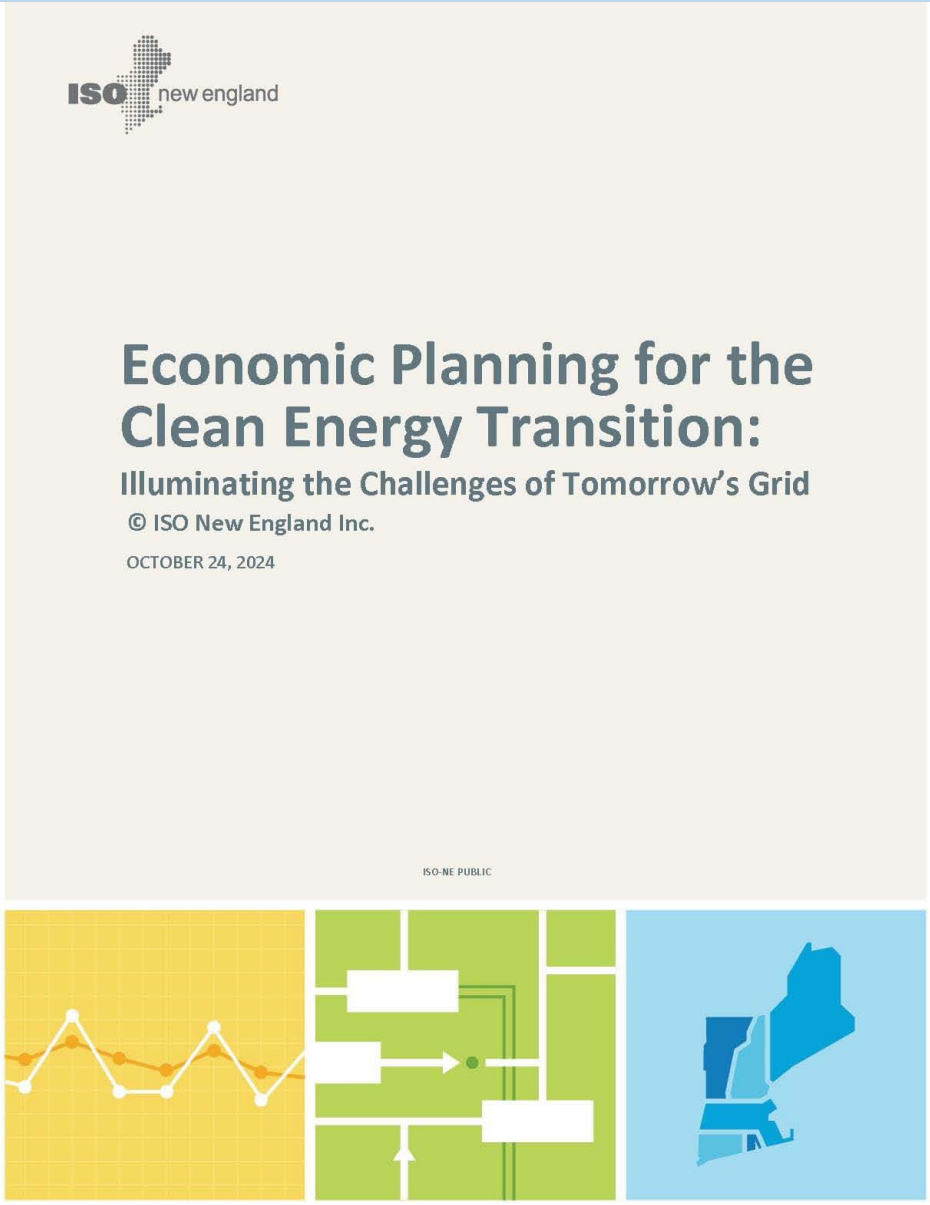
Bipartisan Group of Governors Direct State Energy Agencies To Explore Advanced Nuclear Energy Technologies, Support Continued Operation of the Region’s Existing Nuclear Resources

3/31/2026

[1] https://portal.ct.gov/governor/news/press-releases/2026/03-2026/new-england-governors-announce-commitment-to-explore-advanced-nuclear-energy?language=en_US

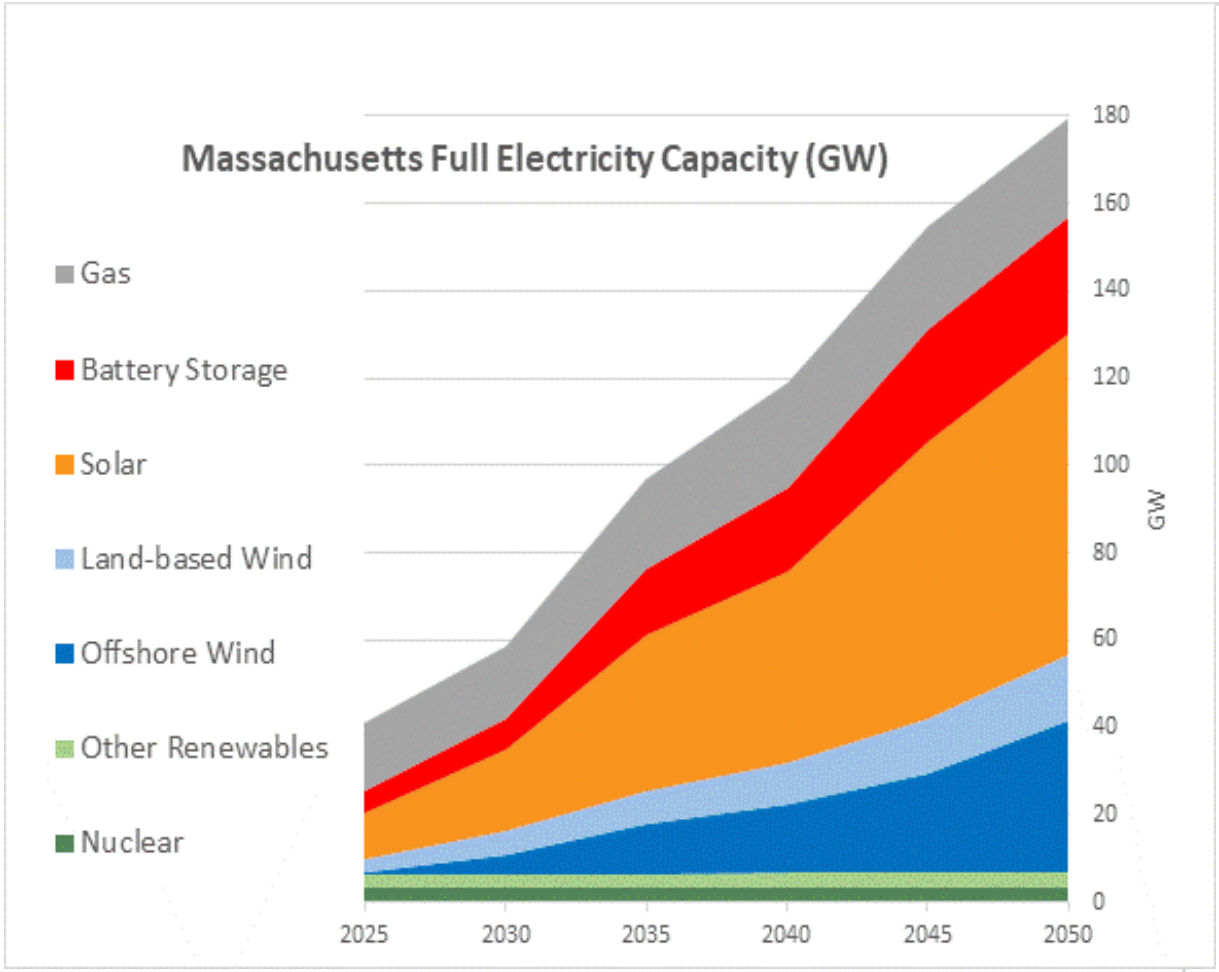
Two decarbonization plans have been prepared for New England. Neither uses nuclear power because of state restrictions on its use.

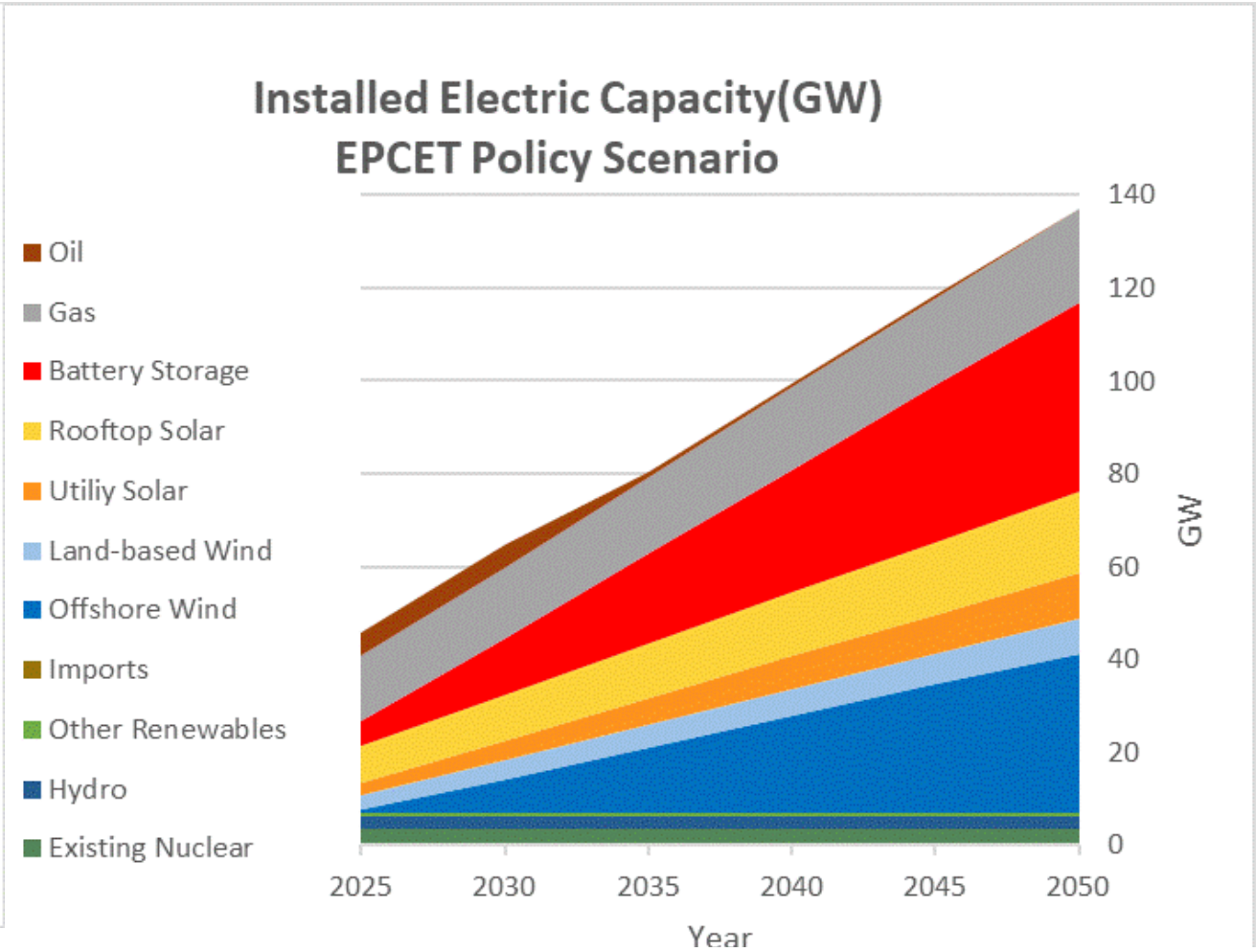




← EPCET

In both studies, renewables would be greatly expanded, but gas would still be burned.





Source: Massachusetts Workbook of Energy Modeling Results 2024.xlsx
https://www.mass.gov/doc/energy-pathways-for-deep-decarbonization-report/download

Source: EPCET Policy Scenario Reference Case
https://www.iso-ne.com/static-assets/documents/100014/epcet_policy_final_results.pdf

Key conclusion from both studies: A firm, dispatchable, zero-emission source is essential.

- **Grid demand cannot be met by weather-dependent, intermittent, non-dispatchable renewables without the addition of a large clean, dispatchable source.**
- **Such a source does not exist today in any significant quantity**.

"The use of low- and zero-carbon fuels, synthesized mainly from biomass and from "green hydrogen" produced by zero-carbon electricity, is likely necessary to achieve Net Zero by 2050 and was present in all pathways the Roadmap Study examined."

-- https://www.mass.gov/info-details/ma-decarbonization-roadmap

"New zero-carbon dispatchable energy technologies like synthetic natural gas and small modular nuclear reactors could ensure reliability."

-- https://www.iso-ne.com/static-assets/documents/100016/2024-epcet-report-fact-sheet.pdf

Both studies are discussed in detail in our report.

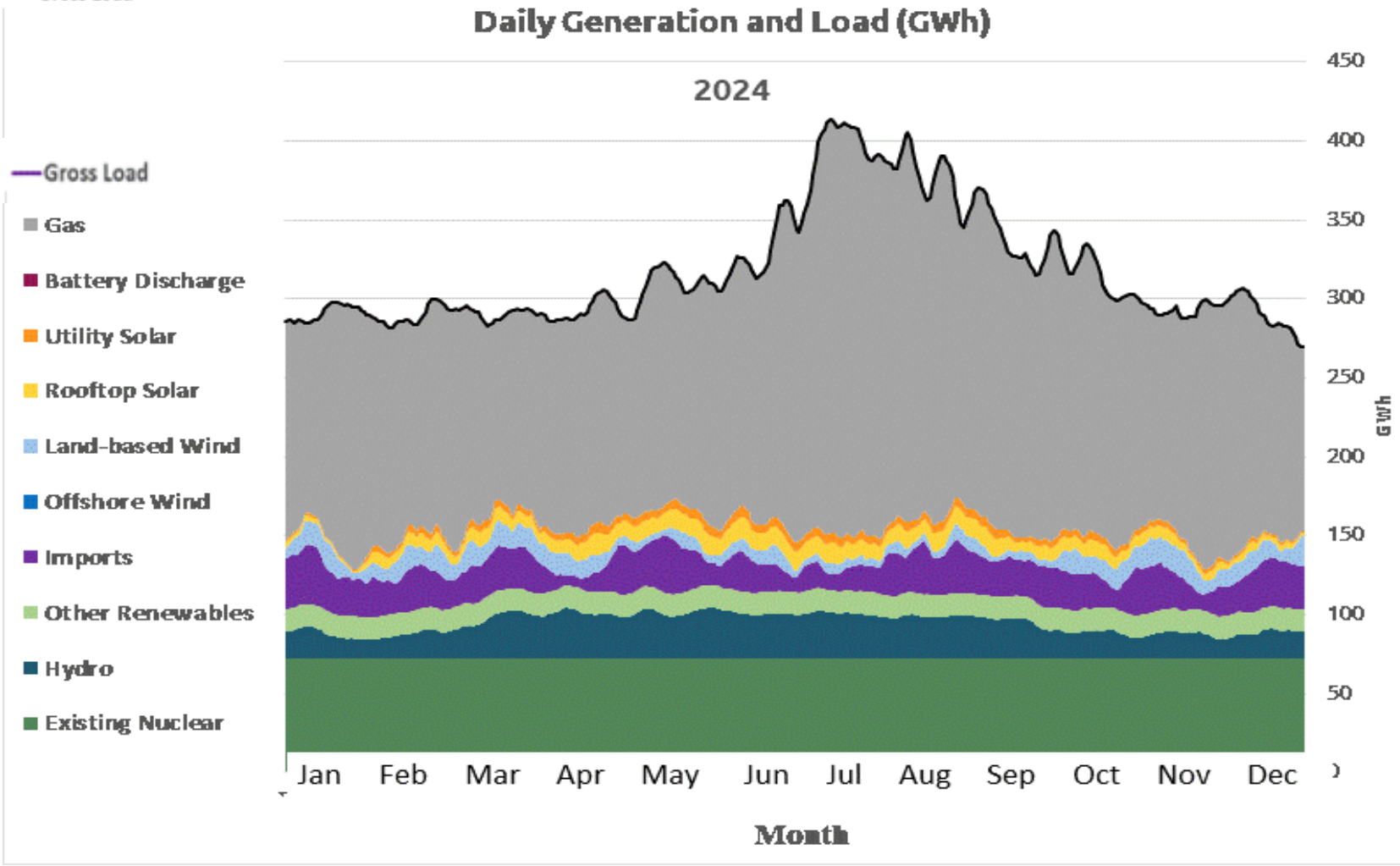
In this presentation, we focus on the EPCET analysis.

This report applies a new computer model of the electric grid: The Hourly ELectric Grid Analysis (HELGA) model describes the output of each source for each hour of the year.

HELGA Inputs and Assumptions:

- New England is treated as a single zone.
- Hourly solar and wind outputs and system load for 2024 are from data supplied by the Independent System Operator of New England, Inc. (ISO-NE).
- Source capacities and projected load for 2050 are from the Mass and ISO-NE studies.
- The same solar and wind output for each hour is assumed for 2050 but using projected capacities at that time.
- Batteries are charged by excess solar and wind output.
- Current and projected costs are from the 2024 Annual Technology Baseline of the National Renewable Energy Laboratory.
- Nuclear costs: $7,600/kw in mid-2030s; $5,000/kw by 2050.

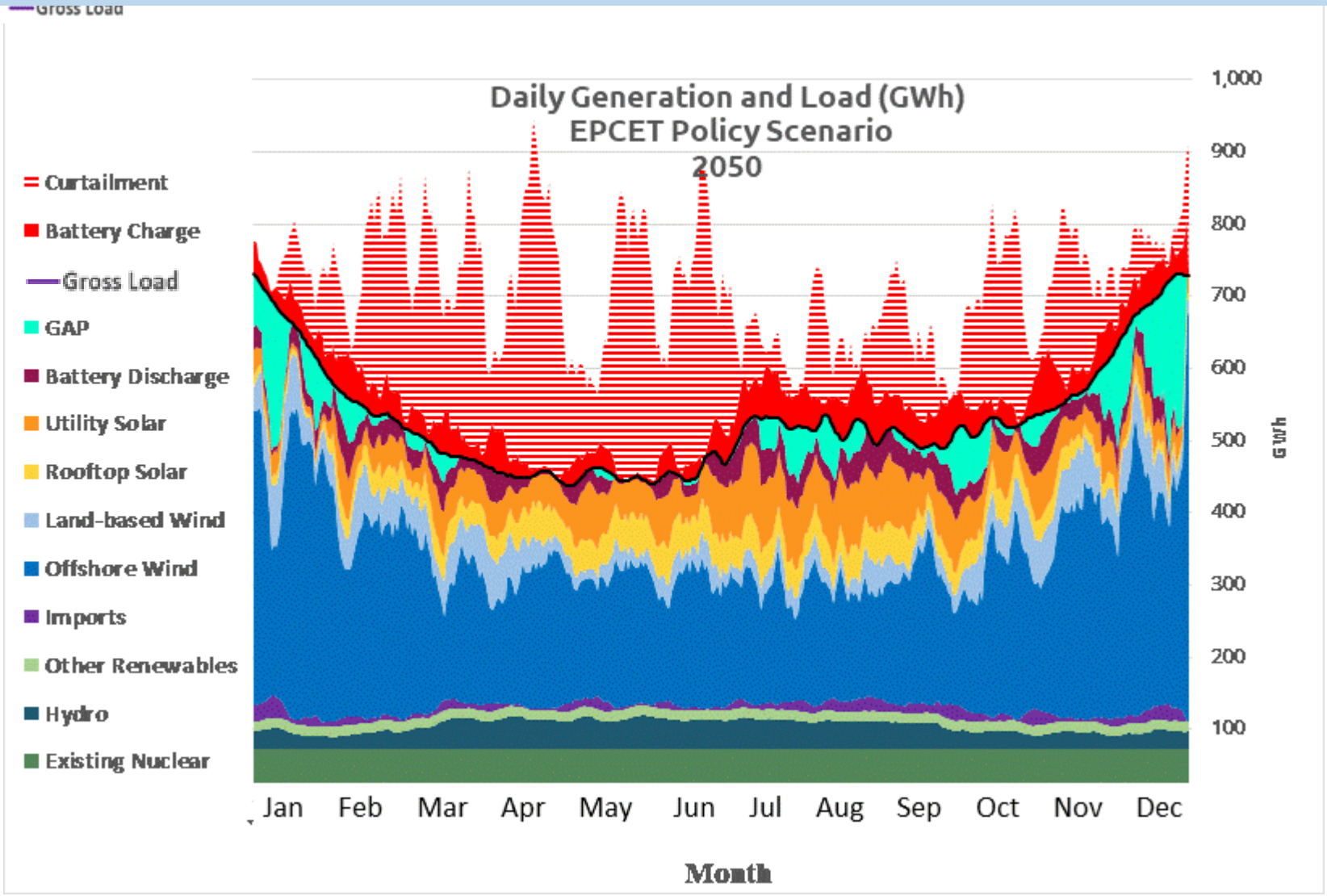
New England's Daily Generation of Electricity in 2024



Electricity Generation 2024				
Energy Source	Capacity (MW)	Output (GWh/yr)	Capacity Factor (%)	% Load
Existing Nuclear	3,326	26,478	90.9%	22.8%
Hydro	2,766	8,173	33.7%	7.0%
Other Renewables	763	5,210	78.0%	4.5%
Rooftop Solar	2,493	3,037	13.9%	2.6%
Utility Solar	1,247	1,519	13.9%	1.3%
Land-based Wind	1,253	3,521	32.1%	3.0%
Offshore Wind	0	0	0.0%	0.0%
Battery Discharge*	160	0	0.0%	0.0%
Gas	30,000	60,019	22.8%	51.7%
Imports		8,221		7.1%
Load		**116,179**		**100.0%**
Curtailment		0		0.0%
Total Cost ($/MWh)	**Current $63.20**			

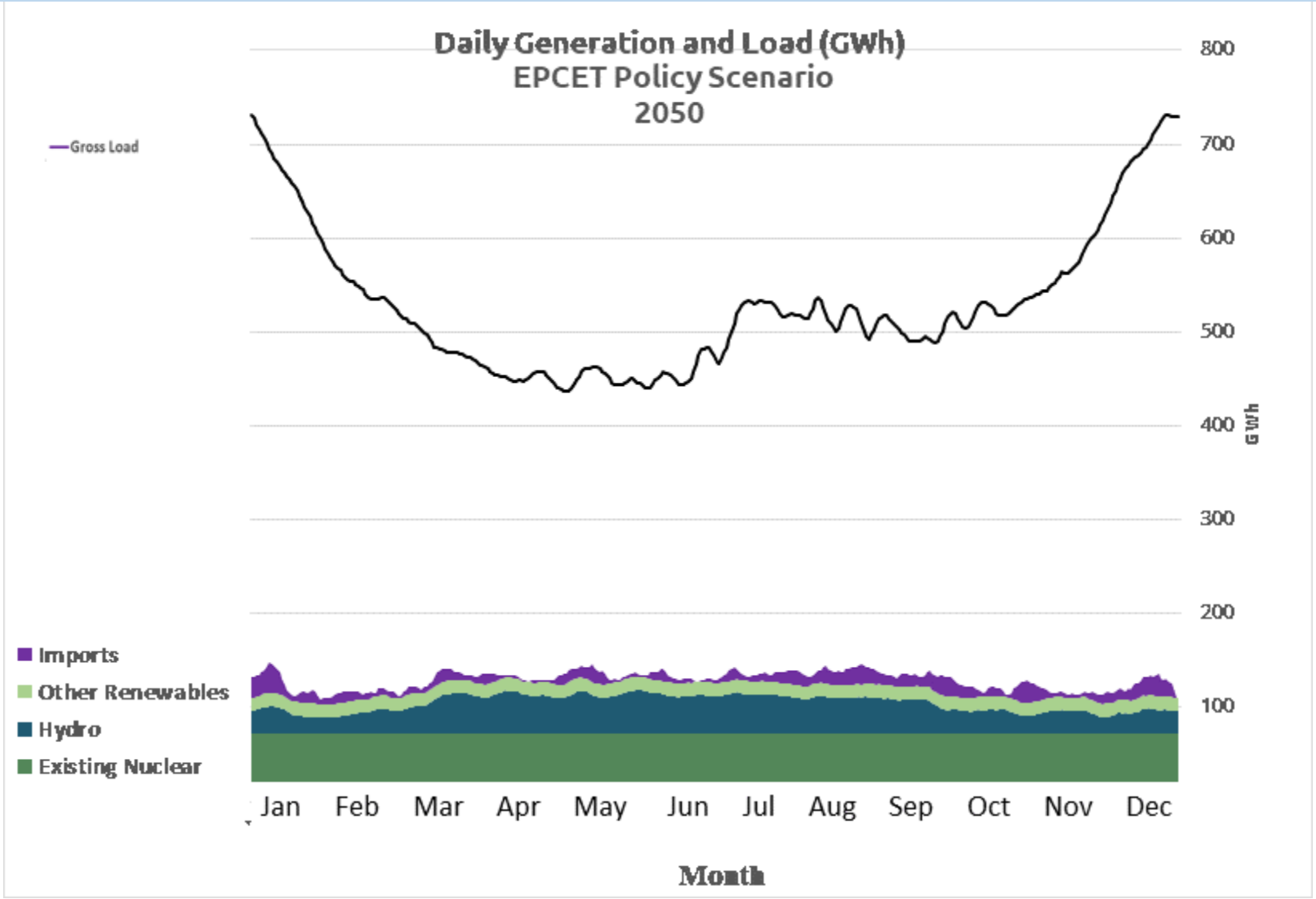
Note: In New England, generation costs are 50-60% of residential prices. The rest consists of the cost of transmission, distribution, and management. https://www.eia.gov/electricity/data.php#revenue

In 2050, there is a Gap: The renewables fail to meet the demand and need a backup for much of the year.

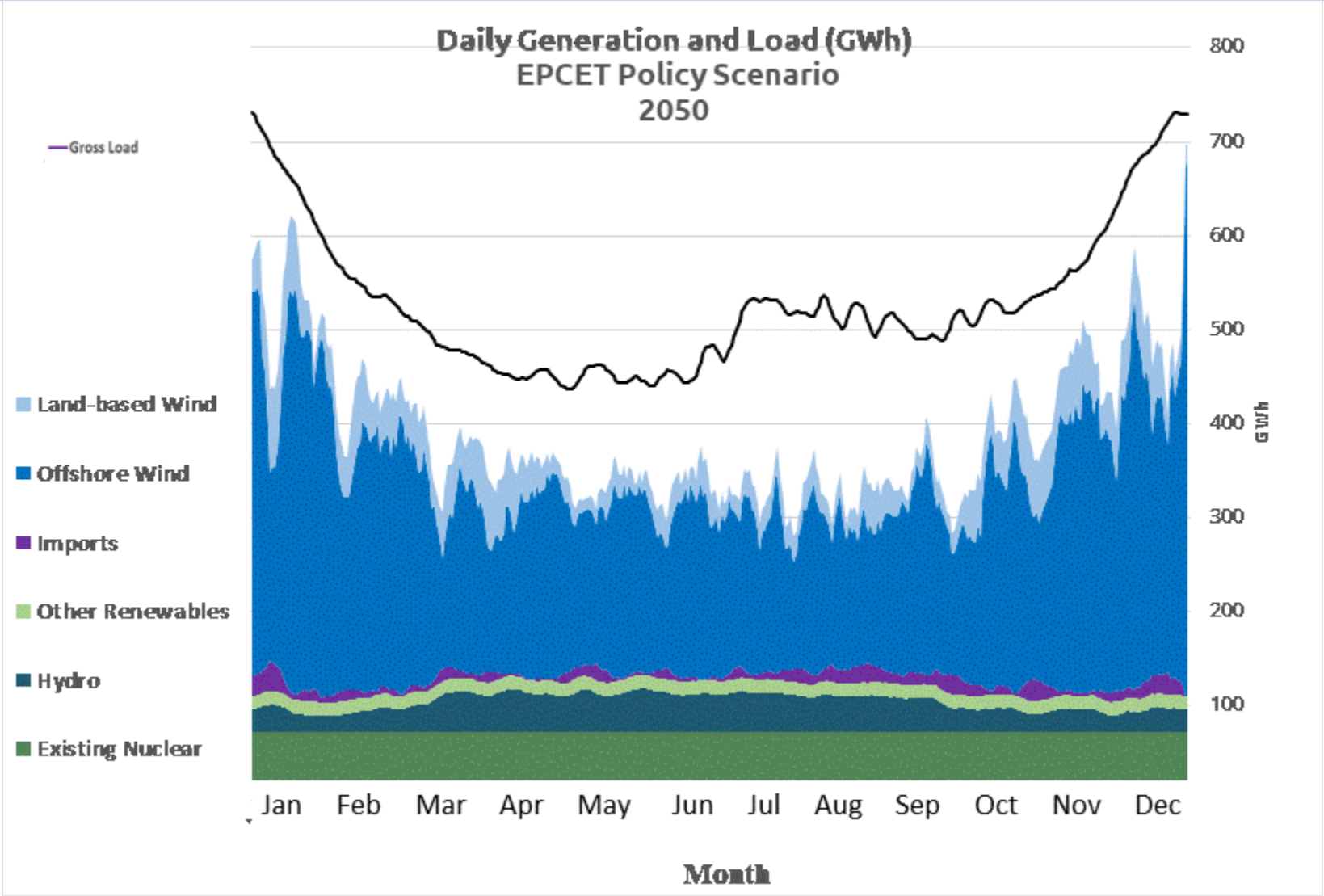


First, let's make sure everyone understands this graph…

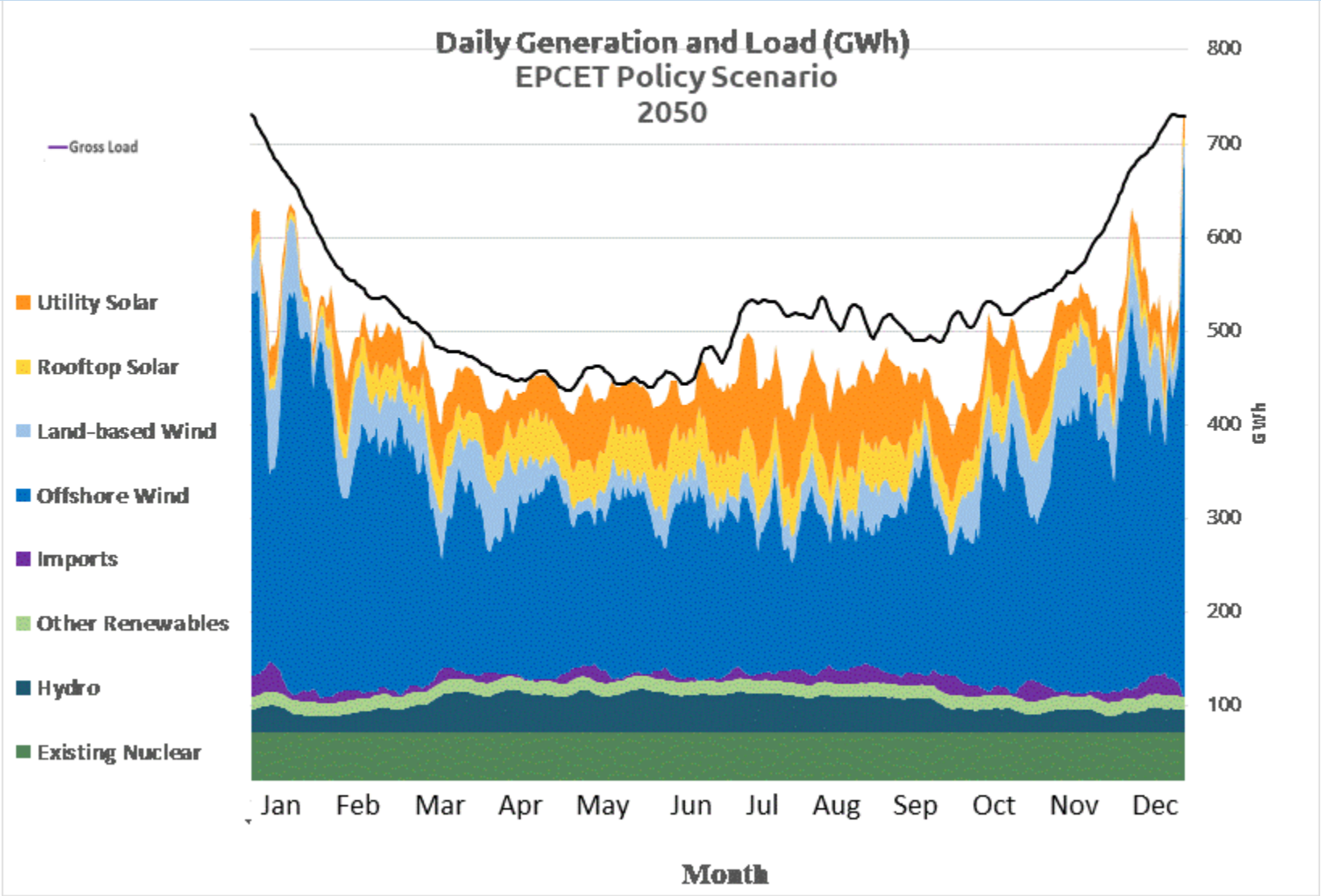
First, include the small, fixed sources



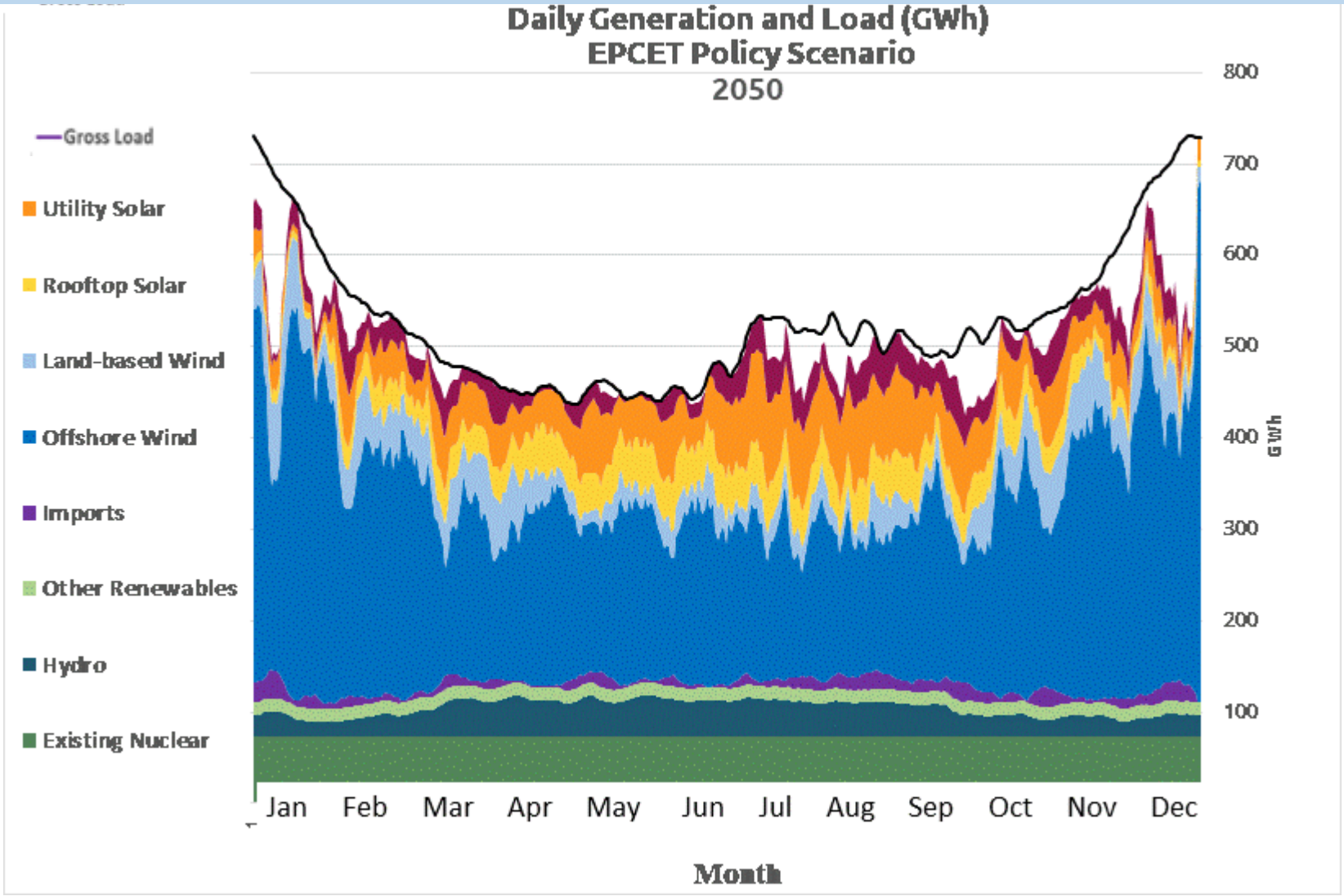
Then add offshore and land-based wind



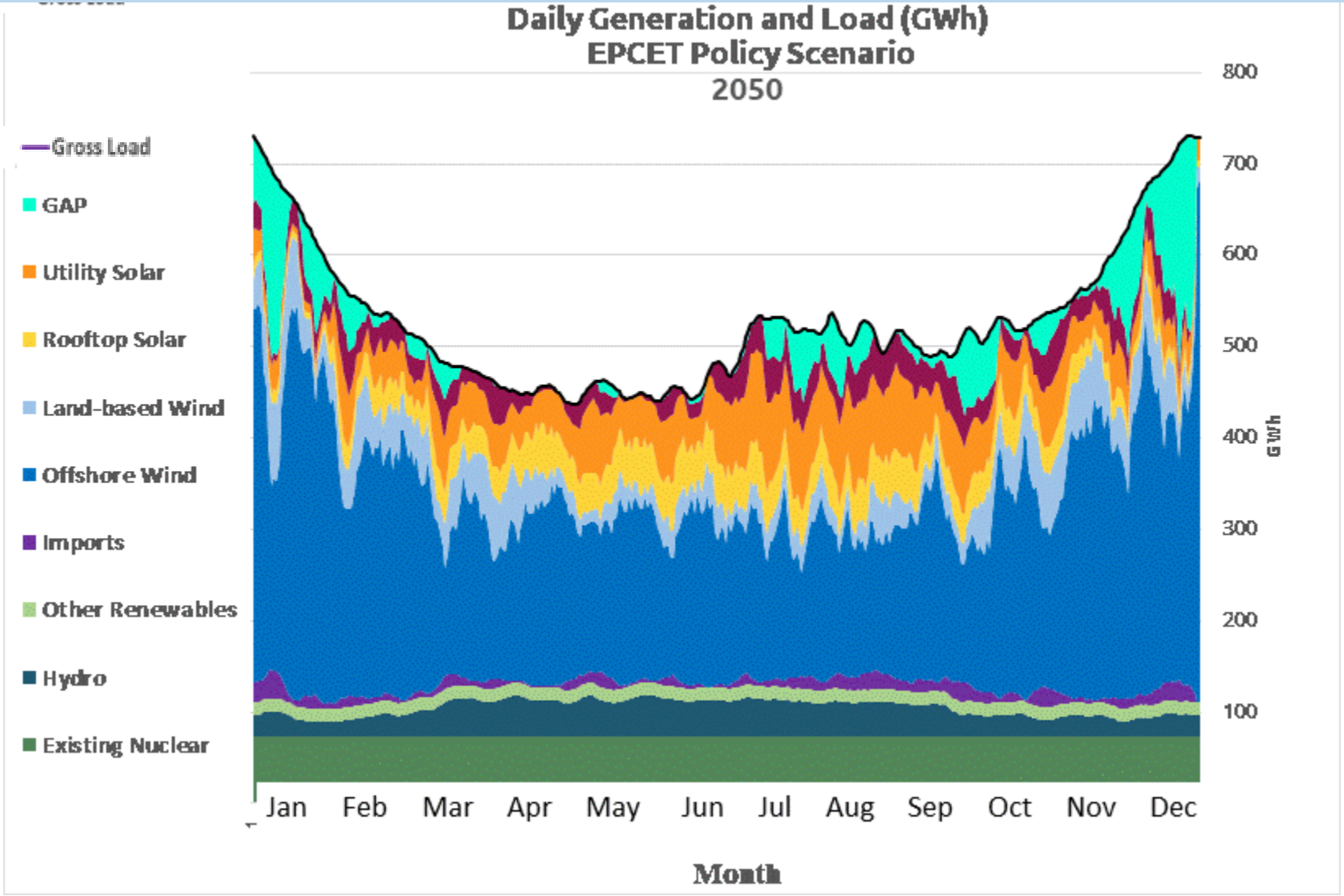
Adding rooftop and utility solar



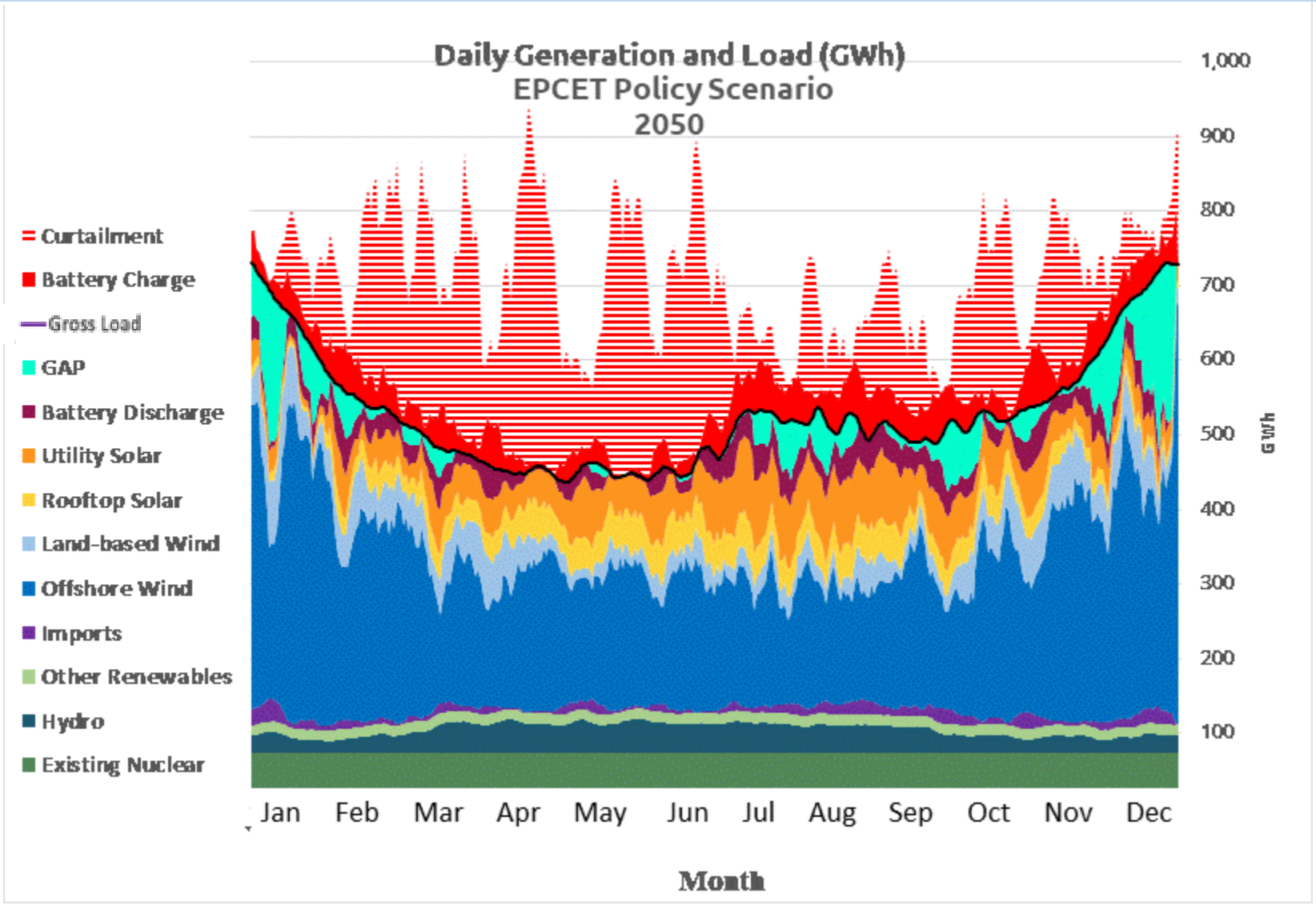
Add battery storage discharge



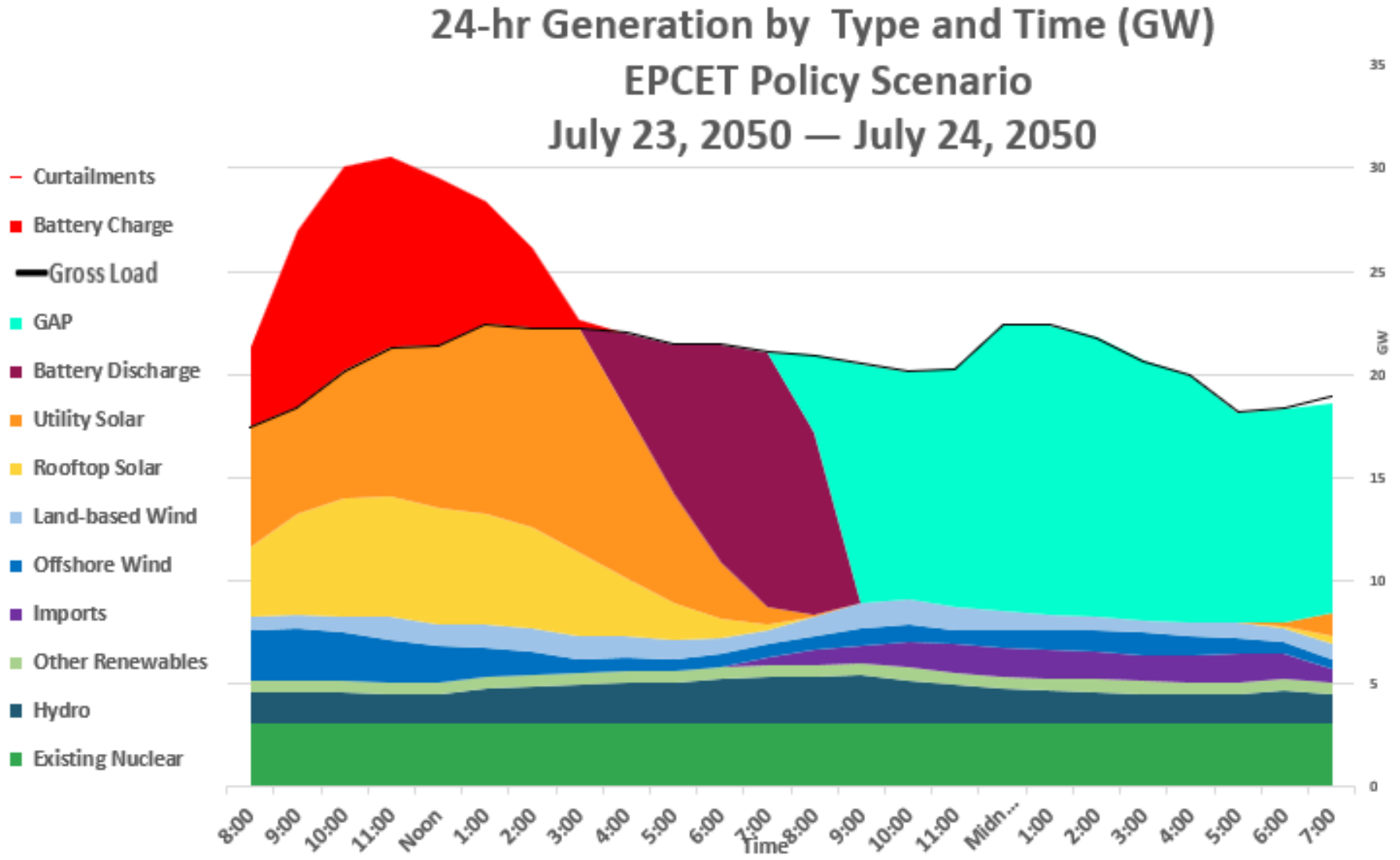
Then fill in the GAP between supply and demand



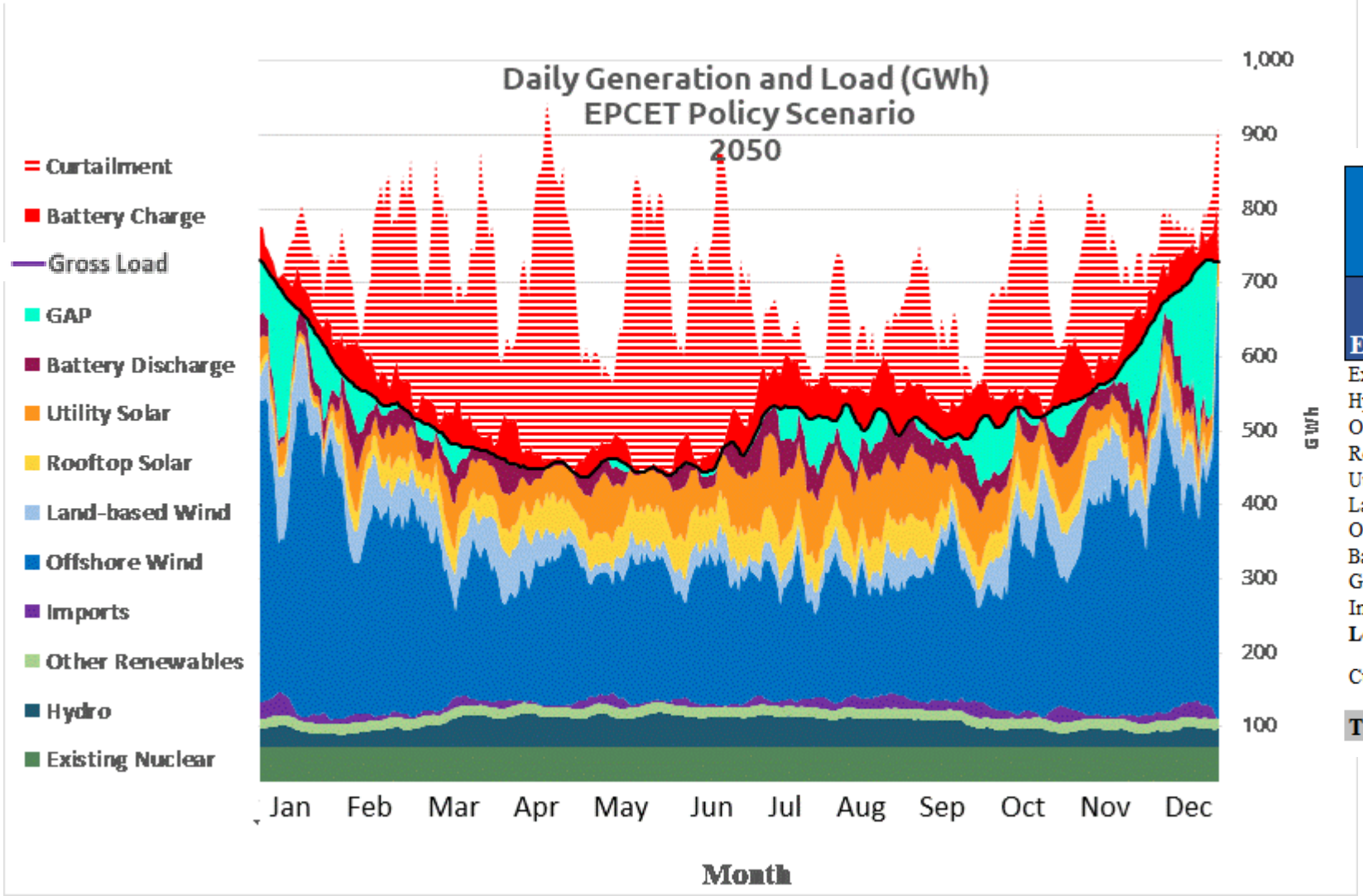
Finally, show battery charging and curtailments



A Summer Day in 2050 via EPCET



In 2050, there is a Gap: The renewables fail to meet the demand and need a backup for much of the year.



Electricity Generation
EPCET Policy Scenario
2050

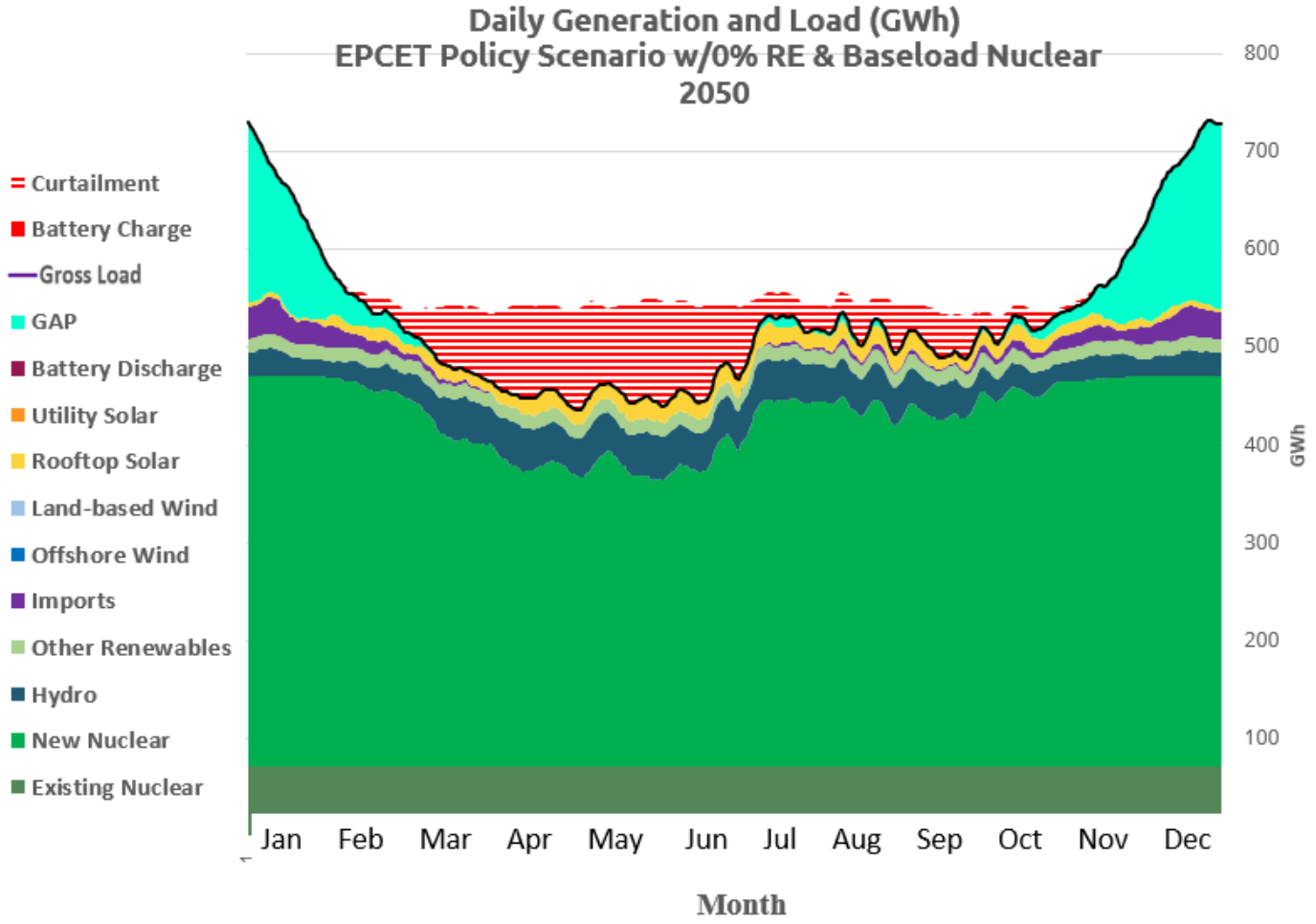
Energy Source	Capacity (MW)	Output (GWh/yr)	Capacity Factor (%)	% Load
Existing Nuclear	3,326	26,478	90.9%	13.6%
Hydro	3,991	11,792	33.7%	6.0%
Other Renewables	763	5,210	78.0%	2.7%
Rooftop Solar	9,734	11,860	13.9%	6.1%
Utility Solar	27,538	22,505	9.3%	11.5%
Land-based Wind	7,500	15,952	24.3%	8.2%
Offshore Wind	34,406	86,479	28.7%	44.3%
Battery Discharge*	27,500	9,524	4.0%	4.9%
GAP	25,000	11,352	5.2%	5.8%
Imports		3,723		1.9%
Load		**195,352**		**100.0%**
Curtailment		53,884		27.6%
Total Cost ($/MWh)	**Current $184.93**		**Projected $107.61**	

Characteristics of an all-renewable policy

- Renewable build-outs are vast, requiring approximately four times the capacity of today's electric grid and much greater expense.
- During days following low wind and PV generation, battery storage will be depleted.
- The grid will need significant amounts of firm, dispatchable resources on days with low wind and PV output to ensure reliability.
- In the Massachusetts and EPCET studies, the fossil gas supply is assumed to be replaced with carbon-neutral synthetic gas or liquid fuel.

Source: https://www.iso-ne.com/static-assets/documents/100016/2024-epcet-report-fact-sheet.pdf

Replacing the renewable buildup with nuclear power saves money and the environment.

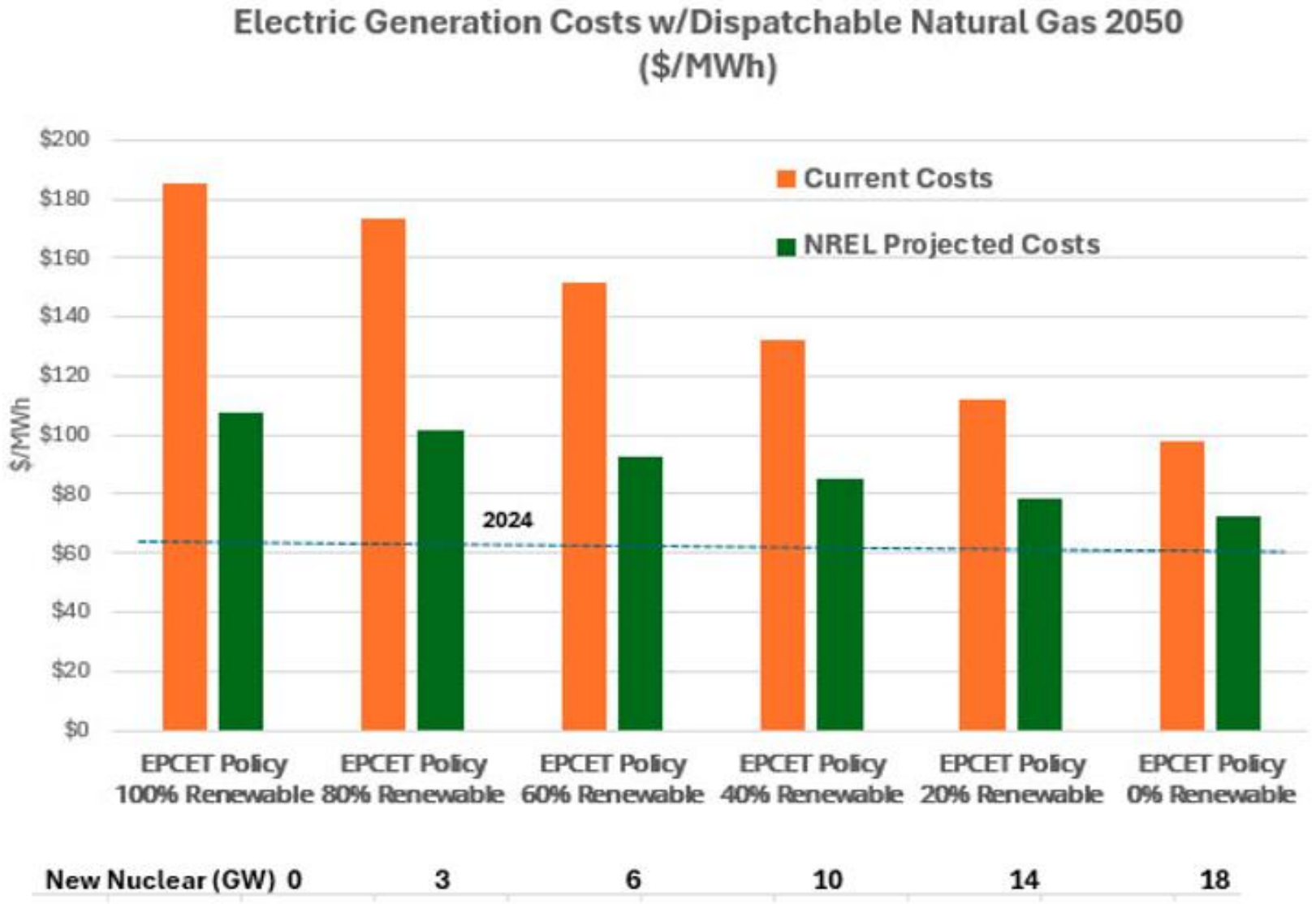


Electricity Generation
EPCET Policy Scenario w/0% RE & Baseload Nuclear
2050

Energy Source	Capacity (MW)	Output (GWh/yr)	Capacity Factor (%)	% Load
Existing Nuclear	3,326	26,478	90.9%	13.7%
New Nuclear	18,000	131,341	83.3%	67.9%
Hydro	3,991	11,792	33.7%	6.1%
Other Renewables	763	5,210	78.0%	2.7%
Rooftop Solar	4,000	4,874	13.9%	2.5%
Utility Solar	0	0	0.0%	0.0%
Land-based Wind	0	0	0.0%	0.0%
Offshore Wind	0	0	0.0%	0.0%
Battery Discharge*	0	0	0.0%	0.0%
GAP	25,000	10,738	4.9%	5.5%
Imports		3,140		1.6%
Load		**193,573**		**100.0%**
Curtailment		14,077		7.3%
Total Cost ($/MWh)	**Current $97.62**		**Projected**	**$72.61**

Note: This adds the equivalent of nine Millstone plants.

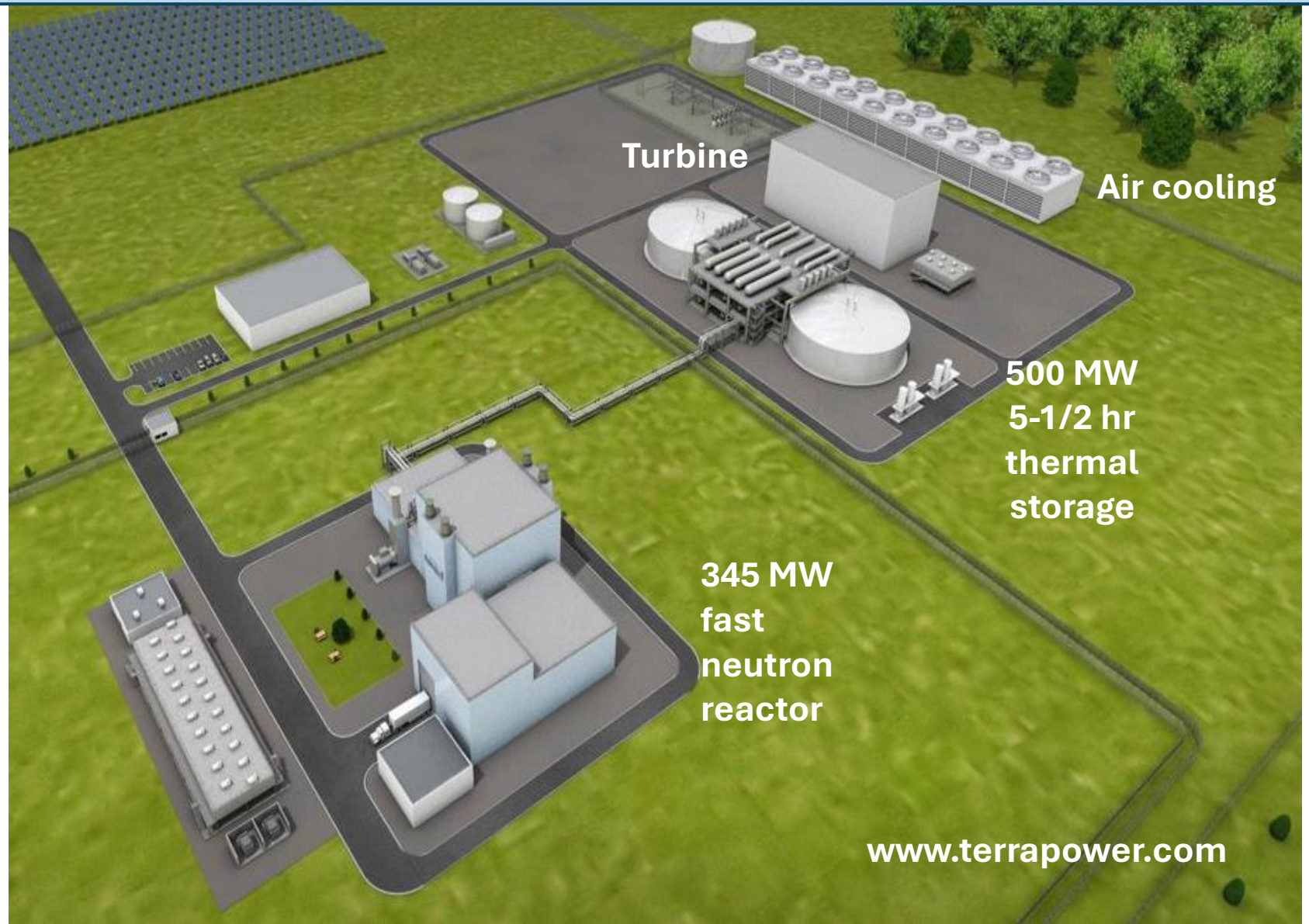
Fewer renewables = lower costs



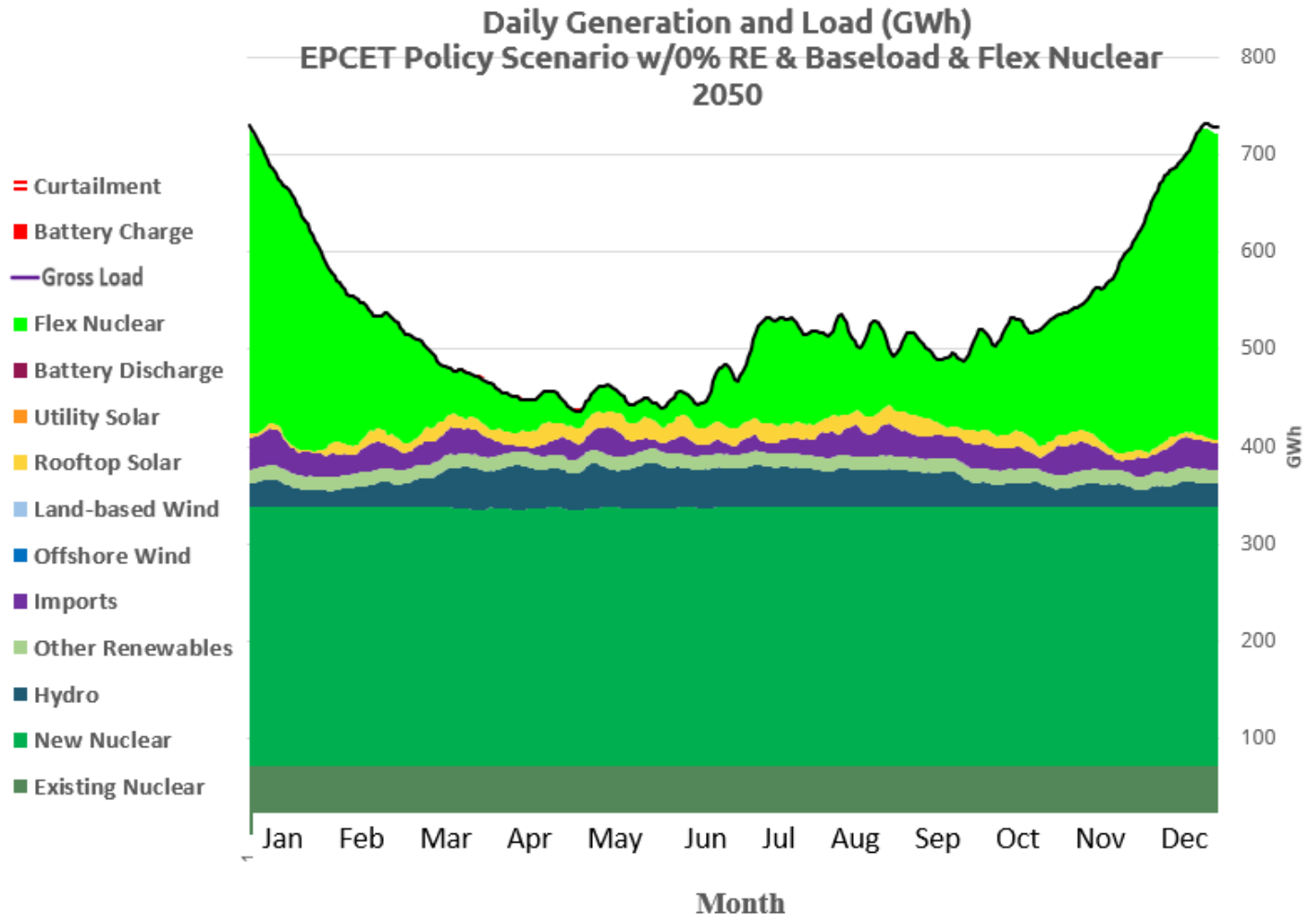
New England needs a reliable, dispatchable emission-free resource.

- Massachusetts and ISO-NE planners found a large gap between what the renewables and batteries could provide and what would be needed to keep the lights on. We find the same result.
- A backup is needed with a capacity nearly as large as the full load on the system.
- Currently, natural gas plays that role. That is not consistent with state decarbonization objectives.
- The gap has to be filled by a source that is emission-free, reliable – always available when needed – and dispatchable – able to provide whatever power is needed moment to moment as the demands on the grid change.

Nuclear power can serve as the needed flexible dispatchable resource. Here's an example: Terrapower Natrium



Adding flexible nuclear leads to a reliable, emission-free grid, but it is expensive.



Electricity Generation
EPCET Policy Scenario w/0% RE & Baseload & Flex Nuclear 2050

Energy Source	Capacity (MW)	Output (GWh/yr)	Capacity Factor (%)	% Load
Existing Nuclear	3,326	26,478	90.9%	13.7%
New Nuclear	12,000	96,812	92.1%	50.0%
Hydro	3,991	11,792	33.7%	6.1%
Other Renewables	763	5,210	78.0%	2.7%
Rooftop Solar	4,000	4,874	13.9%	2.5%
Utility Solar	0	0	0.0%	0.0%
Land-based Wind	0	0	0.0%	0.0%
Offshore Wind	0	0	0.0%	0.0%
Battery Discharge*	0	0	0.0%	0.0%
Flex Nuclear	23,000	40,715	20.2%	21.0%
Imports		7,643		3.9%
Load		**193,523**		**100.0%**
Curtailment		133		0.1%
Total Cost ($/MWh)	**Current $157.40**		**Projected $101.65**	

We can reduce the cost of flexible nuclear plants by using them to supply other essential services.

- Nuclear plants are most efficient when running full-time.
- Dispatchable plants are needed less than 20% of the time. At other times, they could provide useful, emission-free services:
  - ✓Export power to other regions which need it.
  - ✓Desalinate seawater.
  - ✓Run electrolyzers to produce hydrogen for industrial and power applications.
  - ✓Supply heat and electricity to create synthetic fuels using carbon extracted from seawater or agricultural products or f the air to power transcontinental aircraft, cargo ships, or long-distance trucking.

With the revenue earned from these services, electricity would cost no more than it does today using fossil fuels.

Key Takeaways: How to achieve an affordable carbon-free grid in New England

- A reliable grid will require a source of dispatchable, emission-free power that is available year-round.
- It is possible, using nuclear power, to create a reliable, decarbonized, affordable electric grid.
- A strategy centered on large-scale expansion of intermittent renewables cannot achieve that goal because of the massive overbuilding and storage buildup required.
- Replacing a buildup of renewables with nuclear will reduce system costs and avoid the extensive land use, material needs, transmission lines, and environmental impacts that would accompany the expansion of solar and wind facilities.
- Existing restrictions on new nuclear development will have to be lifted to permit the growth of a reliable decarbonized grid.