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Wirtschaftswissenschaftliche Fakultät

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Forschungsstelle für Nachhaltige Energie- und Wasserversorgung

Premature nuclear retirements and nuclear decommissioning funds: Insights from New York

Muhammad Bah and Hannes Weigt

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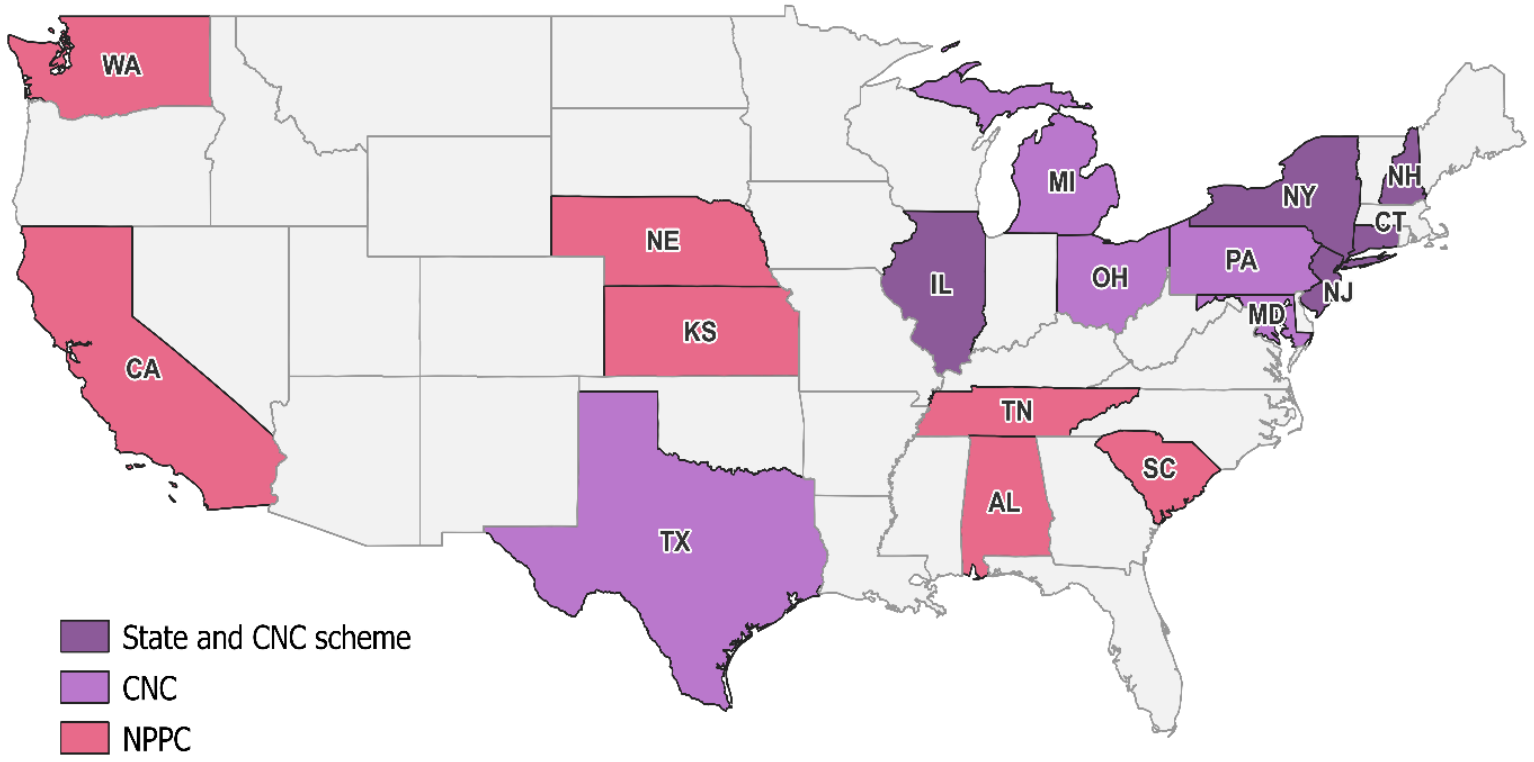
Outline

Motivation

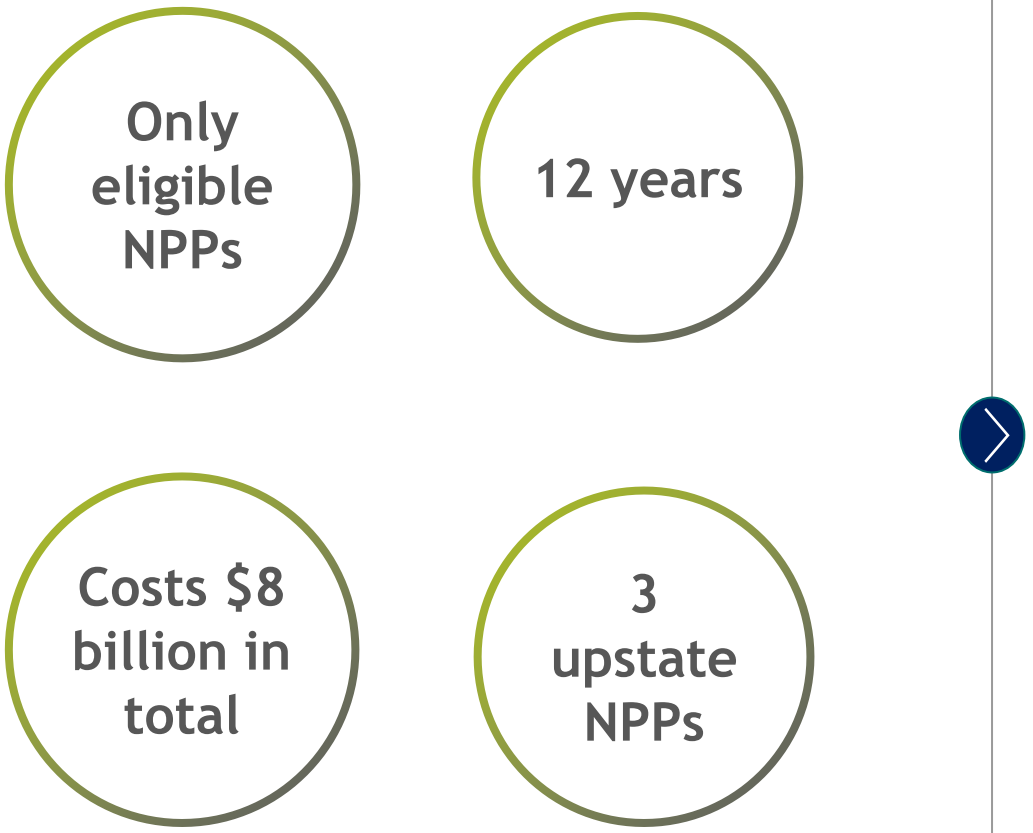
«Active policy support mechanisms at both state and federal levels in the U.S»



- Pre 2021: deteriorating financial conditions of nuclear plants in wholesale electricity markets.
- State level support schemes rapidly introduced in 2017 to prop up struggling plants.
- Concern for premature nuclear retirements also matched at federal level.

Note: CNC: Civil Nuclear Credit, NPPC: Nuclear Power Production Credit
Source: own illustration

New York: Zero Emission Credit



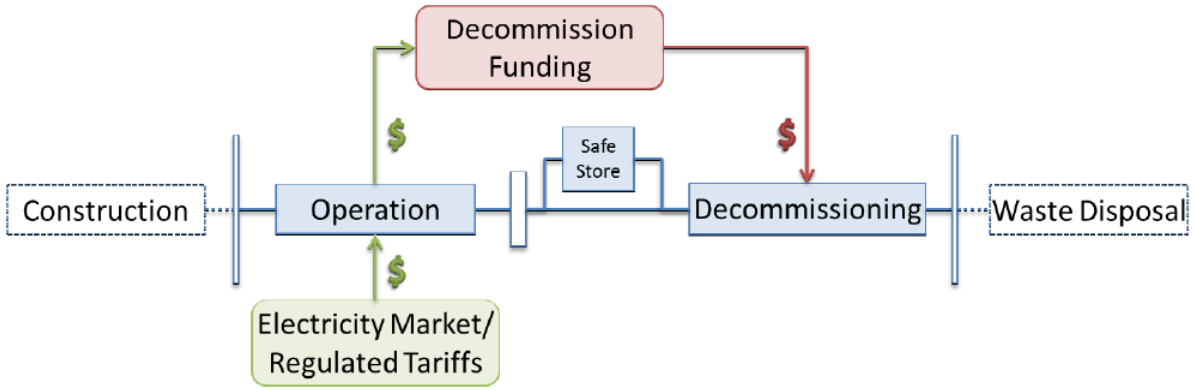
- Introduced in 2016 as part of the State Clean Energy Standard (CES)
- Coverage: Ginna, Fitzpatrick, Nine Mile 1 &2
- Overseen by New York State Energy and Research Development Authority (NYSERDA)
- ZEC credit price set and adjusted upwards over the cover period. As of 2022 ~$21.38/MWh

Motivation

Research Questions

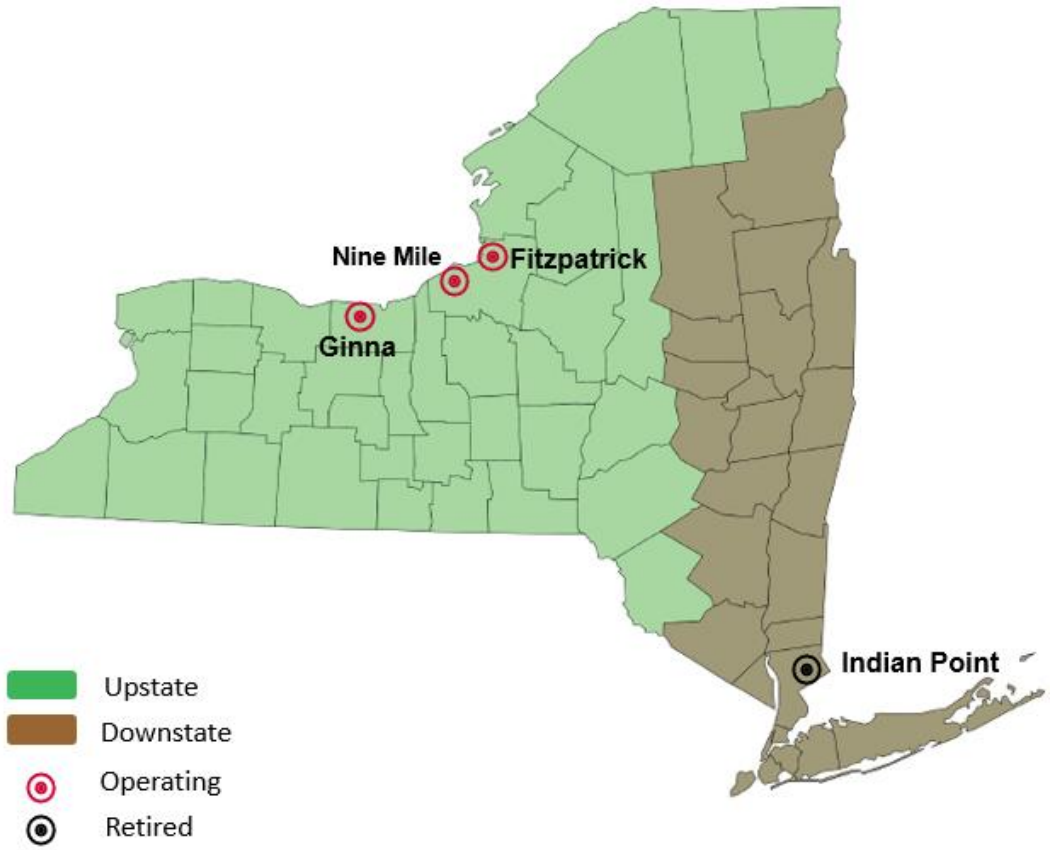
1. What are the combined market price and system costs (i.e. generation cost) of phasing-out nuclear power plants in comparison to the costs of the nuclear subsidy program?

2. In the event of an early nuclear power plant phase-out, what are the potential implications on the sufficiency of decommissioning funds?



Source: (Weigt and von Hirschhausen 2018)

Case study: NYISO



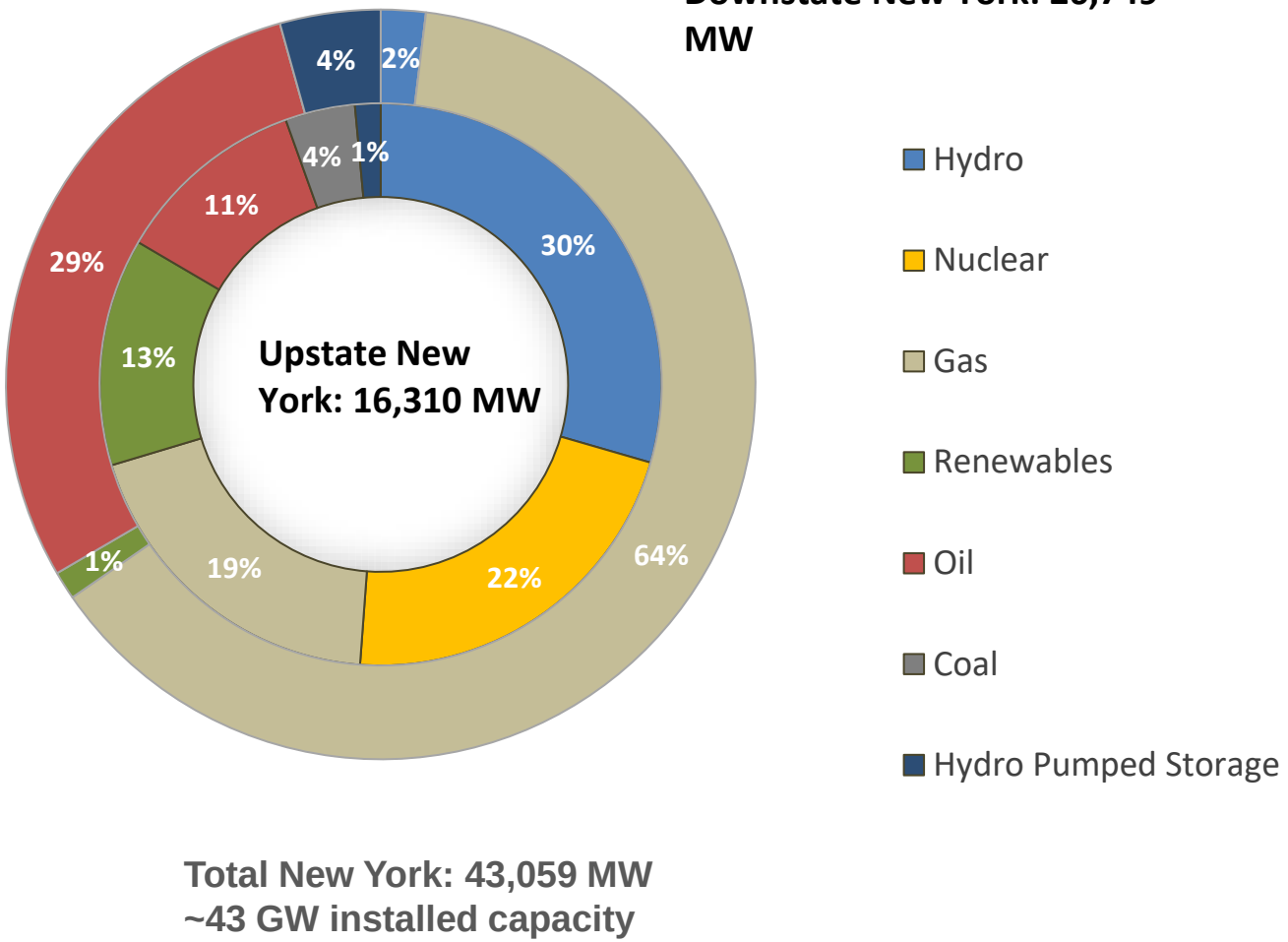
Source: Own illustration

Reactor (Type)	Capacity (MW)	Ownership	Age (2022)	License Expiry
Ginna (PWR)	580	Constellation (*formerlly* Exelon)	53	2029
Fitzpatrick (BWR)	813	Constellation	47	2034
Nine-Mile Point 1 (BWR)	613	Constellation	53	2029
Nine Mile Point 2 (BWR)	1,277	Constellation	35	2046
Indian Point 2 (PWR)	998	Entergy		Retired
Indian Point 3 (PWR)	1,030	Entergy		Retired

Case study: NYISO

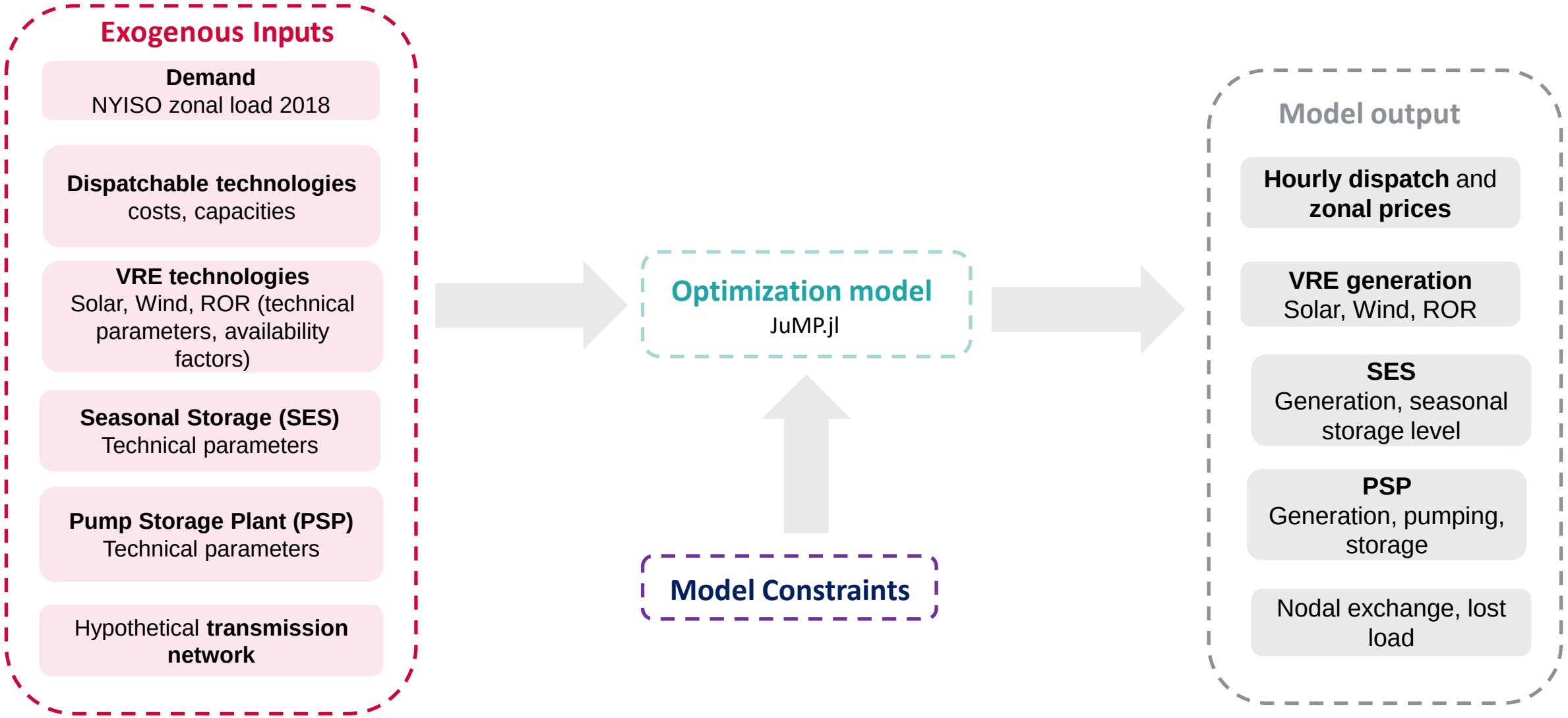
Upstate NYISO: low cost zero emission generation facilities

Downstate NYISO: fossil fuel-based generation facilities

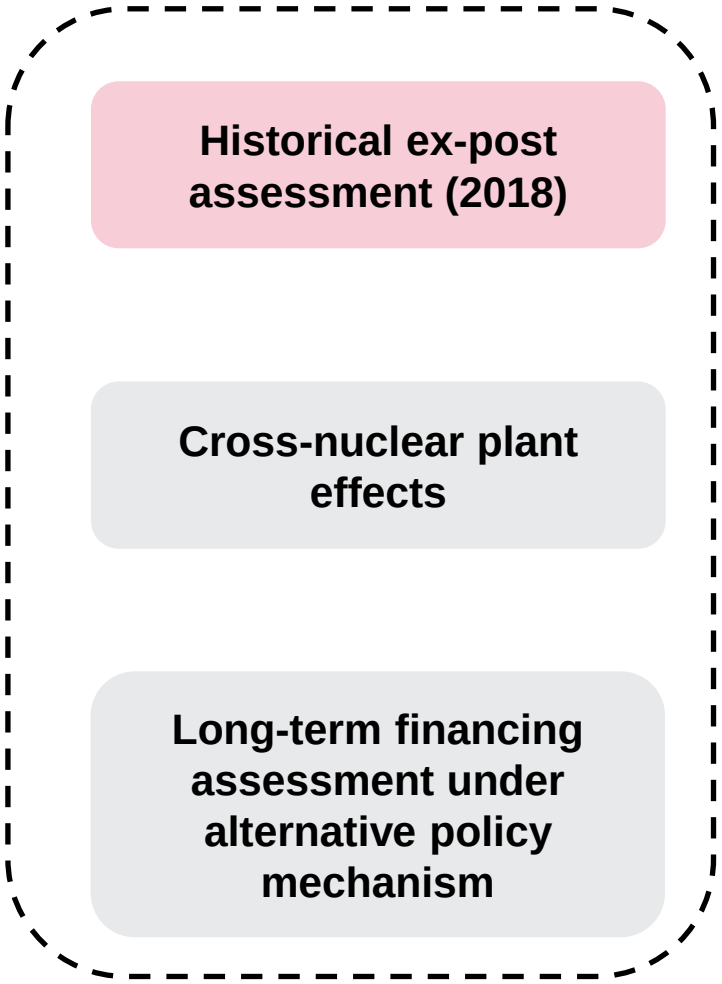


Total New York: 43,059 MW
~43 GW installed capacity

Methods: bottoms-up electricity market model



Model Scenario blocks



Baseline calibration model for 2018

Scenario 1: Phase-out upstate NPP's. No new capacity builds. Existing generation replaces shortfalls.

Market feedback effects of various NPP phase-out scenarios

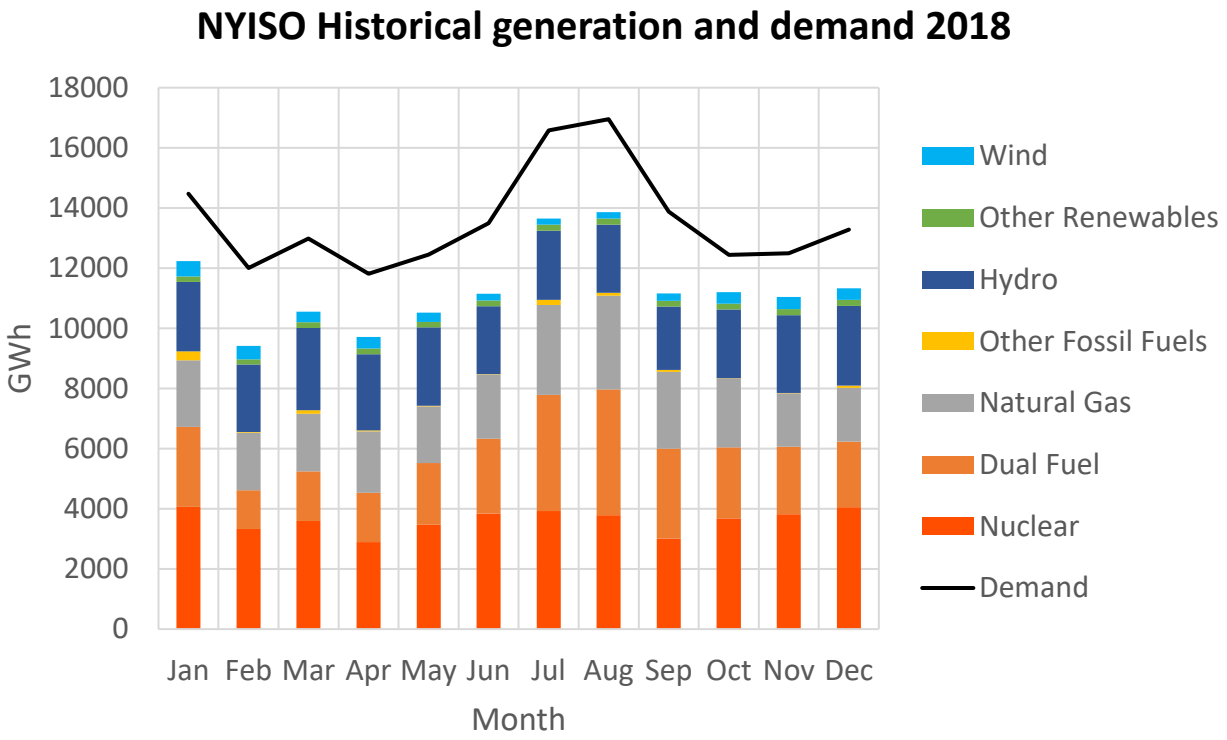
Scenario 1: Maintain ZEC's until 2029

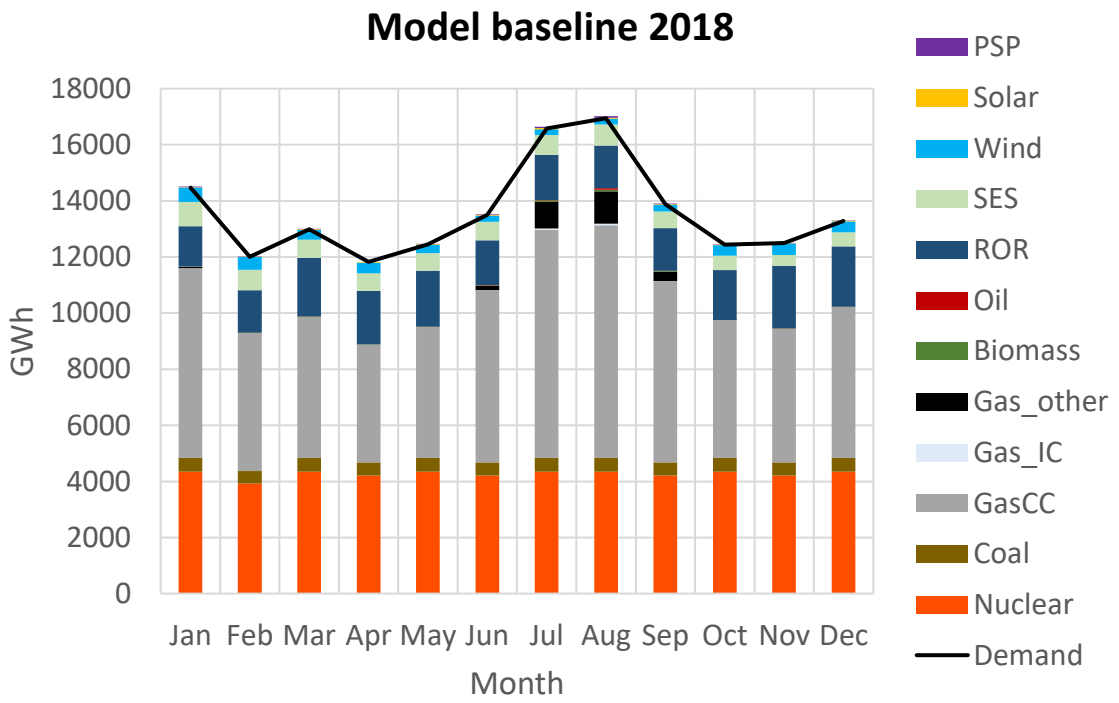
Scenario 2: Replace ZECs with carbon price mechanism

Active

Pending

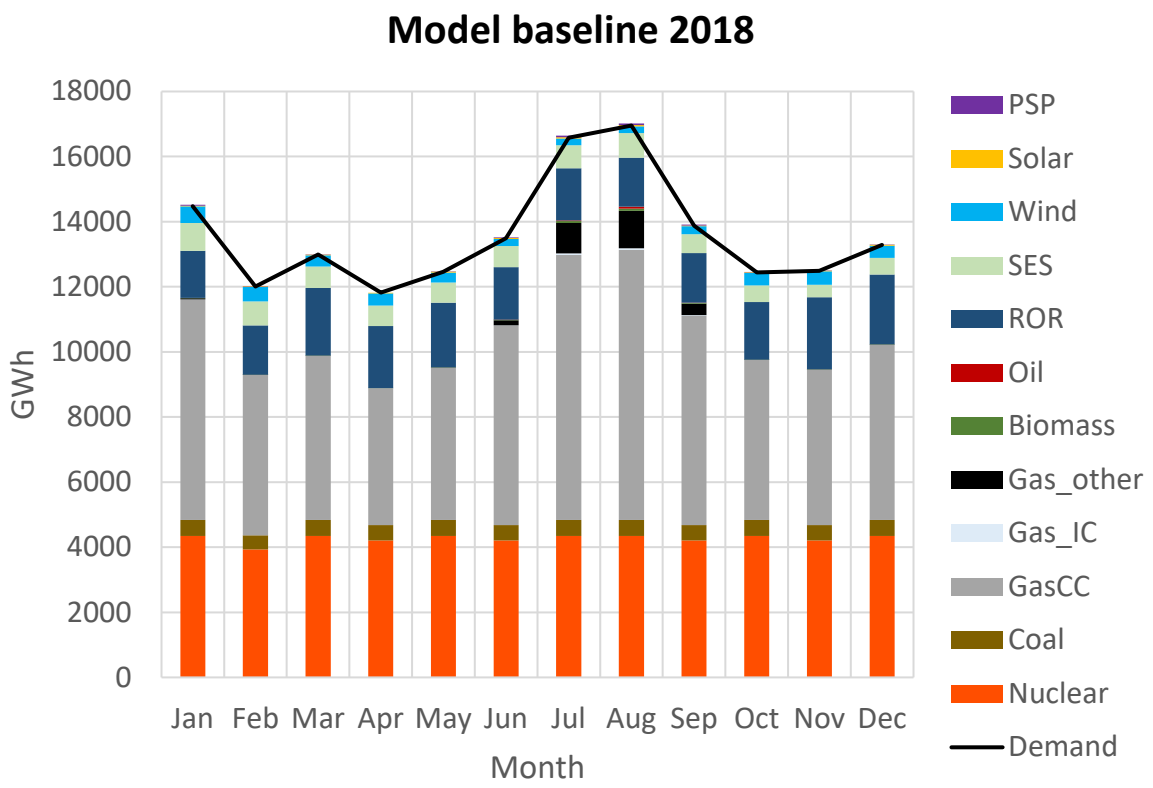
Baseline model calibration 2018

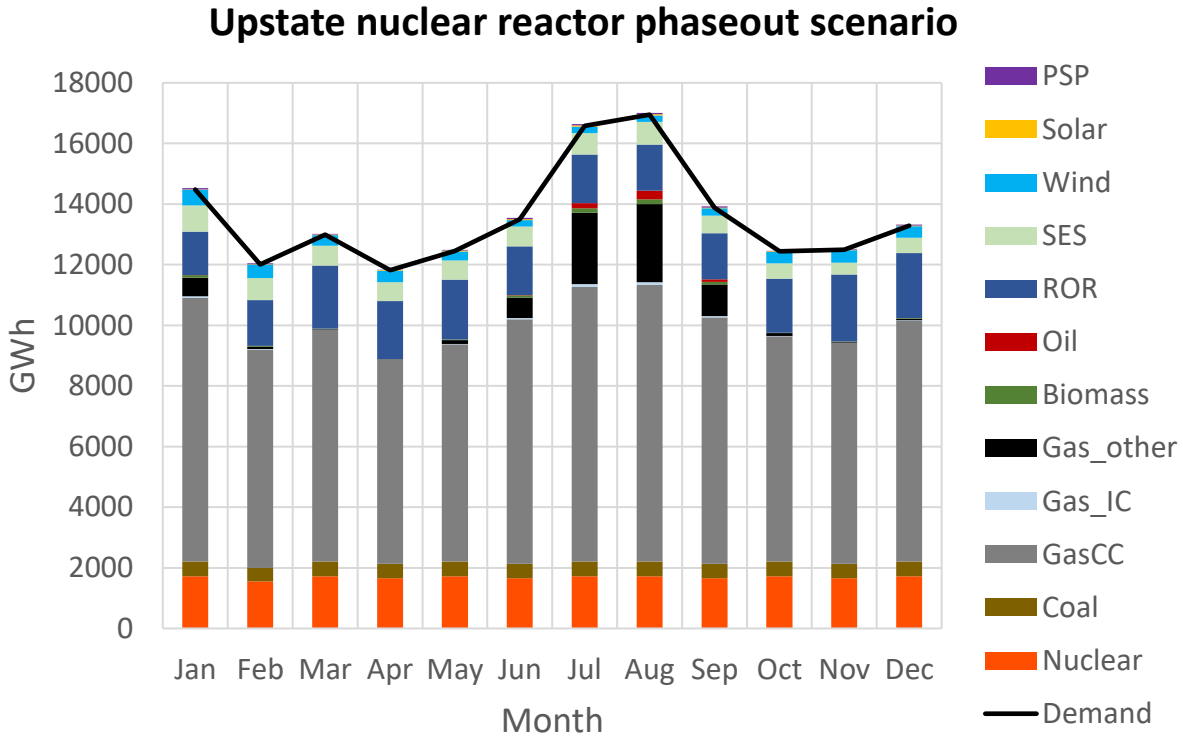




Gas ~ 72,463 GWh (44%)
Nuclear ~51,224 GWh (31.41%)
Renewables (wind, solar, ror) ~ (16%)
SES ~7.6 GWh (5%)

Scenario block 1: Upstate nuclear reactor phase-out

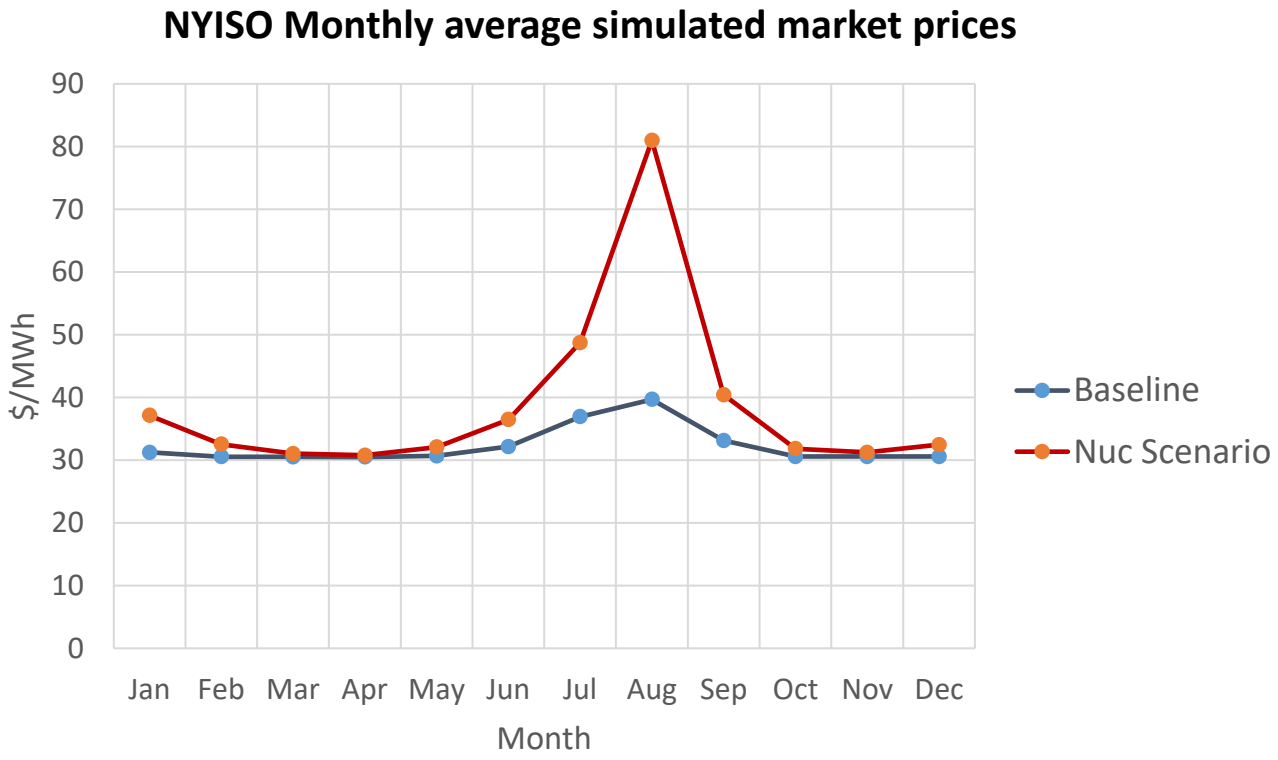




>Expansion of **natural gas generation** to overcome shortfalls from nuclear generation

Gas ~ 102,543 GWh (62.8%) +41.5% from baseline
Nuclear ~20,244 GWh (13%)
Renewables (wind, solar, ror) ~ 25,620 GWh (16%)

Market price development



- NYISO wide average prices post upstate nuclear **shutdown rises by $6.55/MWh** ~driven by natural gas use
- Acute prices in high load summer months

Total system costs vs ZEC subsidy scheme

Baseline 2018 costs	Nuclear phase-out costs	Net system cost	Total ZEC expenditure 2018 ~$17.48/MWh
$5.411 billion	$7.117 billion	**$1.705 billion**	**$541,543 million**

>Maintaining the four upstate nuclear reactors under the ZEC scheme is **cheaper than a full phase-out**

Conclusion and outlook

- Significant market impacts of early nuclear phase-out
- Costs of phasing-out upstate reactors **exceed annual cost of ZEC** scheme.
- Ongoing debate on whether market is adequately compensating nuclear reactors
  - Would a **carbon pricing scheme** be the solution?
- Decommissioning fund assessment of early nuclear phase-out.

Outlook

- Refinement of scenarios.
- Expansion of model spatial resolution (i.e. inclusion of PJM, Hydro-Quebec (HQ), etc…) and full network.
- Refinement of framework for linking market feedback effects to decommissioning funds.

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Thank you!

Muhammad Bah

Research Center for Sustainable Energy and Water Supply (*FoNEW*)
Faculty of Business and Economics, University of Basel

muhammadmaladoh.bah@unibas.ch