Subject April 23, 2022

Notes

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1 Carbon Free Emissions Plan

2 Nationwide Trends

3 Current Statistics

4 Quantitative Data Analysis

Population of NYS 19.45 million as of 2019 (cite census) Population of NYC 8.149 million as of 2019 (cite census)

5 New sources of generation

5.1 Wind

5.1.1 Land

5.1.2 Offshore

New offshore wind projects in pipeline:

1. **Empire Wind 1**: 816 MW, solicited 2018 [**?**]
2. **Empire Wind 2**: 1260 MW, solicited 2020 [**?**]
3. **Sunrise Wind**: 880 MW, solicited 2018 [**?**]
4. **Beacon Wind**: 1230 MW, solicited 2020 [**?**]

5 total projects totaling greater than 4300 MW, leading offshore generation pipeline in the nation

Official target goal for offshore wind generation is 9000 MW by 2035. [**?**]

Substation Locations: Astoria Substation, Gowanus Substation, Barrett Substation, Holbrook Substation, East Hampton Substation
Proposed Port Facilities: South Brooklyn Marine Terminal, Holbrook Substation, East Hampton Substation. [**?**]

All projects are currently in the data collection phase. [**?**]

NYSERDA offers contracts to purchase offshore renewable energy certificates (OREC) from offshore wind developers. NYSERDA sells these to load serving entities (LSEs) like utilities, which are required by law to purchase renewable energy credits. [**?**]

5.1.3 Technology & Implementation

Advances in:

1. Materials
2. Engineering of turbine foudnations
3. Turbine blade design

With respect to foundations: [2]

1. Monopiles - for depths up to 25m. Freestanding; cheap, easy to install and inexpensive to manufacture and transport. Used in 95& of installations worldwide.
2. Gravity - also for up to 25m, but used for les cohesive seabed compositions
3. Suction bucket - Can also be cost effective, but oly for appropriate choice of seabed composition
4. Deepwater -
5. Tripod - 30m - 60m water depth
6. Jacket - $>$ 50m water depth. Expensive and complex to install and manufacture; however, mature

5.1.4 Geography of the Long-Island Area

5.2 Solar

Official target: 10GW distributed solar by 2030 (cite NYSERDA)
Government sponsored incentives via tax credits, NYSun

5.3 Geothermal

6 Maintenance of mature technologies and infrastructure

6.1 Nuclear

7 Policy Changes

NYSERDA energy credits:

1. Tier 1 (new renewables)
2. Tier 2 (maintenance resources)
3. Tier 2 (competitive program)
4. Tier 4 (NYC renewable energy)

7.1 Pricing Changes

7.2 Economic viability

Need Fair distribution of costs between ISOs and RTOs. [2]
Renewable Portfolio Standards
Aggressive federal support amenable to policy decision to focus on offshore wind – allows ISOs to reach LCOE levels for offshore installation costs similar to those seen in the UK, given the tax subsidies [2]

8 Changes in practical implementation

8.1 Changes in control

Demand for smart-buildings and online optimization techniques for realtime energy usage [4], [1], [3]
Better energy usage and demand prediction models.

9 Viability (outside of financial)

9.1 Resource constraints

9.2 Trend constraints

9.3 Location constraints

10 Literature Review

11 Main points (for slide)

References

[1] Muhammad Hilal Khan, Azzam Ul Asar, Nasim Ullah, Fahad R. Albogamy, and Muhammad Kashif Rafique. Modeling and Optimization of Smart Building Energy Management System Considering Both Electrical and Thermal Load. *Energies*, 15(2):574, January 2022.

[2] Daniel Mitchell, Jamie Blanche, Sam Harper, Theodore Lim, Ranjeetkumar Gupta, Osama Zaki, Wenshuo Tang, Valentin Robu, Simon Watson, and David Flynn. A review: Challenges and opportunities for artificial intelligence and robotics in the offshore wind sector. *Energy and AI*, 8:100146, May 2022.

[3] David Sembroiz, Davide Careglio, Sergio Ricciardi, and Ugo Fiore. Planning and operational energy optimization solutions for smart buildings. *Information Sciences*, 476:439–452, February 2019.

[4] Liang Yu, Shuqi Qin, Meng Zhang, Chao Shen, Tao Jiang, and Xiaohong Guan. A Review of Deep Reinforcement Learning for Smart Building Energy Management. *IEEE Internet of Things Journal*, 8(15):12046–12063, August 2021. arXiv: 2008.05074.