

Comparing Area and Energy of 500 MW Plants

Compare the required area for a 500 MW Solar Array, a 500 MW Wind farm, a 500 MW Combined cycle gas plant and a 500 MW nuclear plant and how much annual energy would be generated by each of the four types of generation using wind and solar capacity factors in NY State

How the four 500 MW plants compare

All four have the same 500 MW nameplate, but their land needs differ by about 800 times and their annual output by about 5 times. At 100% output, 500 MW would produce 4,380 GWh a year. The capacity factors below are New York's actual 2024 fleet values from EIA's state capacity-factor data.

500 MW plant	NY capacity factor (2024)	Total site area	Annual energy	Acres per TWh/yr
Solar PV	16.9%	~3,750 acres (5.9 sq mi)	~740 GWh	~5,070
Onshore wind	24.4%	~42,600 acres (67 sq mi)	~1,069 GWh	~39,900
Combined cycle gas	56.9%	~55 acres	~2,492 GWh	~22
Nuclear	92.5%	~416 acres (0.65 sq mi)	~4,052 GWh	~103

Where the land numbers come from

- **Solar:** NREL puts large fixed-tilt PV at 7.5 acres/MW of total area (5.8 acres/MW directly covered). Recent New York projects are denser. For example, [Flat Creek Solar](#) is 300 MW on about 1,000 acres. That suggests roughly 1,650–3,750 acres for 500 MW.
- **Wind:** NREL gives an average total project area of 34.5 ha/MW (about 85 acres/MW). Only about 1 ha/MW is actually disturbed, which works out to roughly 1,200 acres for 500 MW. Most of the land between turbines can still be farmed. New York projects in that study ranged from 11 to 36 ha/MW.
- **Gas combined cycle:** The NRC cites about 110 acres per 1,000 MW. This leaves out gas wells and pipelines.
- **Nuclear:** NEI cites about 1.3 sq mi per 1,000 MW, the median of U.S. sites including the exclusion area. A 500 MW plant may not shrink proportionally, because sites have a minimum size.

Matching nuclear's output

To make the same ~4,050 GWh a year as the nuclear plant:

- **Solar** would need about 2,740 MW on roughly 20,500 acres.
- **Wind** would need about 1,900 MW on roughly 161,600 acres of total project area.

Caveats on capacity factors

- **Solar:** New York's 16.9% average is pulled down by older fixed-tilt plants. A [NY DPS planning tool](#) puts new-build solar at about 20.4% statewide, or roughly 895 GWh a year for 500 MW. NYISO reported 18% for 2024.
- **Wind:** NYISO's 2024 figure is 25%, close to EIA's.
- **Gas:** The gas plant's output depends on how often it's dispatched, not on the weather. At 85% it would produce about 3,720 GWh.

The spreadsheet has these numbers with capacity factors and acres/MW as editable inputs. It also shows each technology's 2020–24 average capacity factor and lists the sources.

Techno...	NY cap...	NY CF...	Total s...	Direct/...	Total s...	Total s...	Direct...
Solar P...	0.169	0.166	7.5	5.8			
Onshor...	0.244	0.237	85.25	2.47			
Combin...	0.569	0.522	0.11	0.11			
Nuclear	0.925	0.946	0.832	0.3			
Sources							
EIA SED...							
NYISO...							
NREL L...							
NREL L...							
NEI nuc...							
NRC ga...							
NY DPS...							

Preview truncated

500 MW Generation Land & Energy Comparison (NY)

Excel Spreadsheet

Update the spreadsheet using the 20.4% new-build New York solar capacity factor

Add a sensitivity analysis for solar, wind, gas, and nuclear capacity factors

Revise the comparison using direct disturbed area separately from total project area

Artifacts

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Sources

Add apps and tools

Usage