

Solar Integration Study

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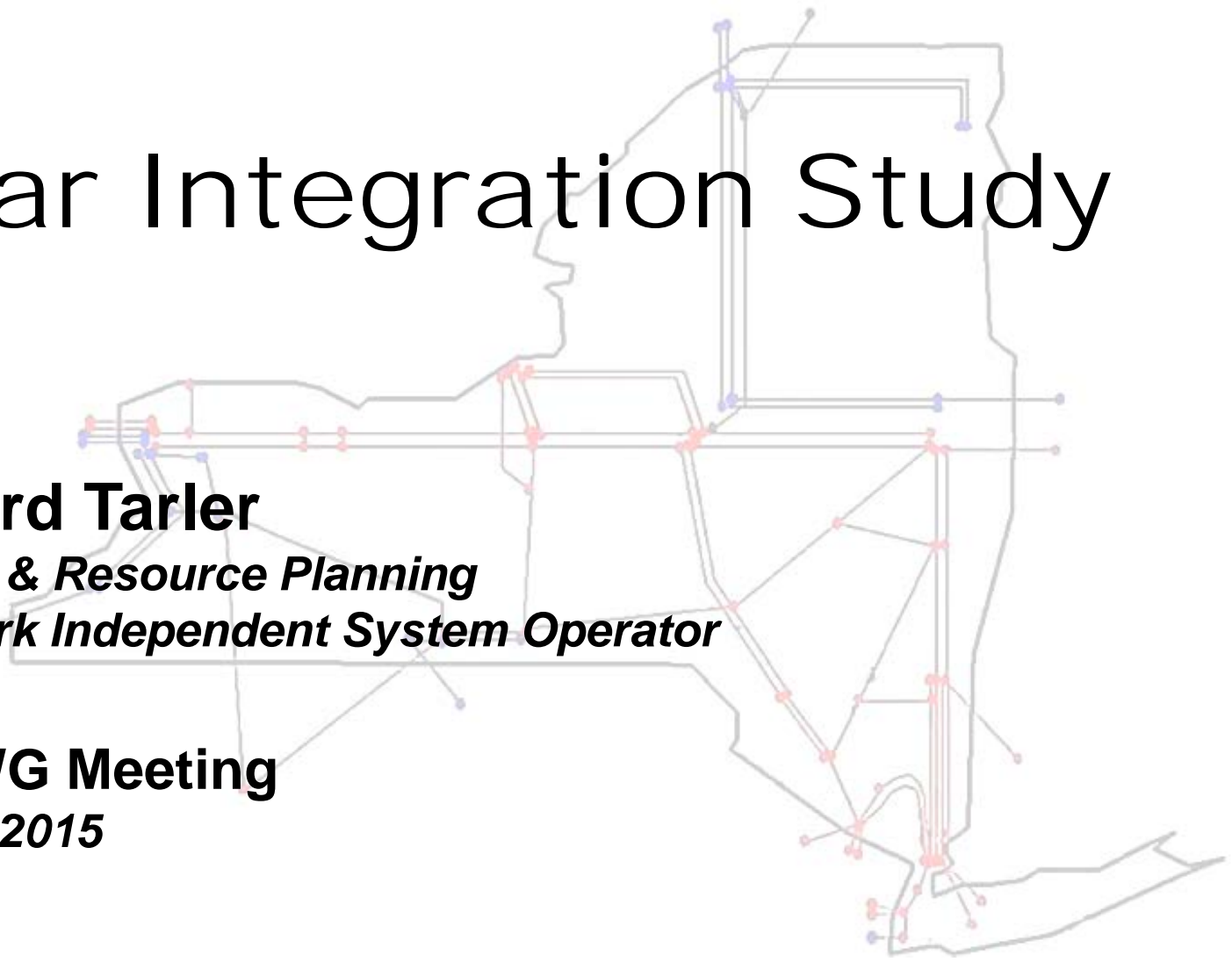
System & Resource Planning

New York Independent System Operator

ESPWG Meeting

May 4, 2015

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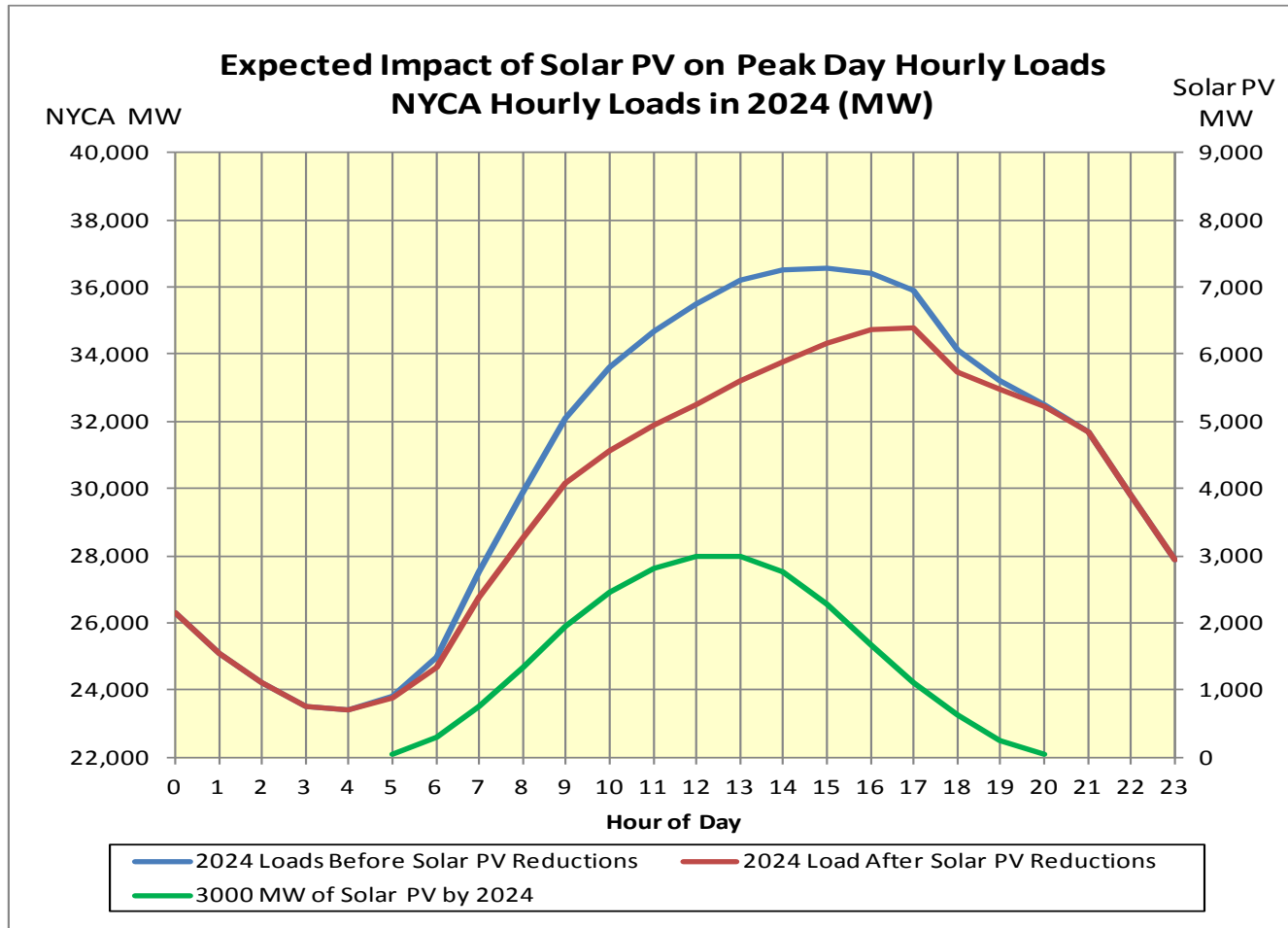


Background

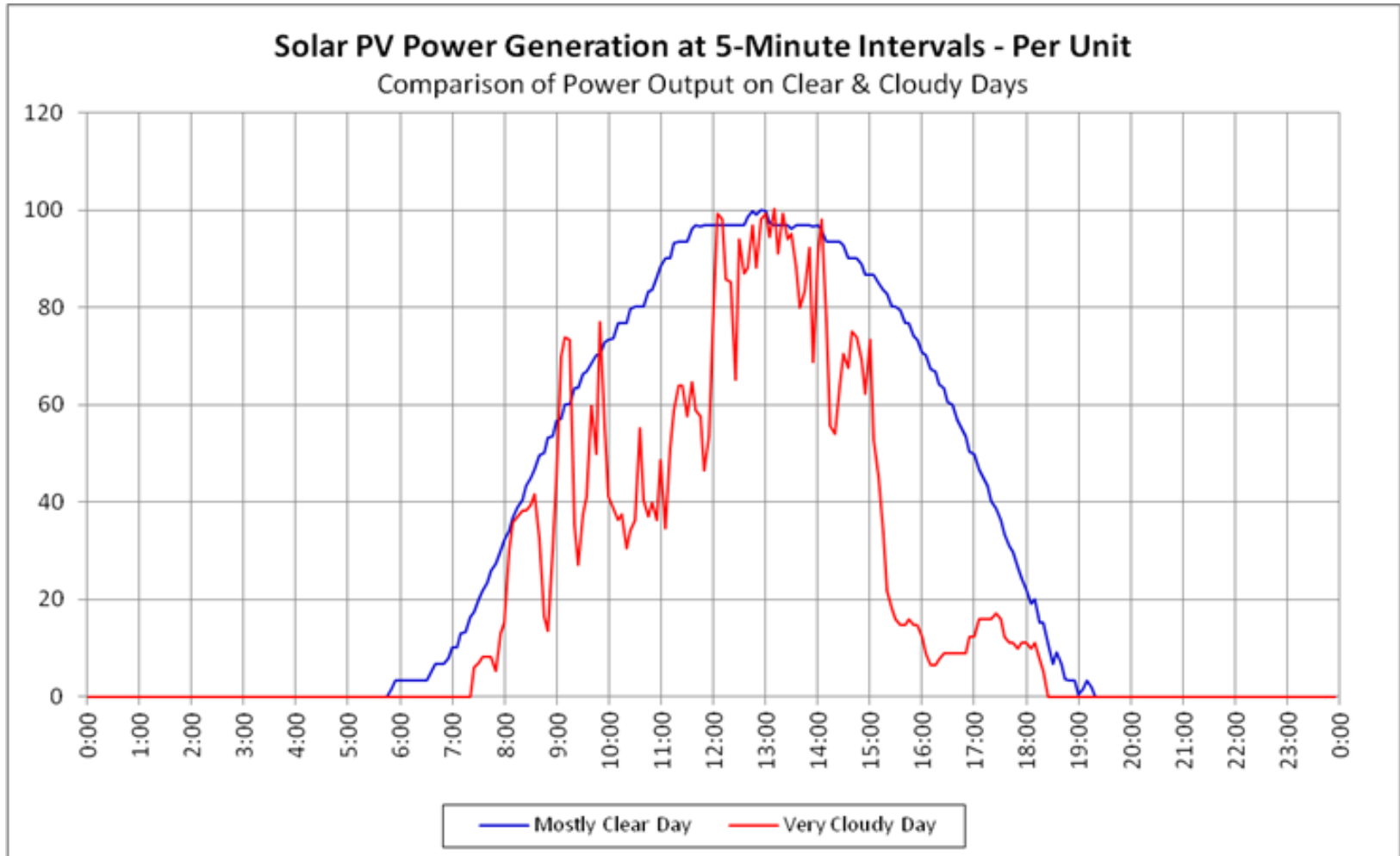
- 310 MW Solar generation (behind-the-meter) on system as of December 2014
- NY-Sun Initiative: 3000 MW by 2024*
- NY-Sun Initiative will change load shape as well as reduce system loads
- Solar variability effects will increase and can, in conjunction with wind variability, affect system operations, reliability, and planning

* Potential for additional large scale solar projects

3,000 MW of Solar PV by 2024 Will Have an Impact on System Planning & Operations



Volatility of Solar PV May Affect Real-Time Operations for Load Following and Regulation



- ◆ **Task 1 – Forecast incremental installed PV**
 - ***Prepare 15 year forecast of solar PV MW by zone***
 - **Short term (i.e. daily and real time) - Develop PV load shapes for 2019 @ 1500 MW, 2024 @3000 MW and 2030 @4500 and 9000 MW**
 - **Long term (e.g. monthly) for eleven zones in state -**
 - Prepare monthly statistics of load, solar generation output, wind output, “net load” variation, etc.
 - Prepare high resolution plots of load, PV, wind, and “net load” for typical days per season
 - Estimate standard deviation in expected solar and wind resources, and “net load”
 - ***Evaluate forecast accuracy of solar irradiance and behind-the-meter generation over the next six months***

- ◆ **Task 2 – Research recent experience and studies**
 - *Evaluate the solar integration experiences in California, PJM, Hawaii, Germany, Italy and elsewhere, and review recent research papers by national labs*
 - *Compare capacity and energy factors and contribution at different times of day/locations*
 - *Evaluate performance during disturbances, including low voltage ride-through*
 - *Document PV interconnection, metering and communication requirements in other states*

- ◆ **Task 3 –“Net Load,” Wind and Solar Variabilities**
 - *Use a backcast of historic solar irradiance to determine solar generation variability on a spatial and temporal basis*
 - *Prepare “net load” variation with different levels of wind and solar, such that updated regulation requirements can be established*
 - **“Net load” profiles at wind generation levels of 2500, 3500, and 4500 MW coinciding with PV output at 1500, 3000, 4500 , and 9000 MW levels**
 - **For 2030 consider 4500 MW of total wind either with or without 1000 MW of offshore wind**
 - **Up to 9000 MW of solar by 2030 to include both behind-the-meter and in front-of-the-meter PV**

Task 3 – (Cont’d)

List of Scenarios to be Studied

Scenario	Load Year	Wind (MW)	Solar (MW)
Scenario 1	2019	2,500	1,500
Scenario 2	2024	3,500	3,000
Scenario 3A	2030	4,500	4,500
Scenario 3B	2030	3,500 1,000*	4,500
Scenario 3C	2030	4,500	9,000
Scenario 3D	2030	3,500 1,000*	9,000

* designates off-shore wind

- ◆ **Task 4 – Operational impacts at various levels of PV and Wind MW**
 - ***Specific Outputs to include:***
 - **Provide the NYISO’s regulation requirements for four levels of solar penetration, combined with the three increased levels of wind generation.**
 - **CPS1, BAL-001-2 and ACE impacts**
 - **Potential system impacts due to voltage and frequency ride-through effects**
 - **New state standards for PV interconnections may be needed**

◆ Task 4 – (Cont'd)

■ *Current regulation requirements*

- Up to 3500 MW of wind capacity, hourly regulation requirements range from 150 MW to 275 MW, depending on season
- Up to 4250 MW of wind capacity, hourly regulation requirements range from 175 MW to 300 MW, depending on season

■ *Update regulation requirements for the six scenarios of wind and solar*

◆ Task 5 – Report Development

■ *Draft report in November*

The New York Independent System Operator (NYISO) is a not-for-profit corporation responsible for operating the state's bulk electricity grid, administering New York's competitive wholesale electricity markets, conducting comprehensive long-term planning for the state's electric power system, and advancing the technological infrastructure of the electric system serving the Empire State.



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