



Learning from the Experts Webinar Series

How Converter Stations and Substations Support Offshore Wind



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Director, Transmission Project Development
Con Edison

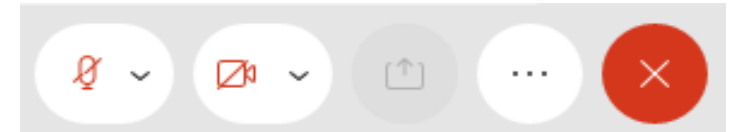
March 20, 2024

Meeting Procedures

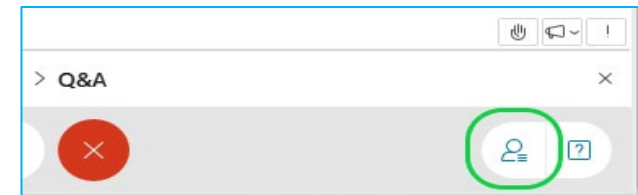
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Participation for Members of the Public:

- > Members of the public will be muted upon entry.
- > Questions and comments may be submitted in writing through the Q&A feature at any time during the event. Please submit to **All Panelists**.
- > If technical problems arise, please contact Sal.Graven@nyserda.ny.gov



You'll see  when your microphone is muted



Learning from the Experts

This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

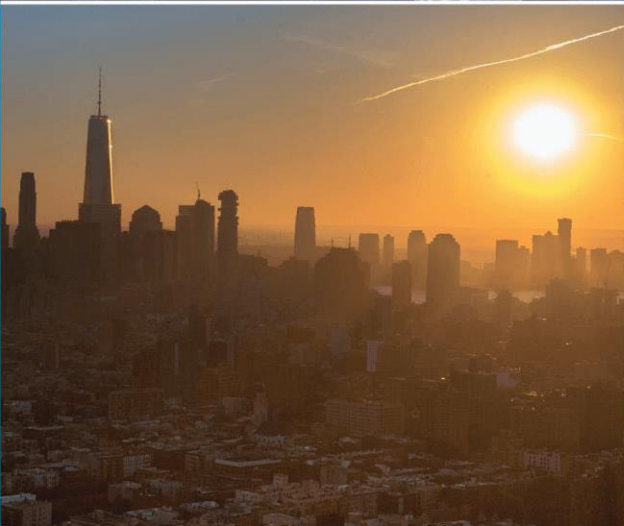
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NYSERDA





Consolidated Edison Company of New York

NYSERDA Webinar Series

Converter and Substations Support OSW

March 20, 2024

Agenda



Con Edison and our Clean Energy Commitment



Electric Transmission Overview



Offshore Wind Injection



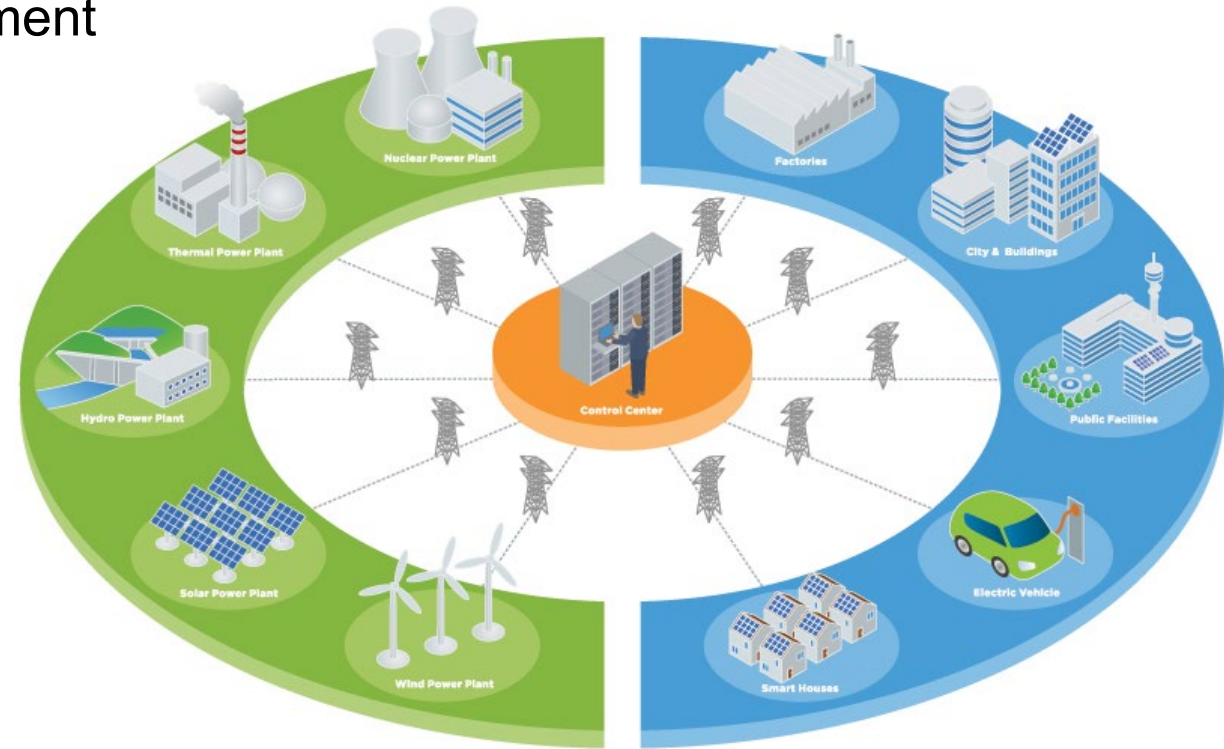
Final Grid Connection



Takeaways



Questions & Answers

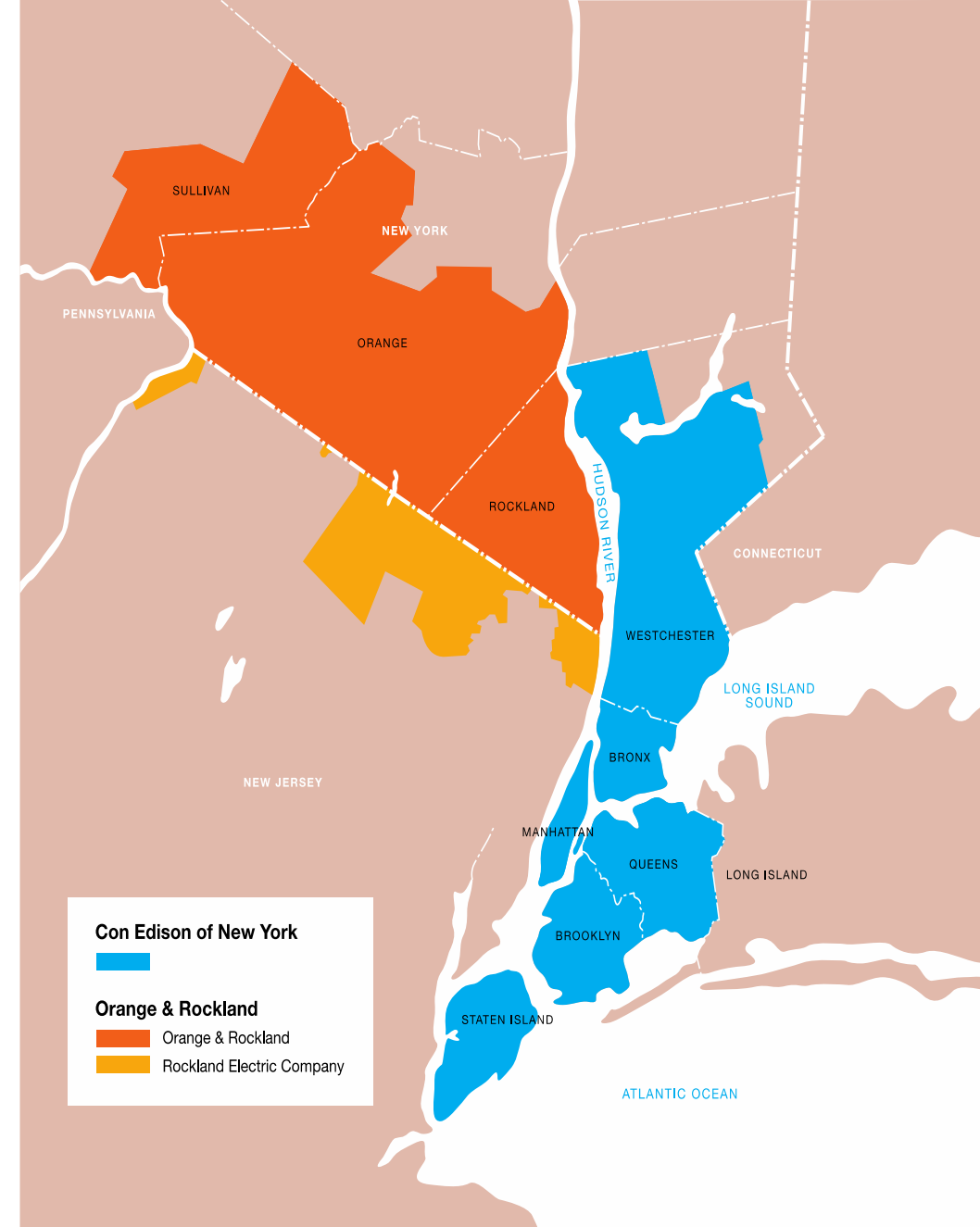




Con Edison and our Clean Energy Commitment

We Deliver Electricity, Gas, and Steam to 10 Million People

- 1,960 square miles (660 / 1300)
- 3.6 million customers
 - 10 million people
- That's about 44% of New York State's electricity needs
- We provide natural gas to 1.2 million customers
- We operate the largest steam distribution system in the U.S.



Con Edison Introduction

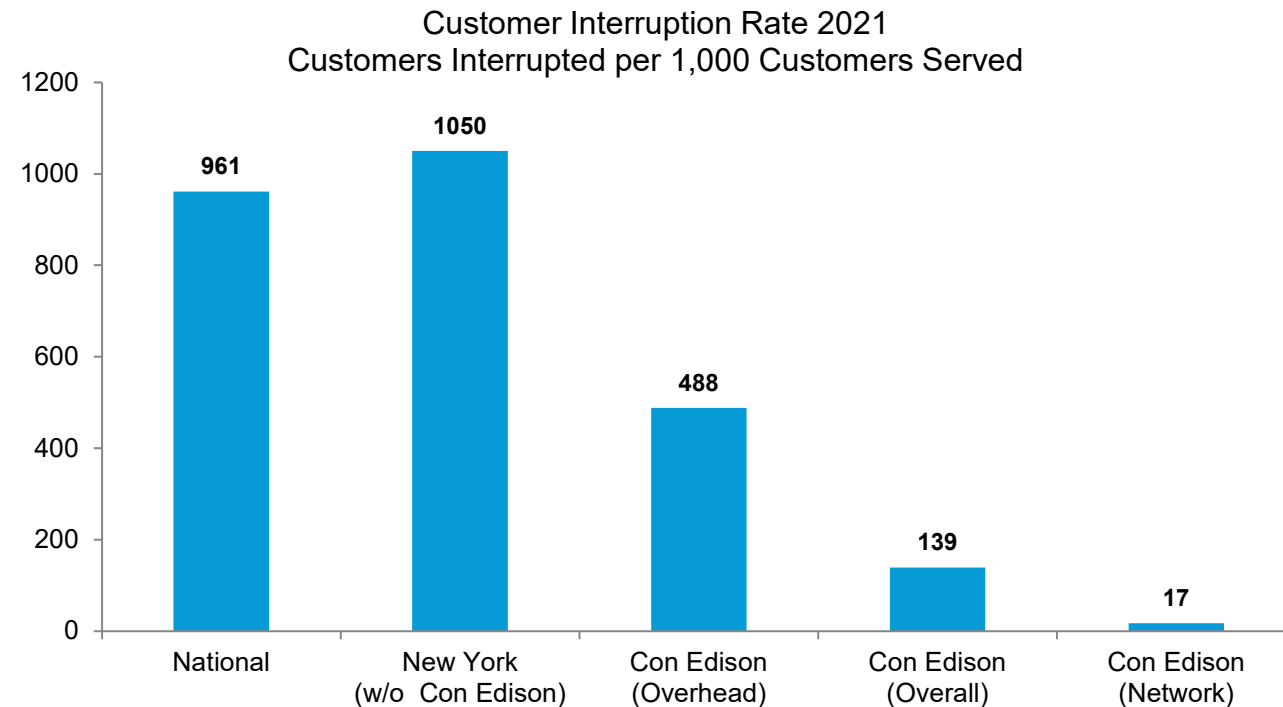
Electric System Density

- Distribution
 - 37,500 miles of overhead
 - 98,500 miles of underground
- Transmission
 - 570 miles of overhead
 - **760 miles of underground**
- 40 Transmission Substations
- 63 Area Substations



We Provide the Most Reliable Electric Service in the U.S.

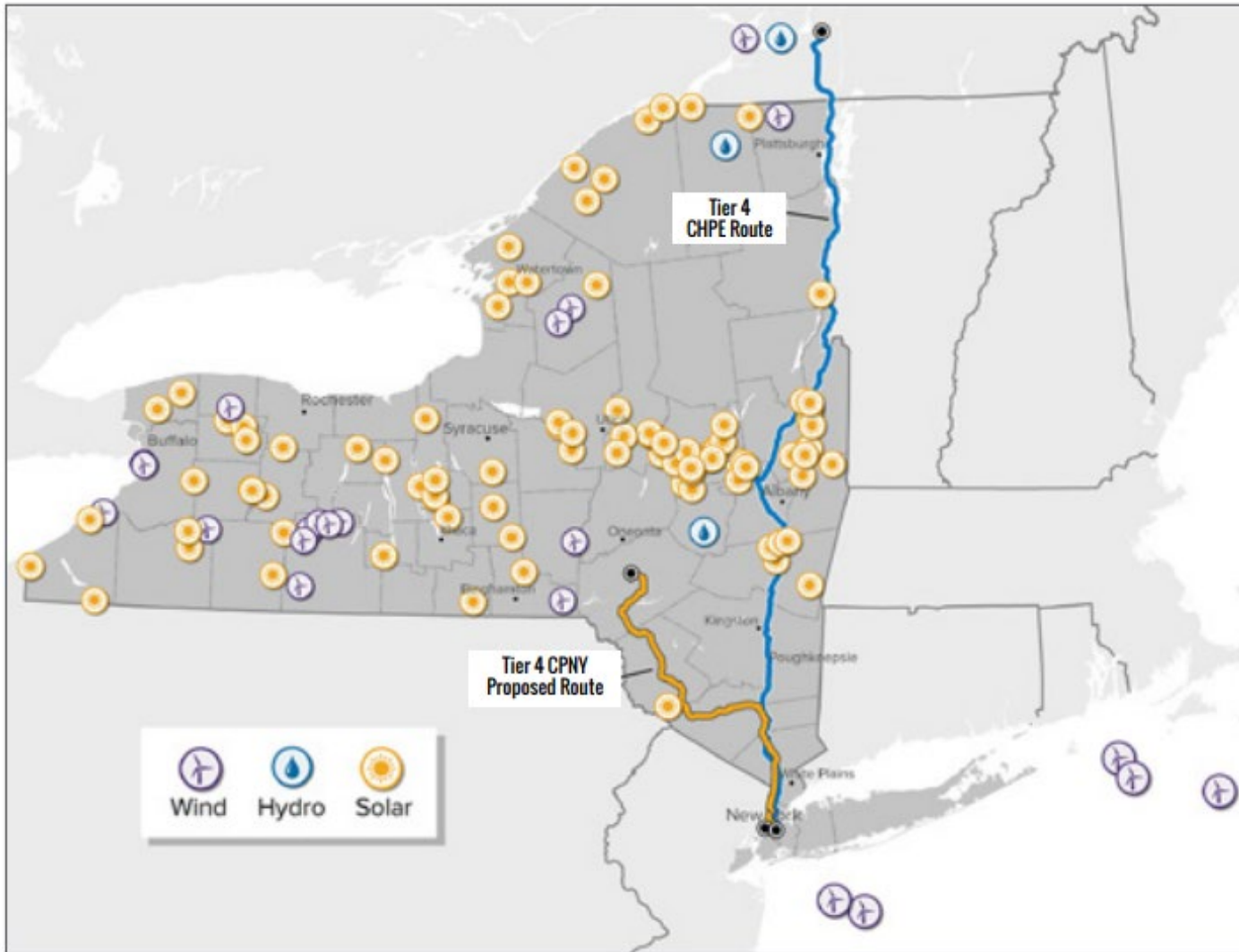
Our system reliability exceeds national and New York averages.



National and New York (without Con Edison) numbers from 2020

Con Edison's electric system is comprised of an overhead system as well as the largest underground network in the U.S.

Clean Energy Transition in New York



Source: NYSERDA's Strategic Plan

New York's Clean Energy Vision

- ☀️
2025
 - NYS:** 6 GW of private solar
 - NYC:** 500 MW of energy storage

- ☘️
2030
 - NYS:** 40% reduction in greenhouse gas emissions (from 1990 levels)
 - NYS:** 70% of electricity from renewable generation
 - NYS:** 3 GW of energy storage
 - NYS:** 10 GW of private solar

- 🚗
2035
 - NYS:** 9 GW offshore wind
 - NYC:** City-owned vehicles to be electric models (passenger and light, medium and non-emergency vehicles)
 - NYS:** All new passenger vehicles and trucks sold in New York will be zero-emissions models

- 🔌
2040
 - NYS:** 100% zero-emissions electricity

- 🌿
2050
 - NYS:** 85% reduction in greenhouse gas emissions (from 1990 levels)

Our Clean Energy Commitment: 5 Pillars



Build the grid of the future



Empower all our customers to meet their climate goals



Reimagine the gas system



Lead by reducing our company's carbon footprint



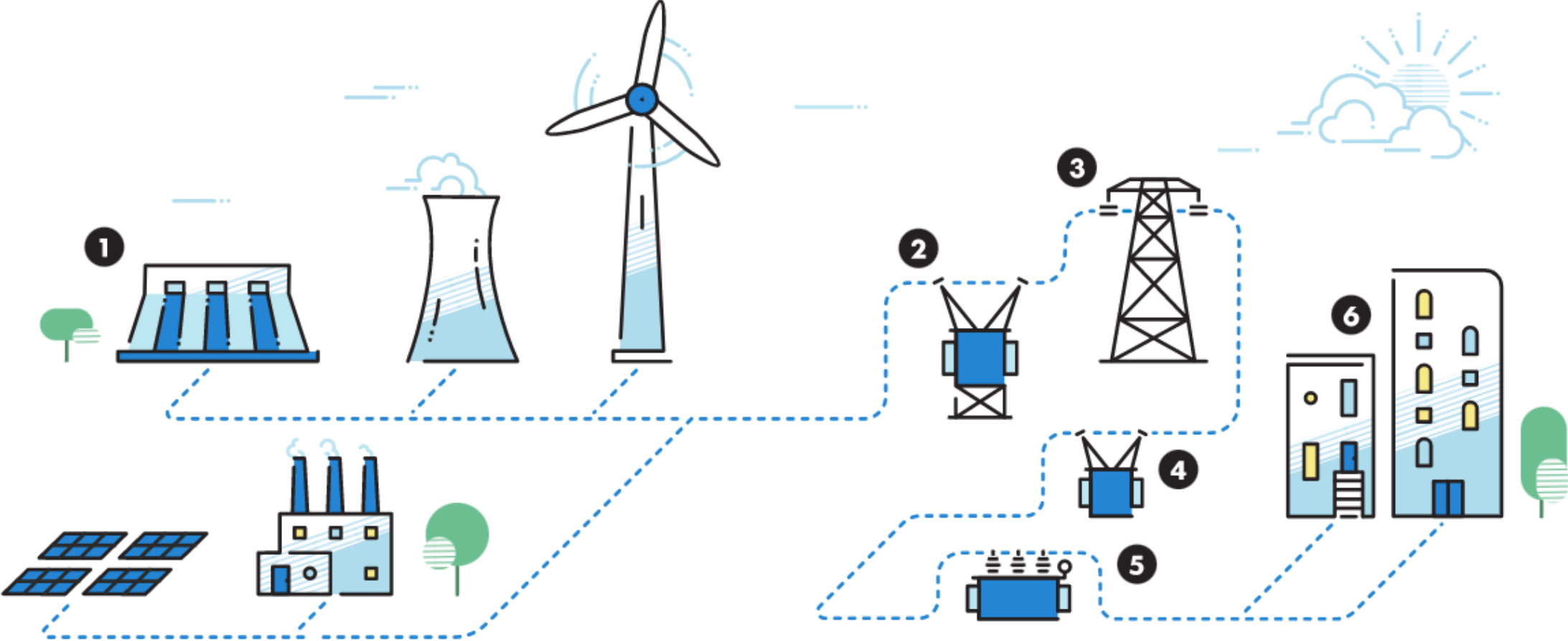
Partner with our stakeholders



Electric Transmission Overview

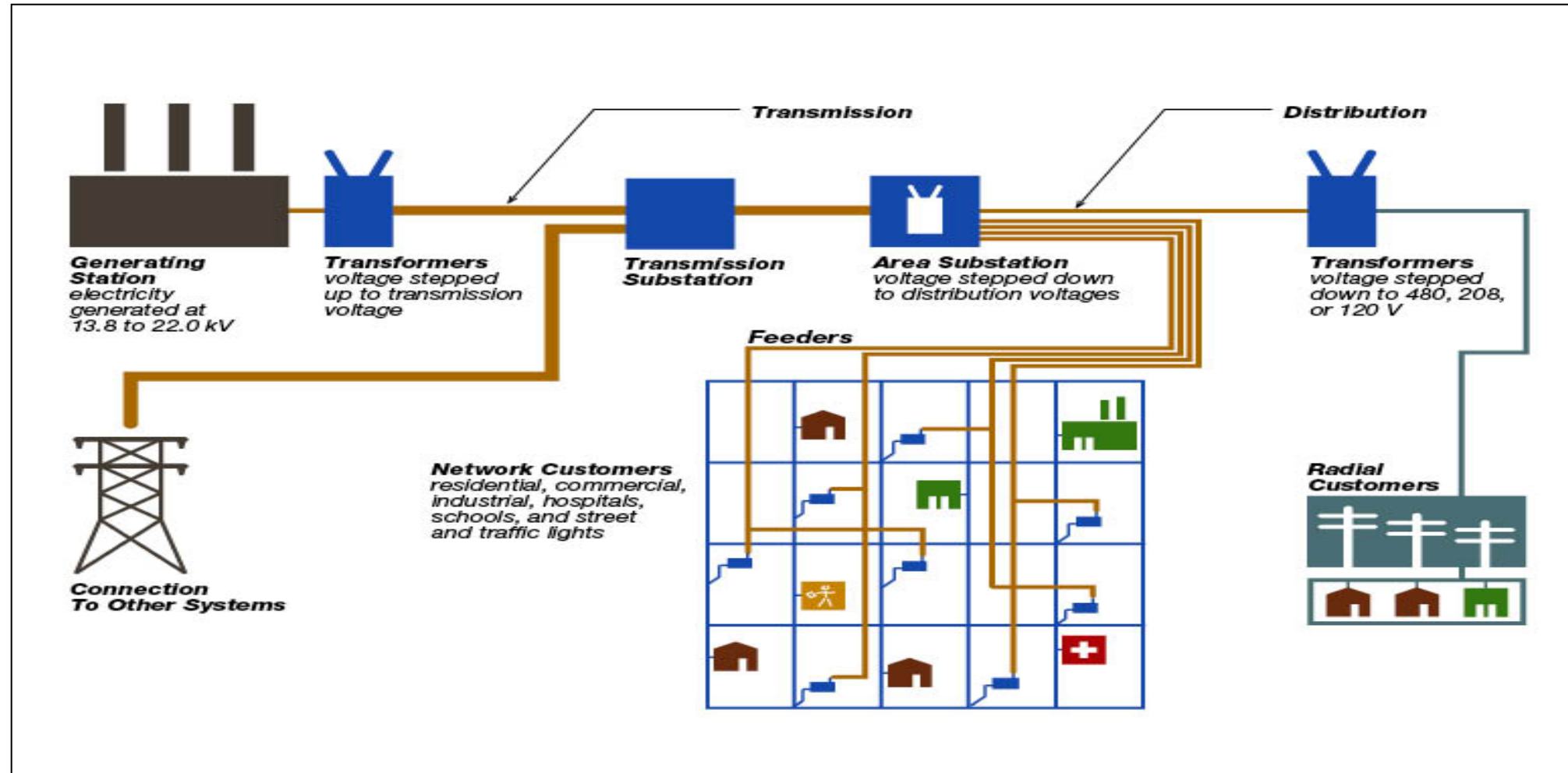
Con Edison Introduction

Electric System Overview



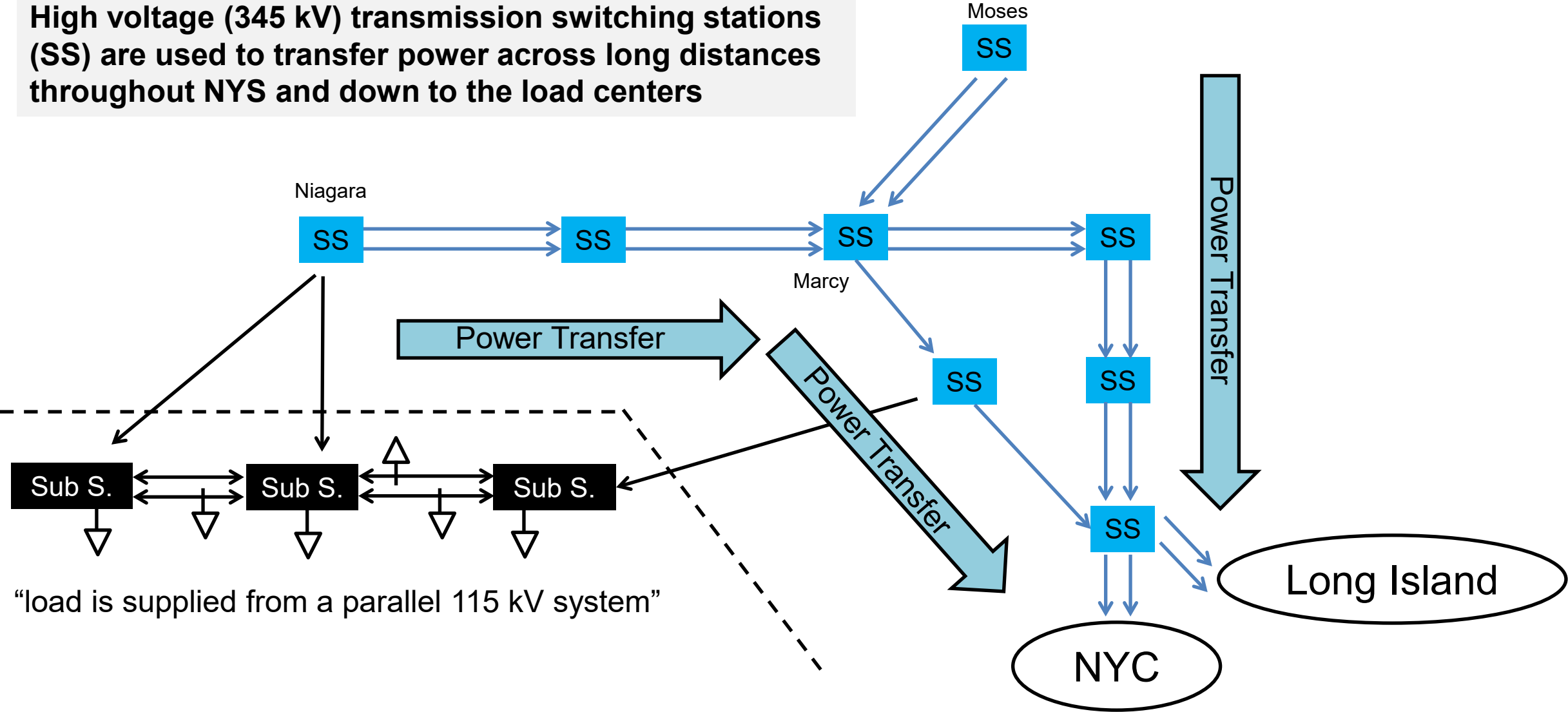
Con Edison Introduction

Electric System Overview



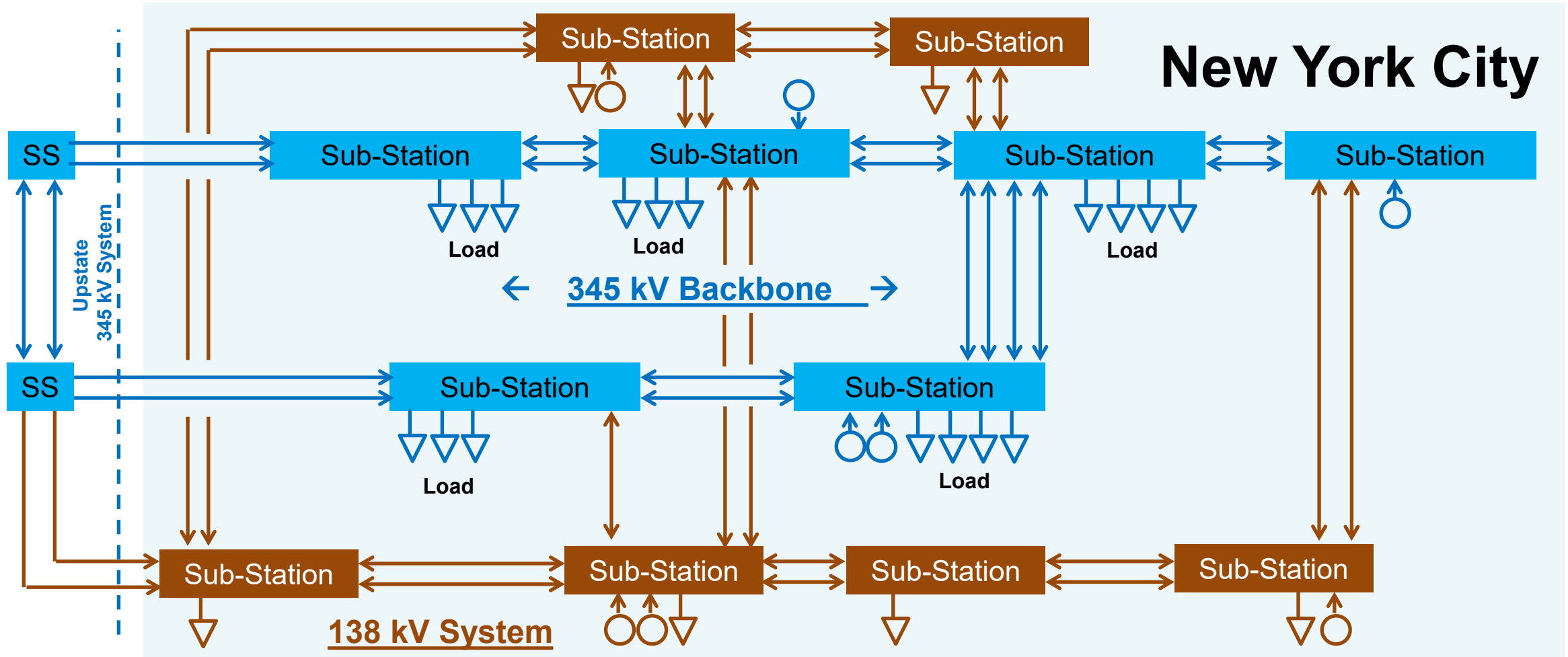
Upstate 345 kV Collects and Transfers Energy to Load

High voltage (345 kV) transmission switching stations (SS) are used to transfer power across long distances throughout NYS and down to the load centers



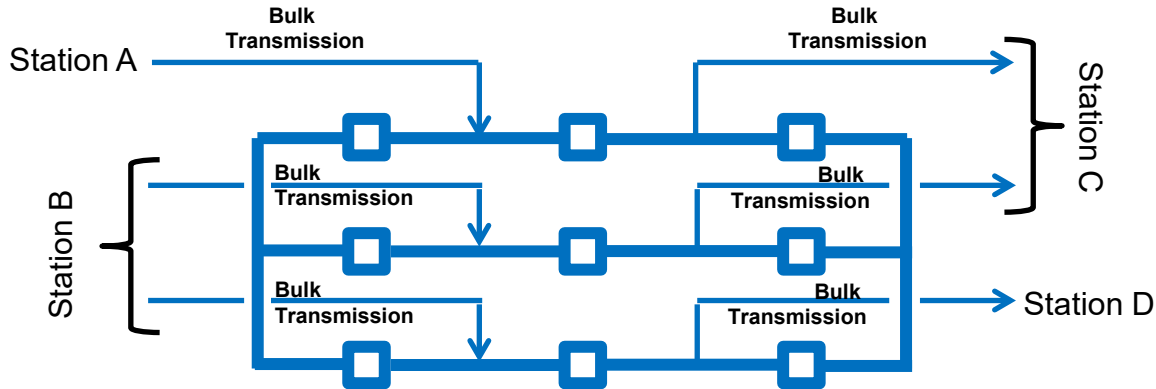
NYC 345 kV Supplies Load

In contrast, High voltage (345 kV) transmission sub-stations are multi-purpose in the densely populated / small geographic area of NYC

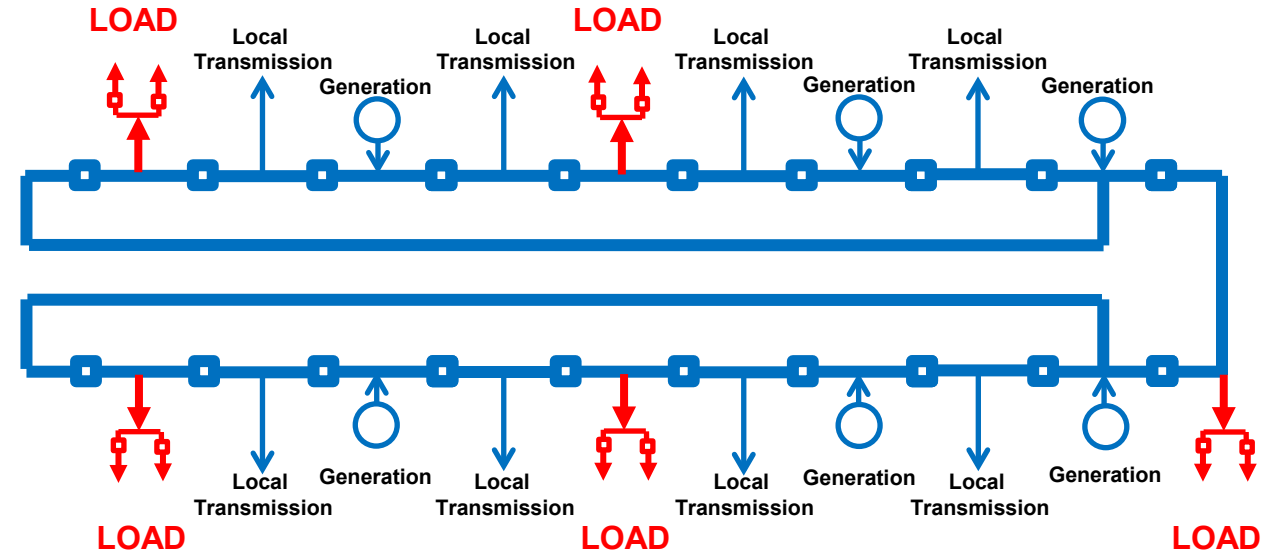


Switching Station vs. Substation

Upstate 345 kV Switching Stations serve different purposes than NYC 345 kV Substations



- “Upstate 345 kV system”
 - Typical 345 kV switching station ties together two or more electric circuits through switches for the purpose of power transfer



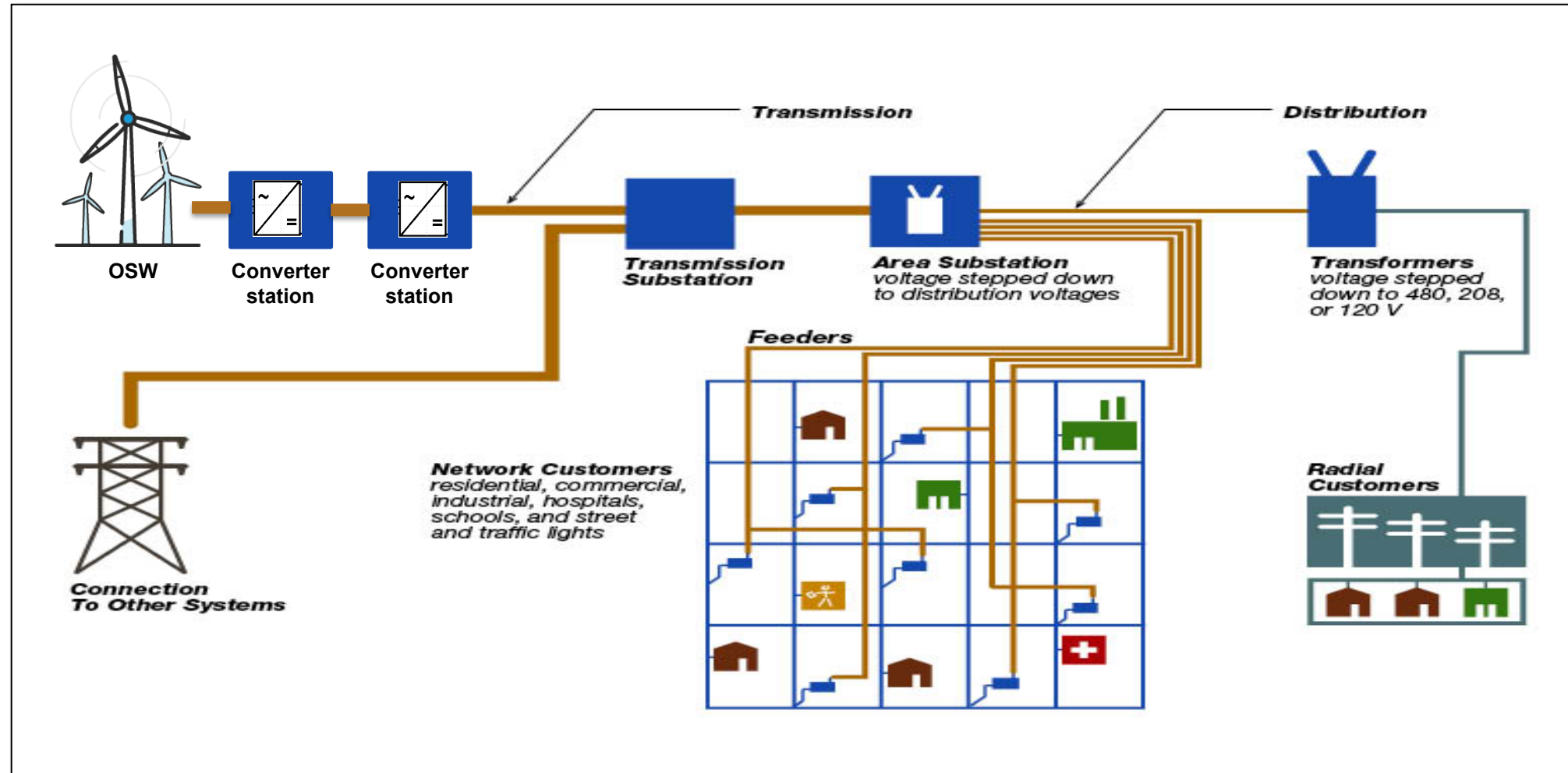
- “NYC 345 kV System”
 - Typical 345 kV substation supplies load, ties in generation, and connects to other local load-serving substations



Offshore Wind Injection

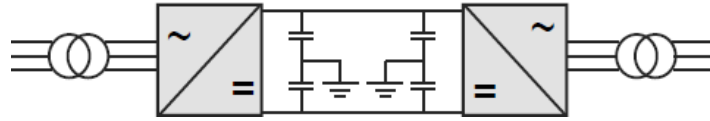
Offshore Wind Injection

Electric System Transformation



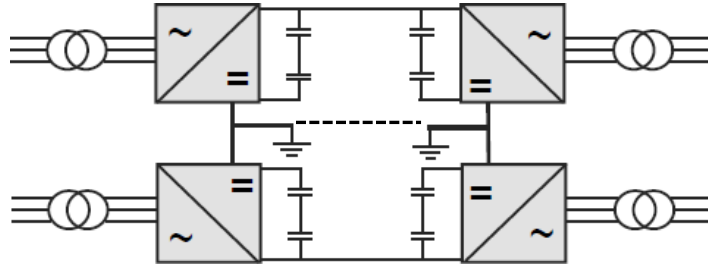
Offshore Wind Injection

Common HVDC Configuration



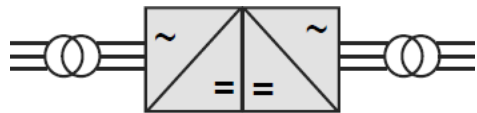
- **SYMMETRICAL MONOPOLE**

- Common rating: 1000-1500 MW
- Site Req: ~350 x 500 ft (4-5 acres)
- Common DC voltage: 320 – 400 kV

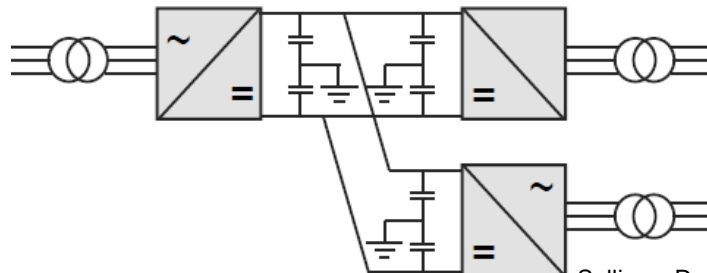


- **BIPOLE**

- Common rating: 2000-3400 MW
- Site Req: ~675 x 850 ft (10-12 acres)
- Common DC voltage: 525 – 625 kV



- **BACK-TO-BACK / 100-1500 MW**

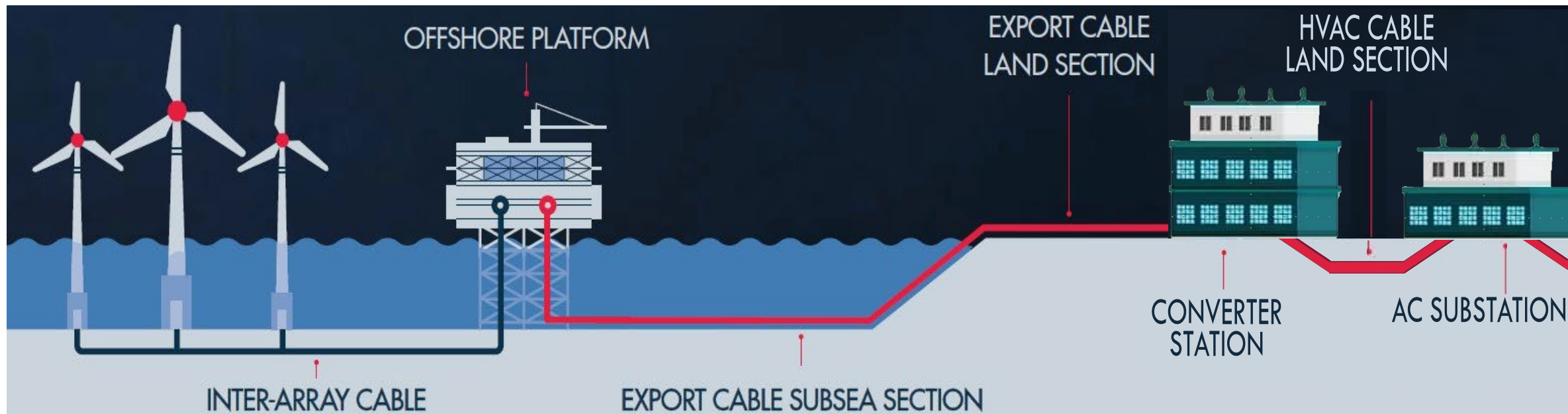


- **MULTI-TERMINAL**

Sullivan, D., & Schaerer, R. (2024, March 6). *HVDC Project Development and Recent Trends* [Powerpoint HVDC Project Development and Recent Trends].

Offshore Wind Injection

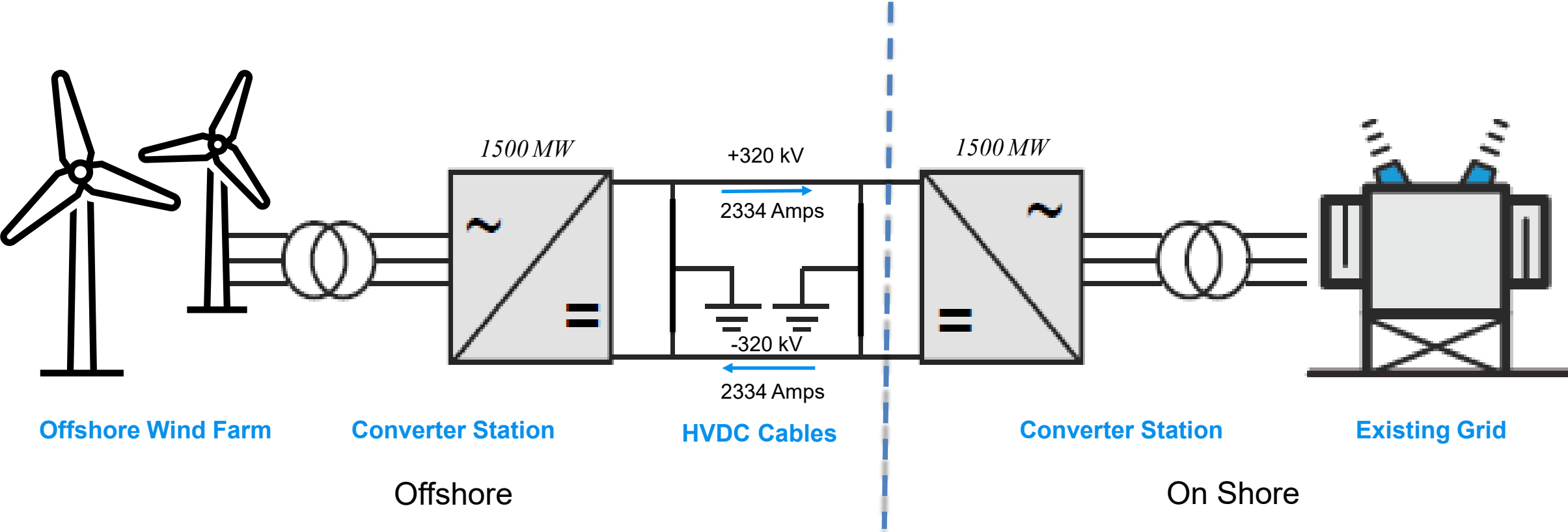
OSW Circuit Overview



Modified from Martin-Lauzer, E. (2023, September 21). *Subsea cables for the US OSW Industry* [Powerpoint *Subsea cables for the US OSW Industry*].

Offshore Wind Injection

Symmetric Monopole



Offshore Wind Injection

On Shore HVDC Converter Station

- Site Requirements: 4-5 acres
- Installed Cost: ~\$600M*
- Schedule: 4 to 7 years*



(Champlain Hudson Power Express Celebrates Start of Construction on Converter Station; Announces First Funding Recipients for Green Jobs Training Fund, n.d.)

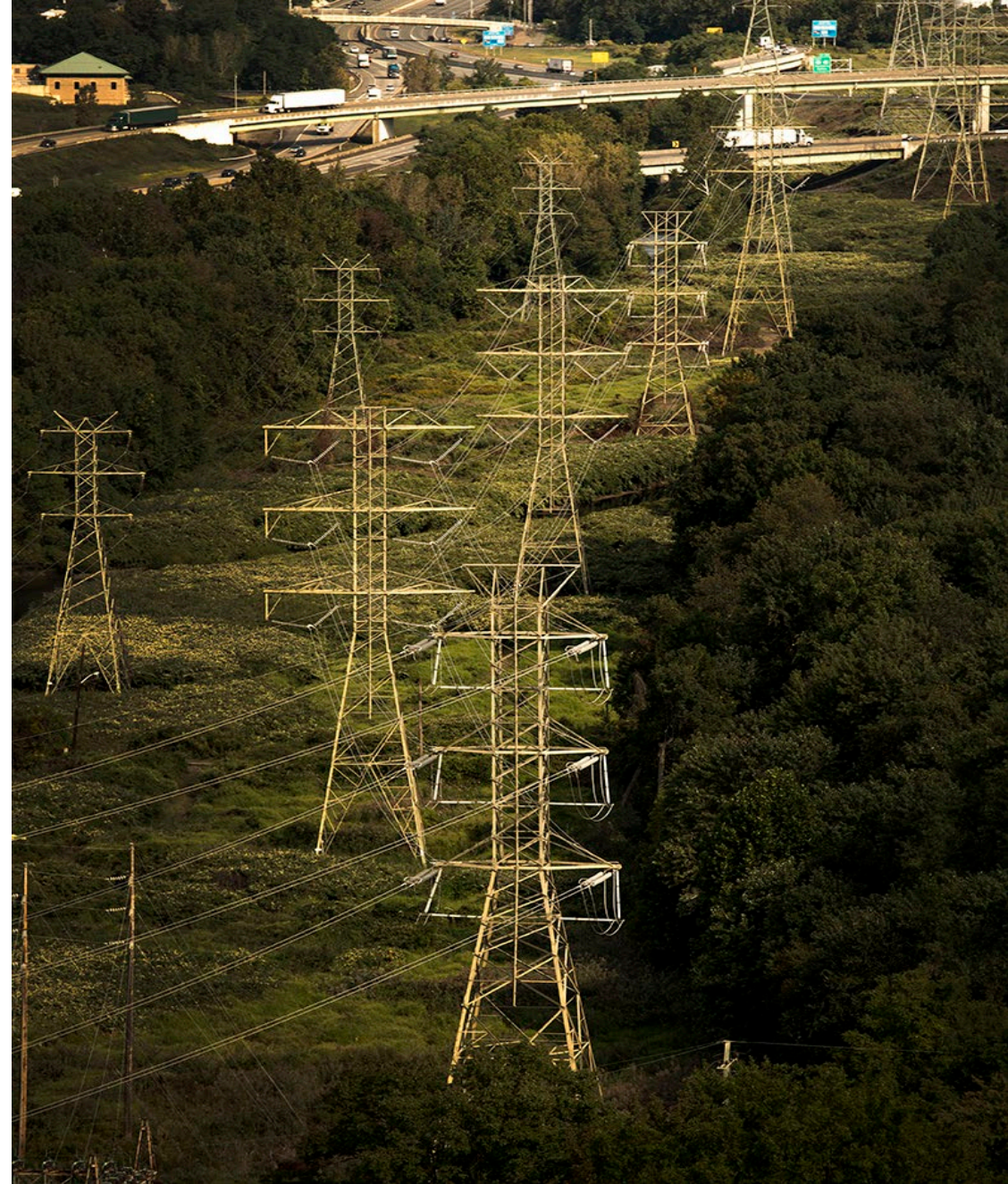


Final Grid Connection

Final Connection to Grid

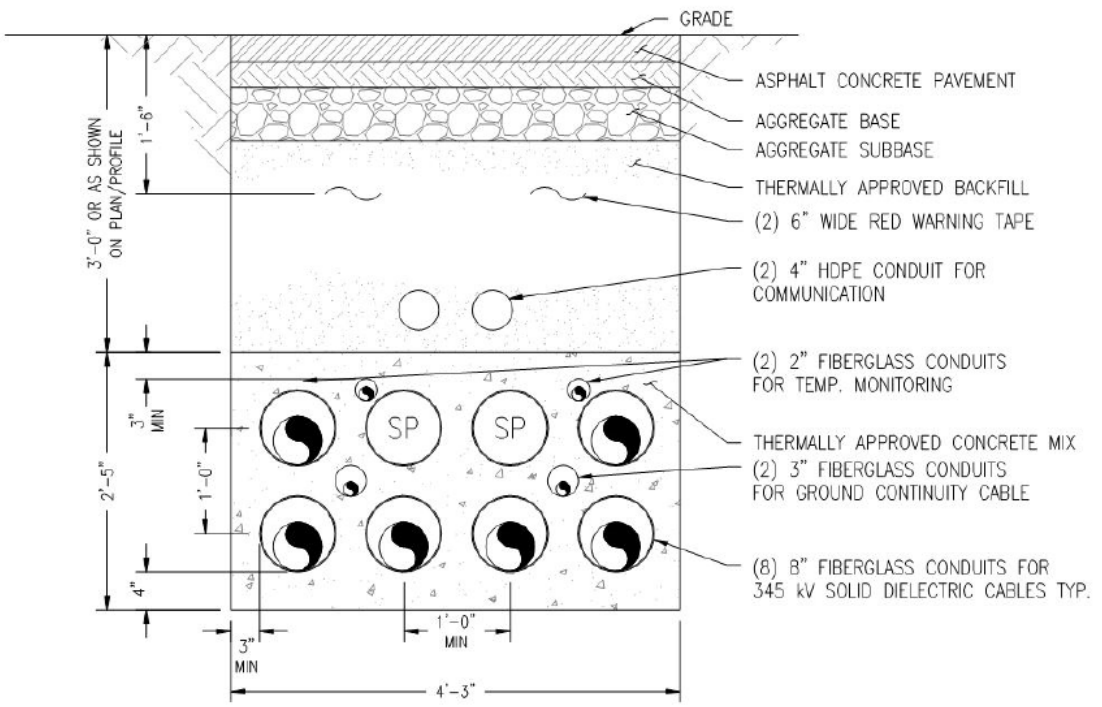
Bulk Transmission System

- Existing Grid Predominately Overhead
 - NERC: 522,922 circuit miles
- Transfer Capability (345kV):
 - Overhead: ~1,200MW
 - Underground: ~700MW*
- Underground cables are more expensive compared to equivalent overhead lines



Final Connection to Grid

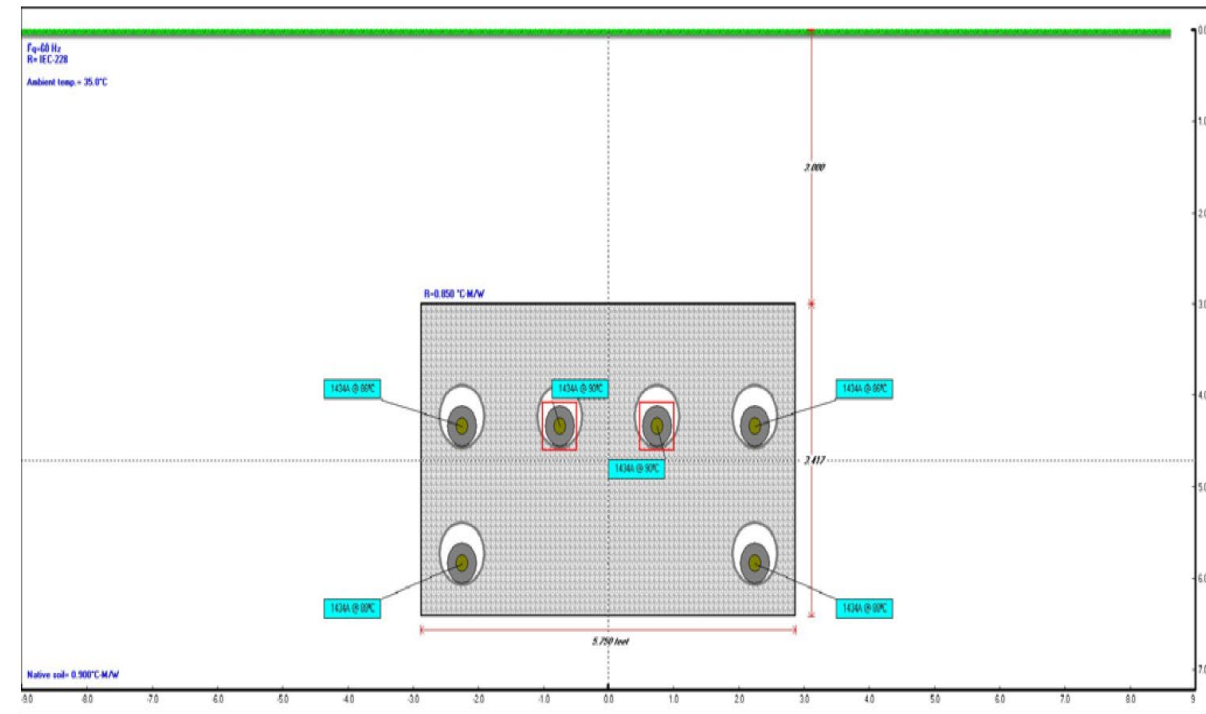
Dense City Centers



Final Connection to Grid

Underground Design Consideration

- Adequate heat dissipation to prevent overheating and reduction in feeder rating.
- Circuit design to prevent the feeder from being harmed and to keep it from posing a hazard to the public.
- Proper access for maintaining the feeders.



Final Connection to Grid

Required Infrastructure

- Multiple AC feeders will be needed from each converter station to Grid substation.
- Existing infrastructure and environmental conditions will impact feeder ratings.
- On land coordination will be as important as offshore cable corridors.
- Upgrades at existing substations will be required to interconnect Offshore Wind.





Takeaways

Transition to Electrification

- World-class reliability is critical today for a region dominated by high rise buildings and electric public transport.
- Maintaining this reliability is crucial as we move to electrifying vehicular transportation and heating.
- Transition to our Clean Energy Future will require thoughtful collaboration to ensure safe and timely completion.





Questions



Consolidated Edison Company of New York

NYSERDA Webinar Series

Converter and Substations Support OSW

March 20, 2024

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Tufts University and Delft University

May 29, 1:00 p.m. ET

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National Offshore Wind Research
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