

What is a Microgrid?

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CIGRÉ C6.22 Working Group, U.S. DOE, & NYSERDA Microgrid Definitions

Conseil international des grandes réseaux électriques (CIGRÉ)

Microgrids are electricity distribution systems containing loads and distributed energy resources, (such as distributed generators, storage devices, or controllable loads) that can be operated in a controlled, coordinated way either while connected to the main power network or while islanded.

U.S. Department of Energy Microgrid Exchange Group

A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

New York State Energy Research and Development Authority (NYSERDA)

Microgrids are local energy networks that are able to separate from the larger electrical grid during extreme weather events or emergencies, providing power to individual customers and crucial public services such as hospitals, first responders, and water treatment facilities.

Definitions of Reliability & Resilience

* **Reliability** focuses on the statistical expectation of power availability during routine conditions, typically over a year with short and/or extreme events usually excluded from the calculation.

ASAI = Average Service Availability Index, e.g. 99.9% is “three nines”

SAIDI = System Average Interruption Duration Index, min/a

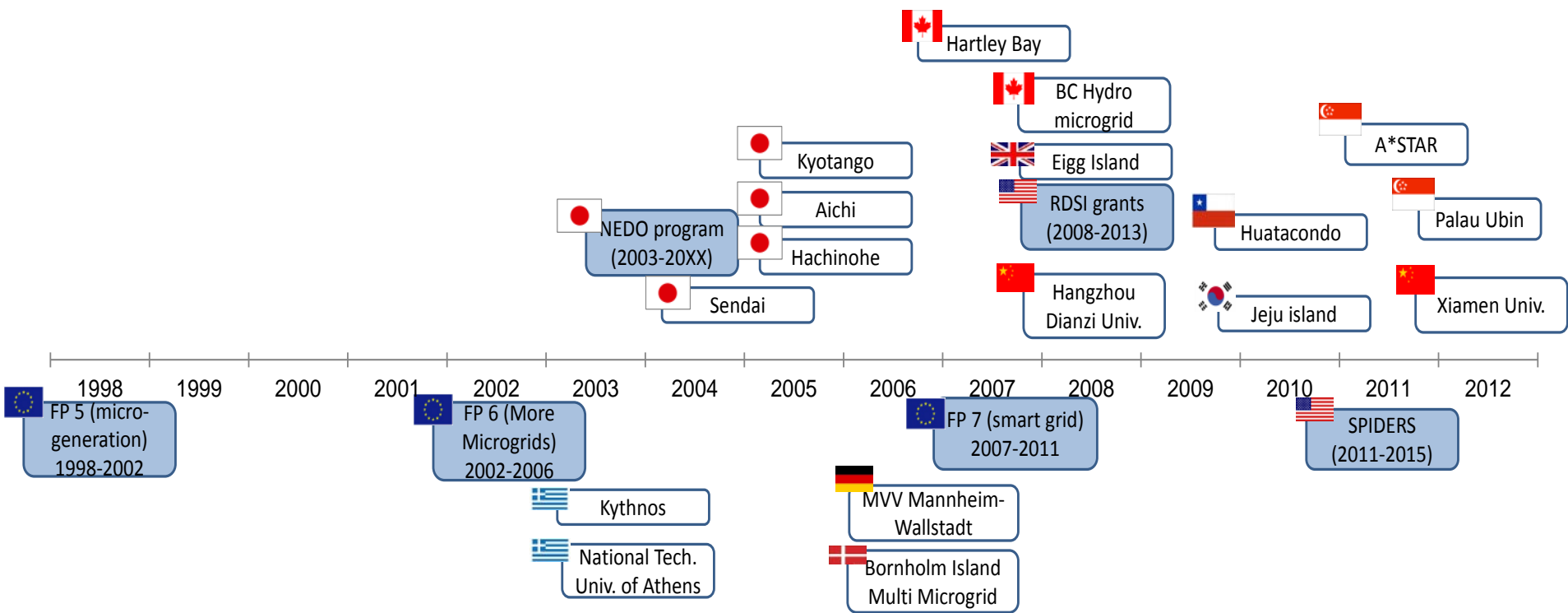
SAIFI = Frequency . . . , prob. of even

● **Resilience** is the “... ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.”

U.S. Presidential Policy Directive 21 (The White House, 2013)

History of Microgrid RD&D (Kyoto to Fukushima)

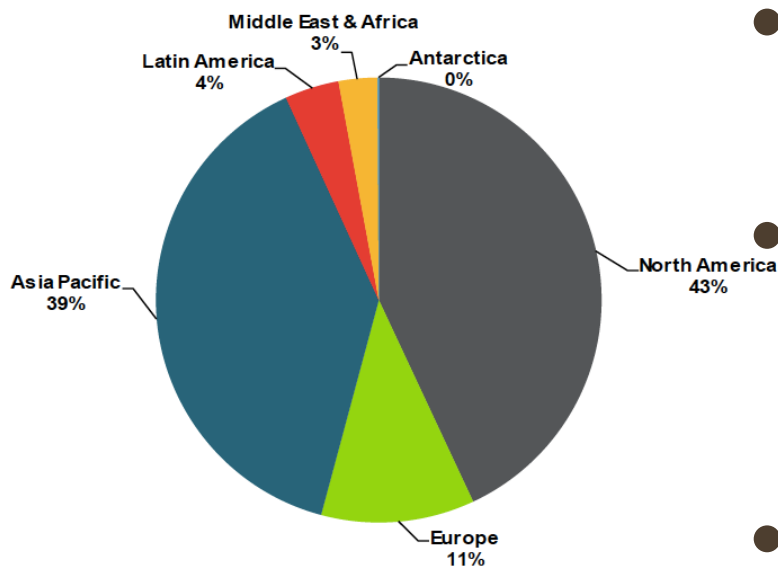
EU → Japan → US (RDSI, SPIDERS) → Asia (China, Korea, Singapore)



Adopter Motivations

(mostly true microgrids i.e. μ grids)

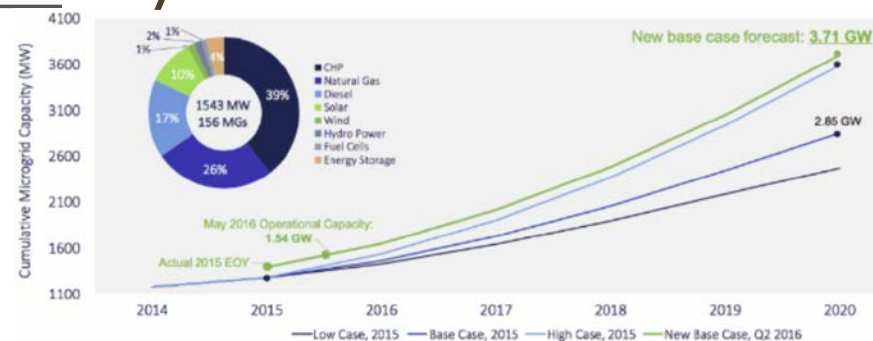
Total Microgrid Power Capacity Market Share by Region, World Markets: 4Q 2016



- reduce direct cost of meeting energy service requirements
- reduce indirect costs (emissions, noise, ...) / (increase renewable fraction)
- reliability & resilience

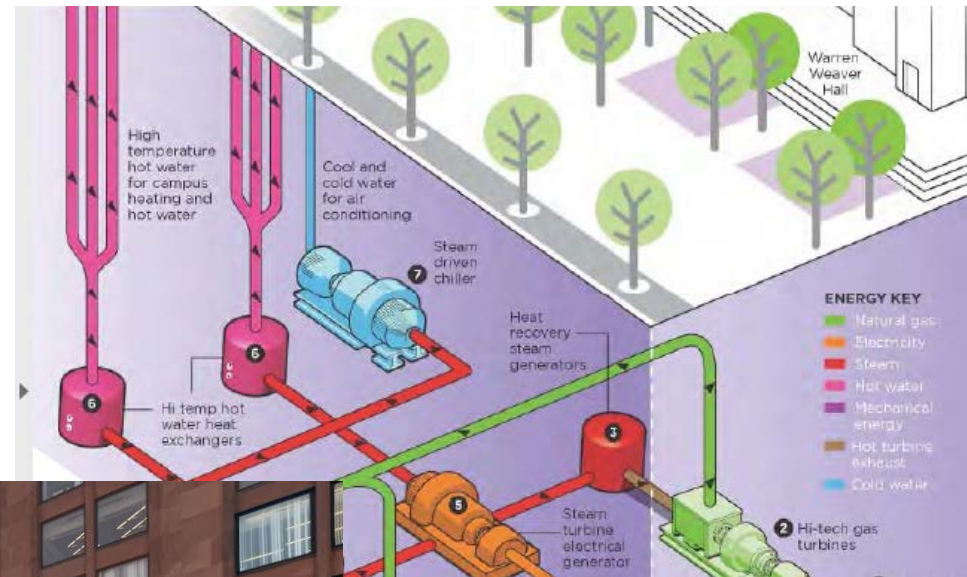
(Source: Navigant Research)

- market opportunities (aggregation, DR, AS,...) "buffering"
- independence & surety



US Microgrid growth beats past estimates; On pace to exceed 3.7 GW by 2020
source: Omar Saadeh

NYU Below Grade Power Station



Tech Hall

Daniel

Photo Sphere - Sep 2015



NY Prize Stage 2 Projects

- **Empire State Plaza:** Times Union Center, city hall, courthouse, & convention ctr.
- **University Heights:** deferral and resilience for multiple civic institutions
- **City of Syracuse:** 39.6 MW waste2energy facility for emergency services & colleges
- **Huntington:** fuel cell, storage, PV, and RNG CHP serving town hall, hospital, etc.
- **Rockville Centre:** municipal with PV and CHP for hospitals, senior center, etc.
- **Village of Freeport:** repowering muni. plant, & solar, wind, fuel cell, CHP, and batteries for telecom, police and fire operations, schools, & customers
- **East Bronx:** CHP upgrade for various medical facilities
- **Clarkson Avenue:** CHP, renewables, fuel cells, batteries, and advanced transmission & distribution technologies for hospital & school
- **Amtrak New York City:** two Manhattan train stations & educational institutions, emergency evacuation capability
- **Binghamton:** CHP, solar, and hydro for city hall, police, fire, & water treatment, plus many other institutions
- **Buffalo Niagara Medical Campus:** CHP and renewables, solar, batteries, alternative fuels, & DR for medical and educational installations

<http://microgridknowledge.com/microgrid-project-list-ny-prize/>

Merci de votre attention!

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