

Storage Solutions for Multi-Stakeholders at Denver's Pena Station

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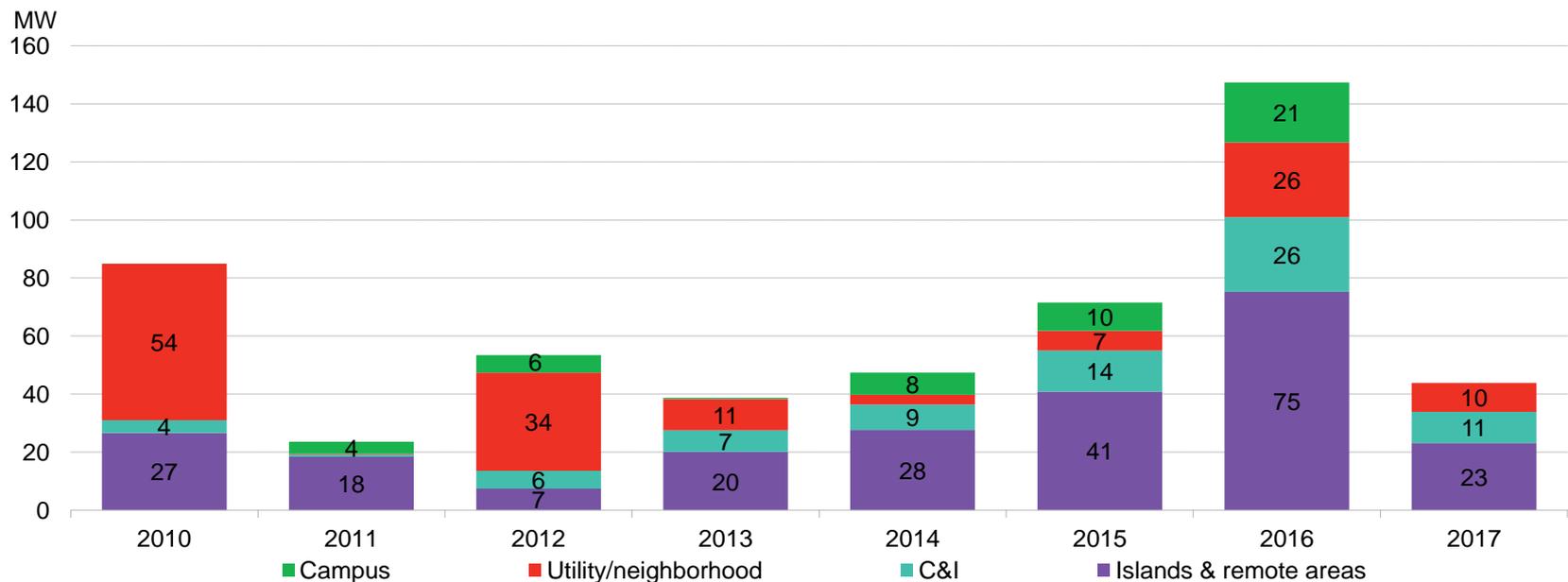


Growth in Microgrids Worldwide

MICROGRID DEPLOYMENT – BY SEGEMENT

- Half of all commissioned microgrids serve islands and remote areas.
- C&I increased every year and is also leading second in the pipeline.
- Islands/remote areas and C&I customers will be the main applications.

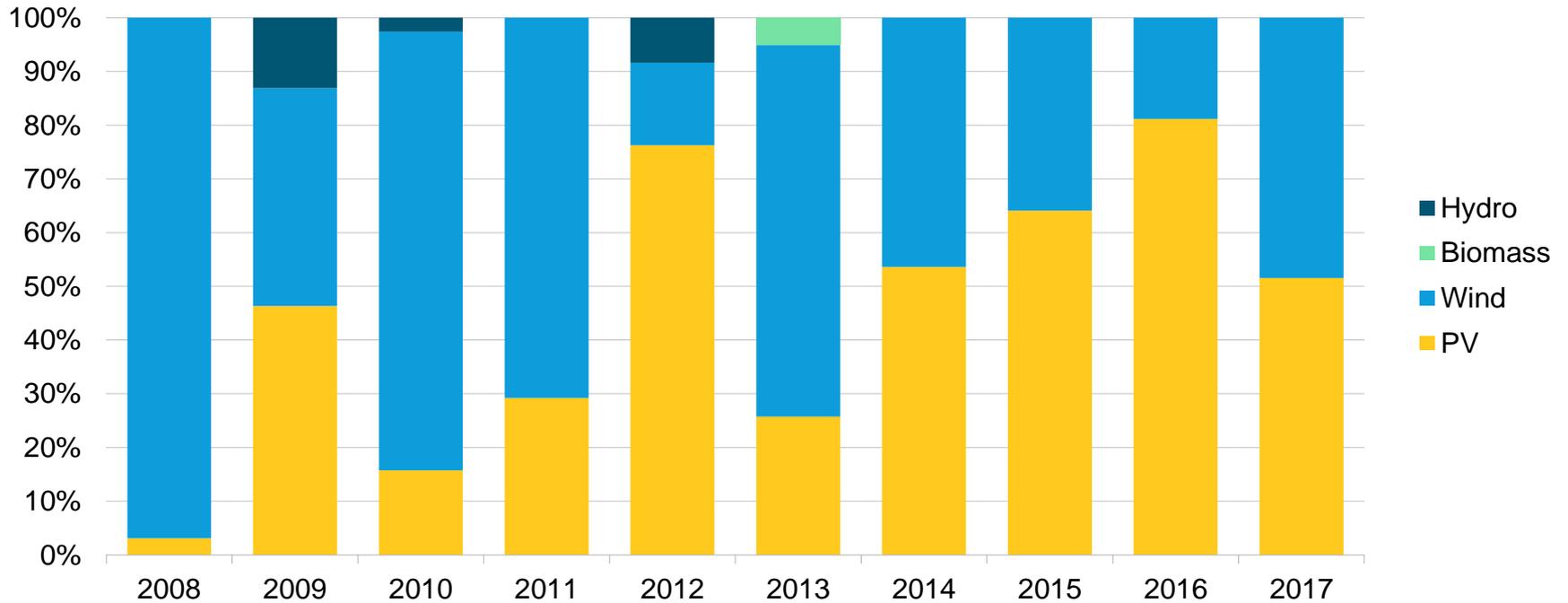
Capacity of commissioned microgrids



BNEF microgrid database

MICROGRID DEPLOYMENTS – BY RES

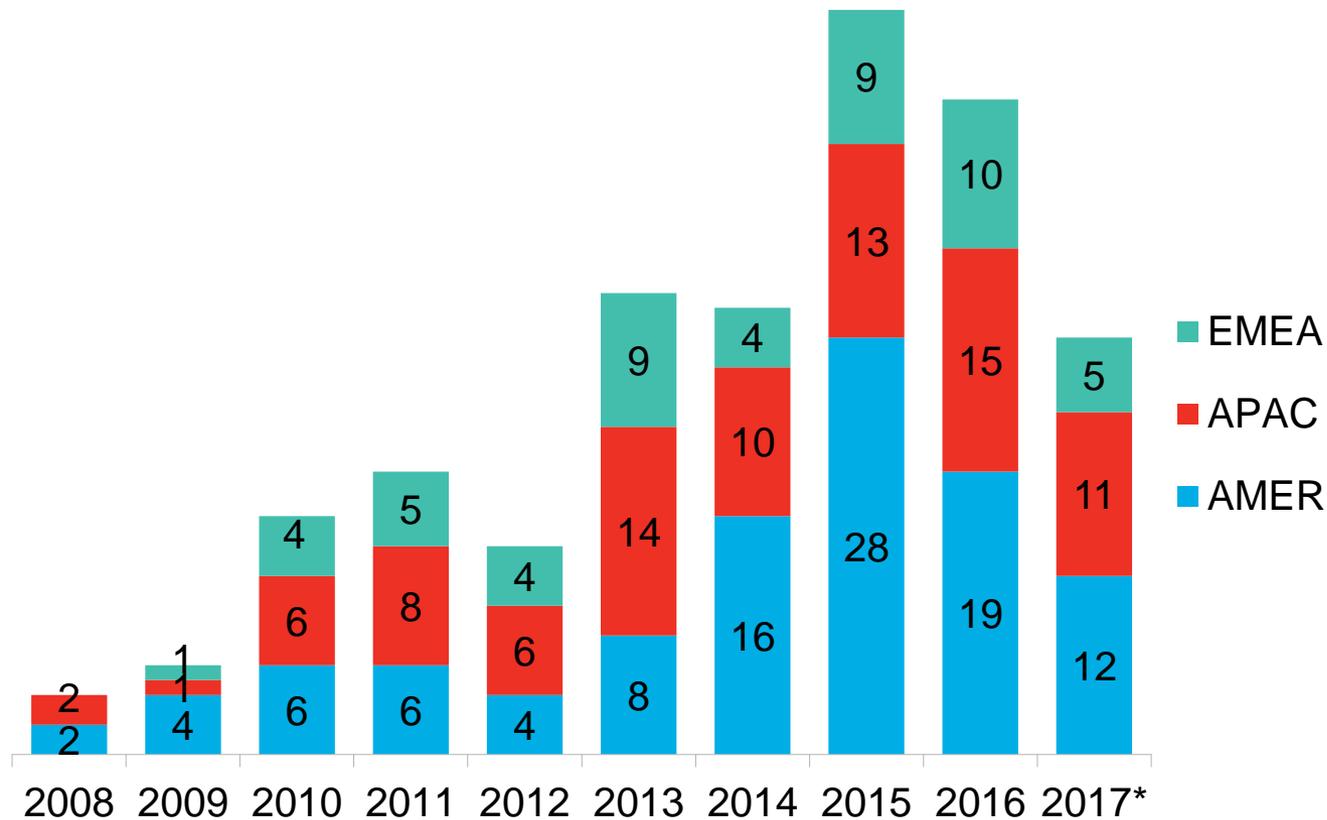
Share of renewables capacity installed



BNEF microgrid database

MICROGRID DEPLOYMENTS – BY REGION

- The **US has the highest amount of commissioned microgrids** which supply industrial and military campuses or work as demonstration projects.
- EMEA has only some island microgrids in Europa, but **Africa and ME have the second largest amount of projects** in the current pipeline.



BNEF microgrid database



What makes up a Microgrid?

WHAT MAKES UP A MICROGRID



Storage

Batteries - balancing services for grid stability, and level out electricity production and demand

Generators

Diesel, Gas, HFO

Renewable Resource

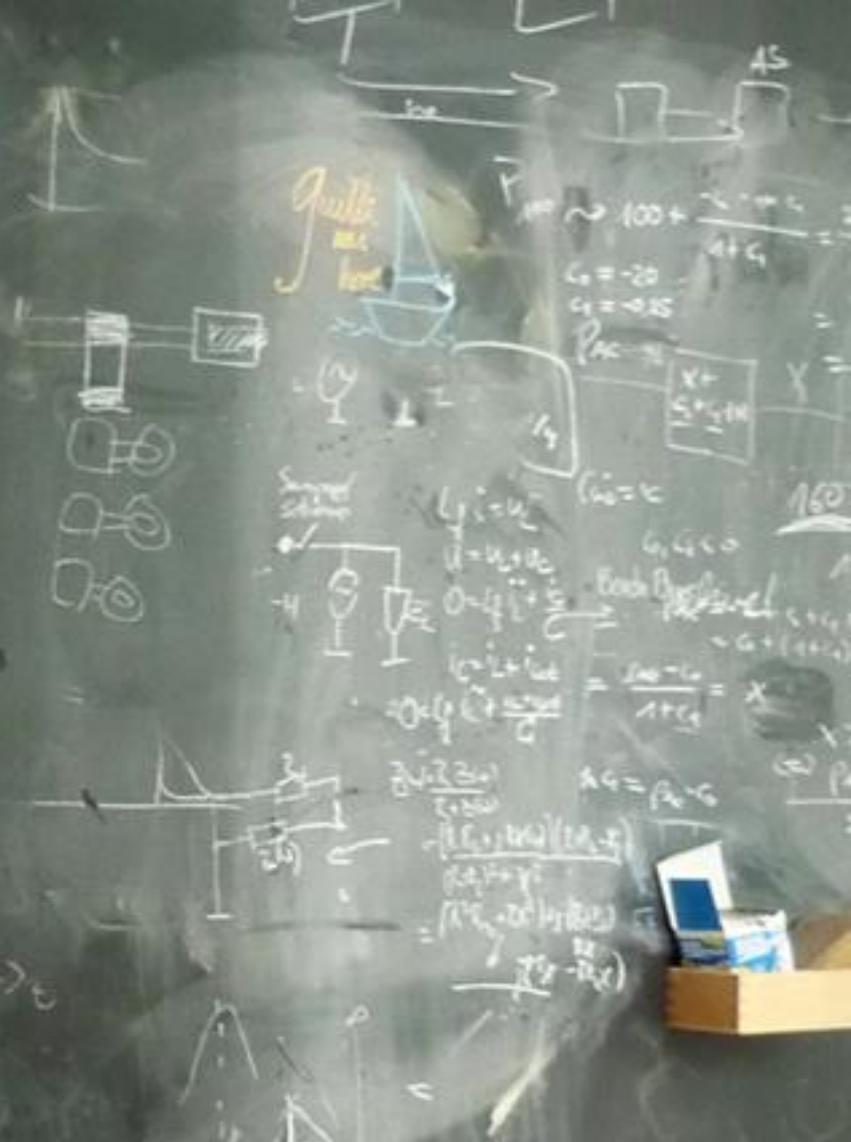
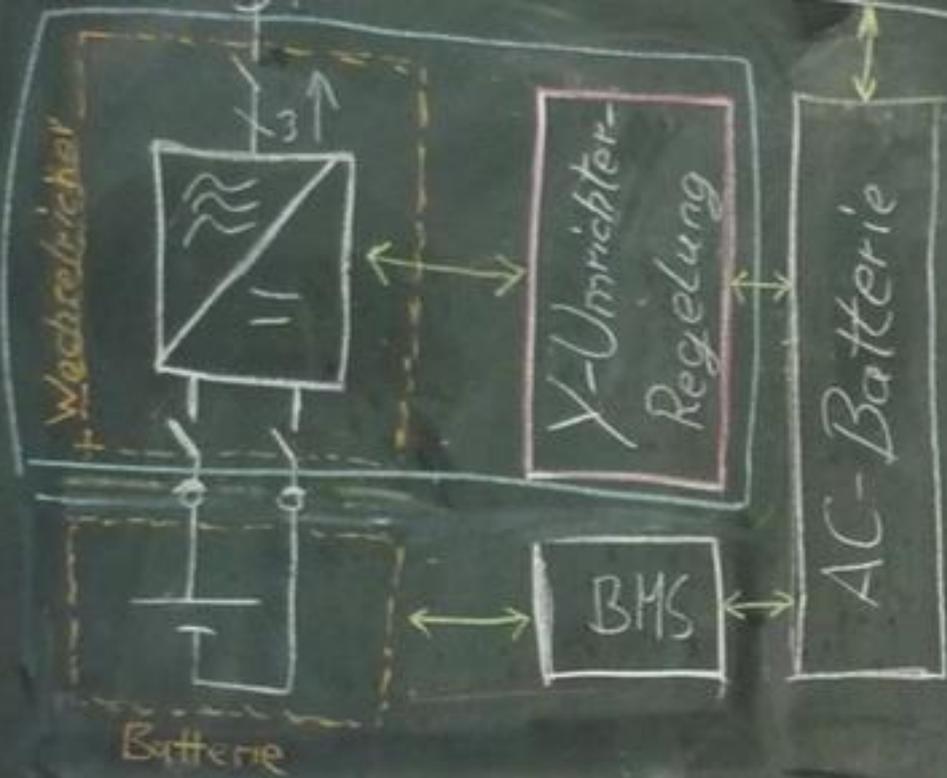
Solar PV generate electricity

Dispatchable load

Excess energy can be used for dispatchable loads

EMS

Plant dispatch manager and optimization with ability to island

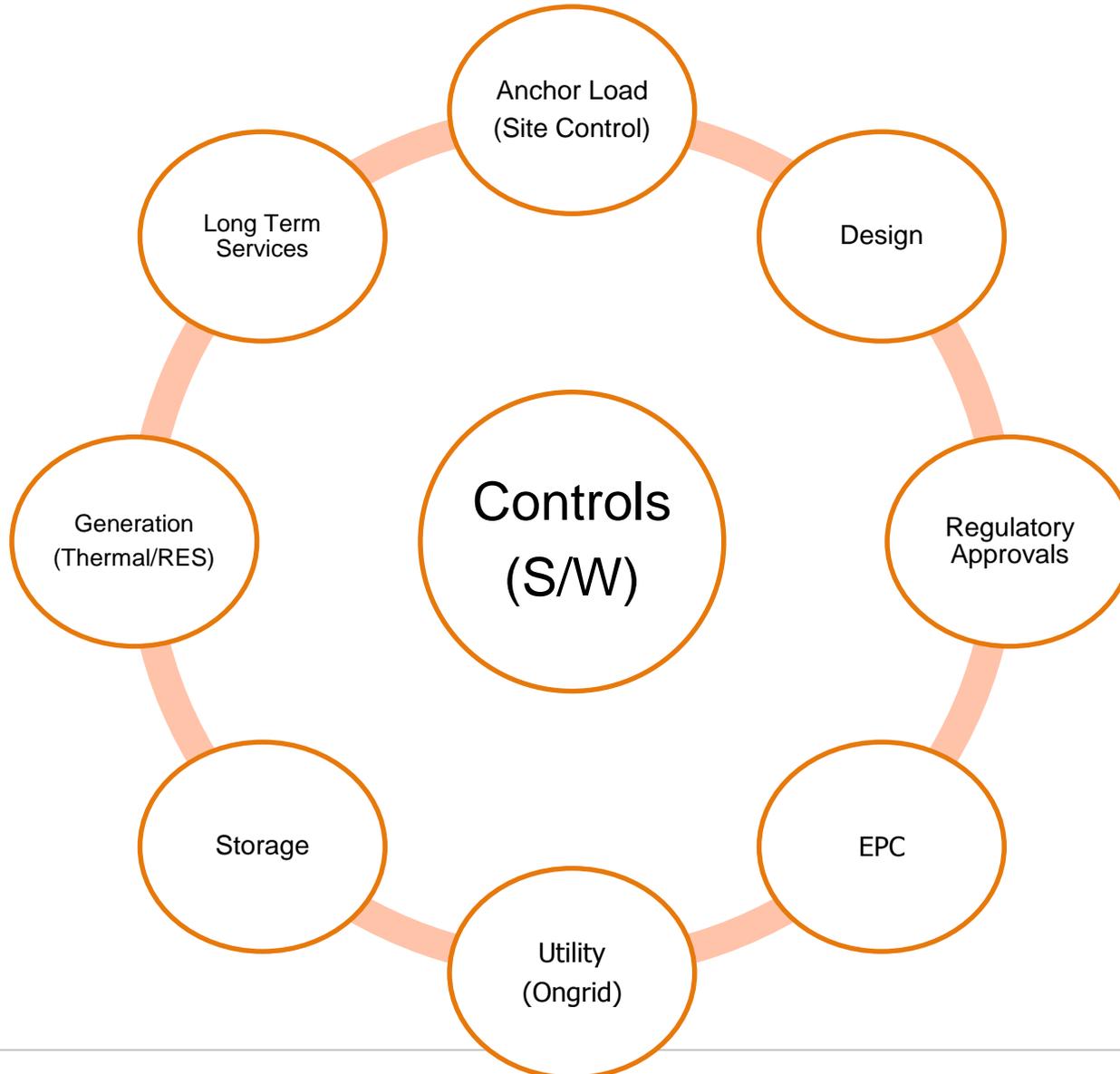


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Microgrids require multiple stakeholders



STAKEHOLDERS...



...BENEFITS OF MULTI-STAKEHOLDERS





Panasonic HQ project with Xcel Energy

STAKEHOLDERS...

Panasonic

YOUNICOS

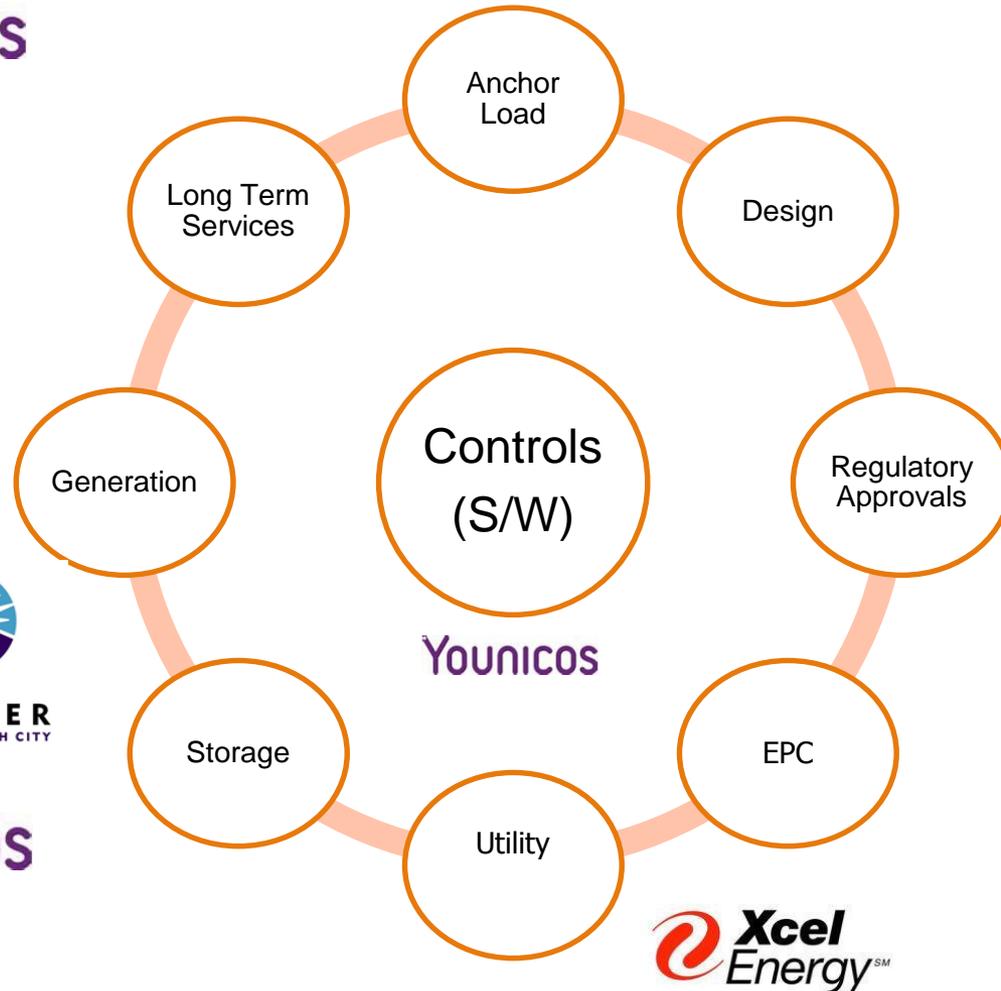
Panasonic

Panasonic



DENVER
THE MILE HIGH CITY

YOUNICOS



DENVER
THE MILE HIGH CITY



Consumer Protection is Our Mission.

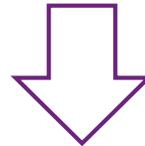


*** Xcel Energy is lead sponsor and owner**

PANASONIC HQ - SIZING



Anchor Load



1.6MW dc Carport Solar



259 kw dc Rooftop Solar



**1MW/ 2.1MWh Battery
Energy Storage + Islanding
Switch**

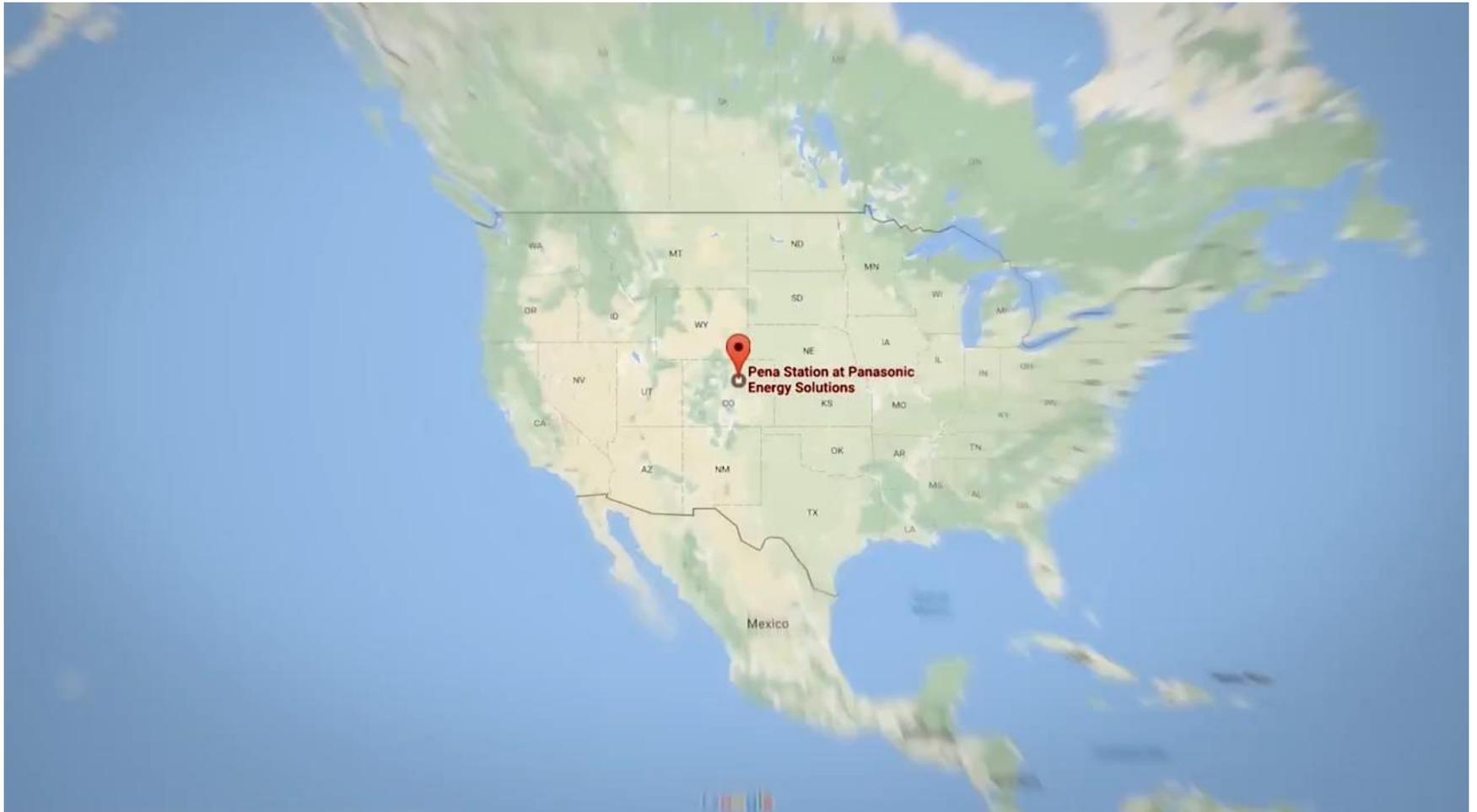
MULTIUSE – REVENUE STREAMS

Beyond UPS for Greater Market Impact

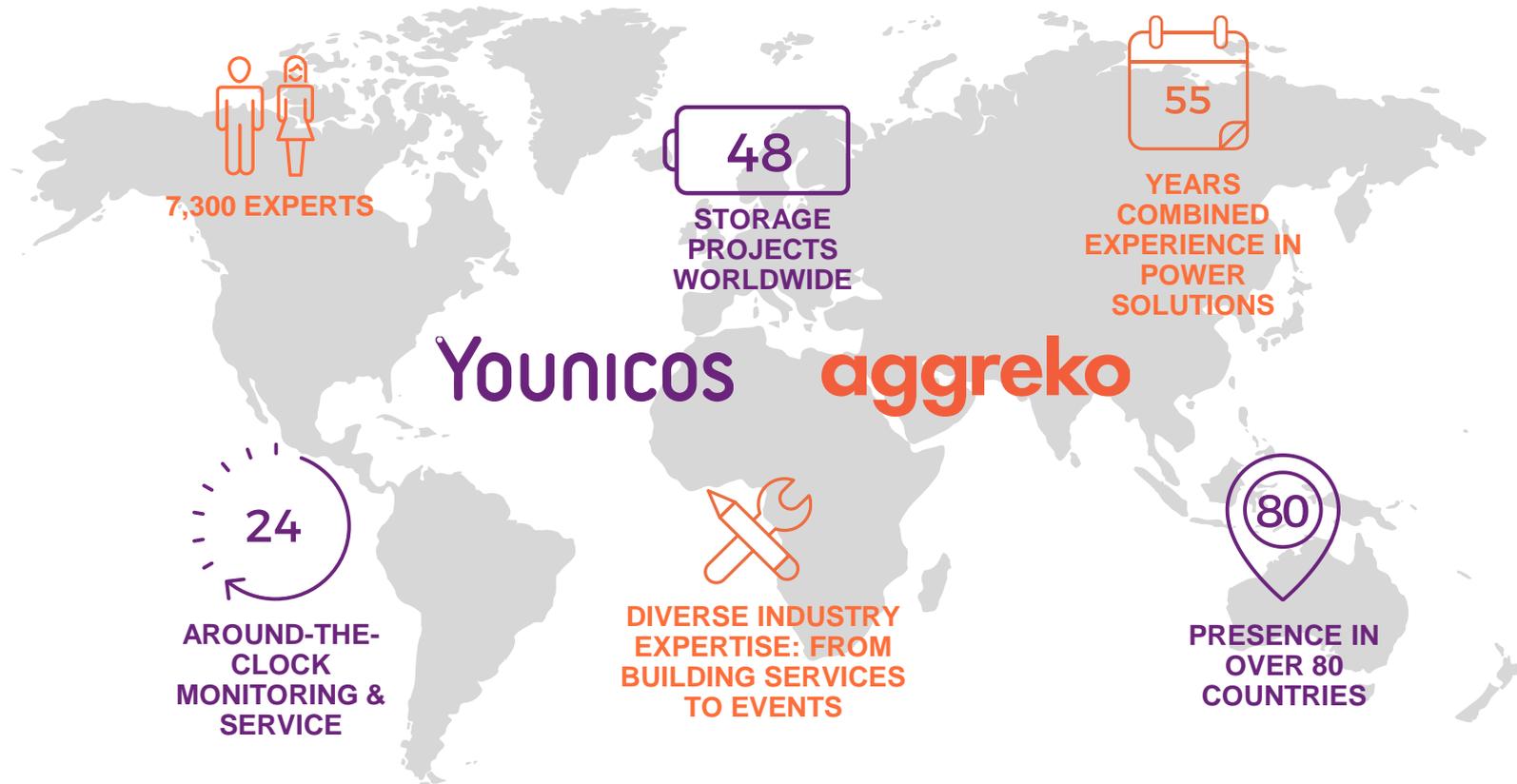
- **Frequency Regulation** as an ancillary service to the grid
- **Solar Firming & Shifting** for both collocated solar & solar penetration on feeder
- **Peak Shaving** to reduce peak demand on the feeder deferring distribution upgrades
- **Back-up Power** capability to create islanded microgrid for 24/7 operation of the Panasonic NOC
- **Energy Arbitrage** charge a low prices and discharge at high prices



PV PLUS STORAGE MICROGRID



GENERATION AND STORAGE FROM TWO GLOBAL LEADERS.



Aggreko owns and operates **over 9.5 GWs** mobile and modular power energy services worldwide.