The Future of Energy is Distributed

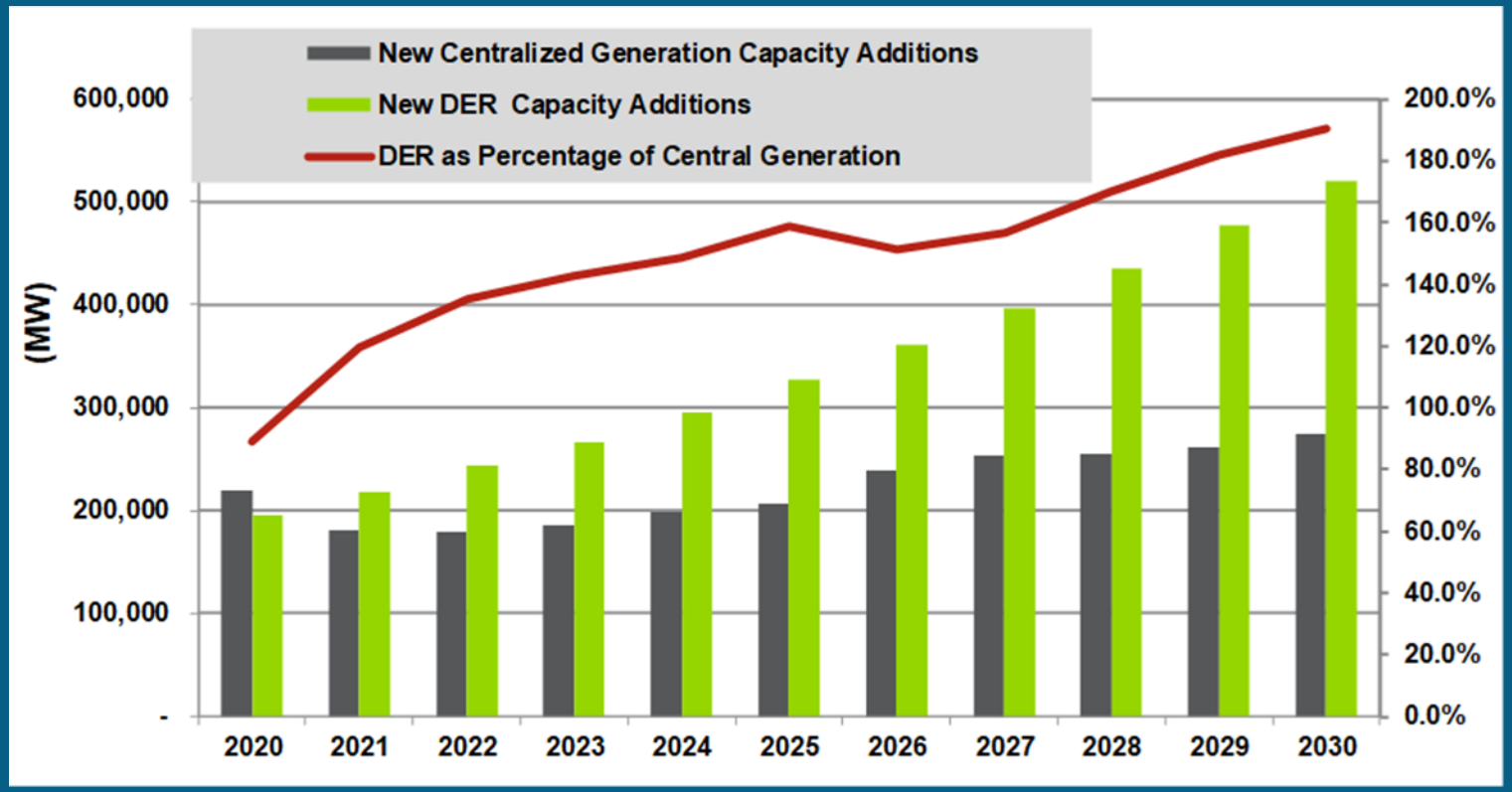
Distributed Wind Energy Conference

February 23, 2026

Pathfinder Communications

Strategy · Integrity · Results

The Big Picture on Energy Trends

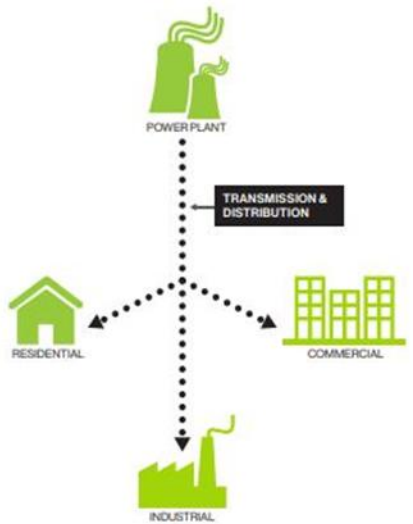


Distributed Energy Resource (DER) versus Centralized Energy Capacity

Not Grandpa's Grid Anymore

Past

Traditional Power Grid



Central, One-Way Power System, focused on Safe, Reliable and Affordable power

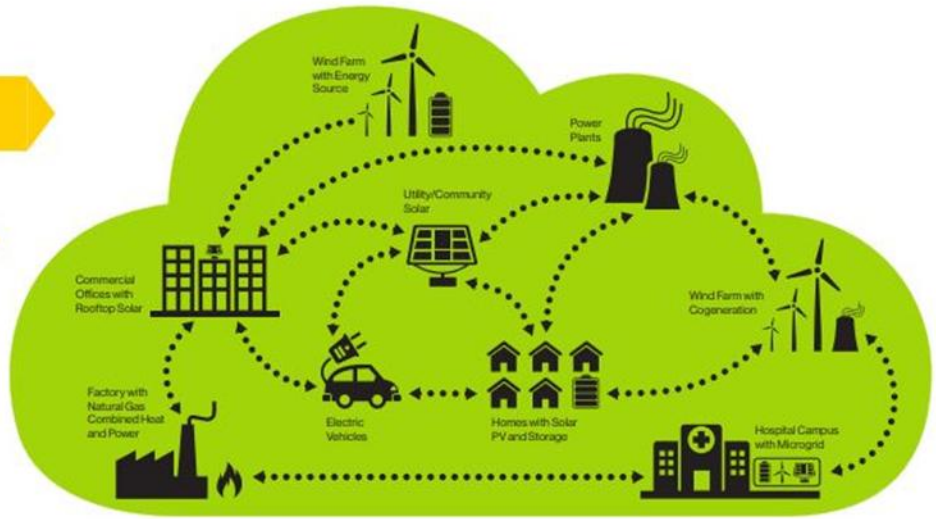
Market Demand

Technology Innovation

Policy & Regulation

Emerging

The Energy Cloud

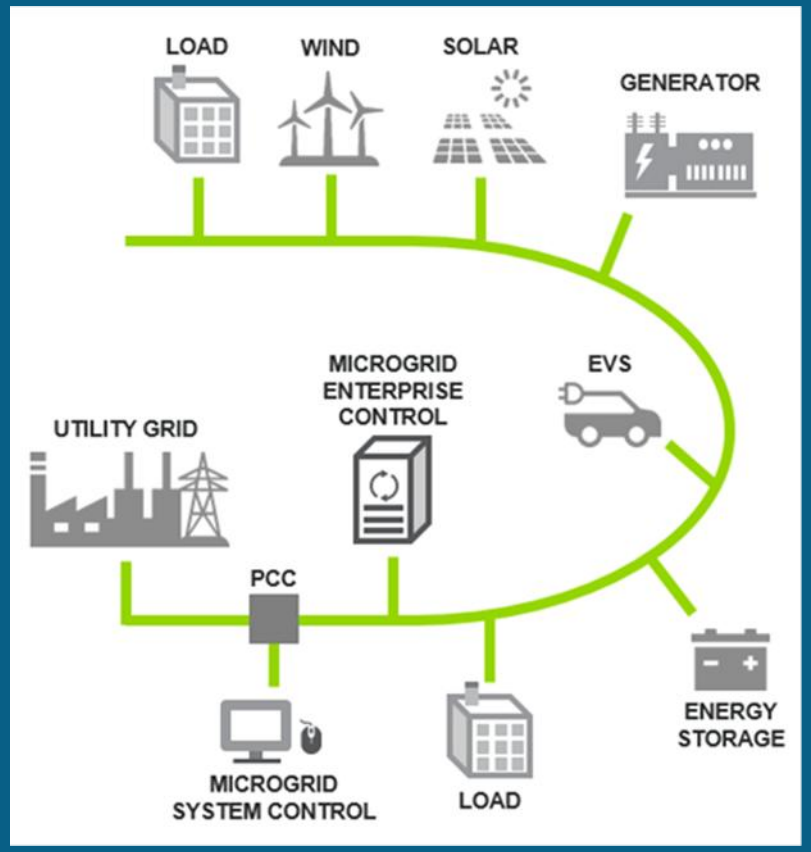


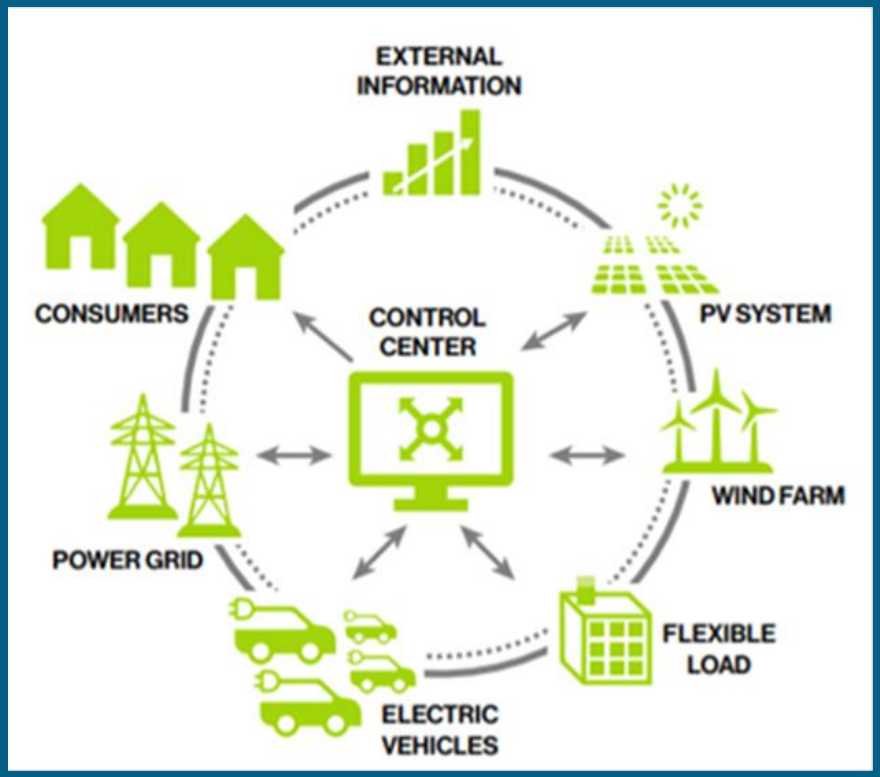
Distributed, Cleaner, Two-Way Power Flows, Mobile energy resources, new digital Energy Cloud platforms

Pathfinder Communications

Strategy · Integrity · Results

DER Growth = Microgrids & Virtual Power Plants





What is a Microgrid?

U.S. Dept. of Energy Definition:

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.

Pathfinder Communications

Strategy · Integrity · Results

Why Microgrids?

- The reliability of the traditional centralized grid is going down, not up
- The cost of DERs is going down (and now are often cost competitive with large centralized power sources)
- Extreme weather events such as hurricanes, extreme freezes, heat waves and wildfires are exposing the limits of traditional grid infrastructure
- The ability of microgrids to island and keep running when the larger grid goes down can increase energy resiliency
- Microgrids can also provide value to the larger grid via demand response and other forms of grid services (and become a VPP)

What is a Virtual Power Plant?

The DOE definition of a VPP –

A VPP is an aggregation of distributed energy resources (DERs) – such as rooftop solar, batteries, electric vehicles and smart thermostats – that are networked together via software to balance electricity demand and supply. Acting as a single, coordinated, digital power plant, VPPs increase grid flexibility, enhance resilience and provide essential capacity and ancillary services…

Pathfinder Communications

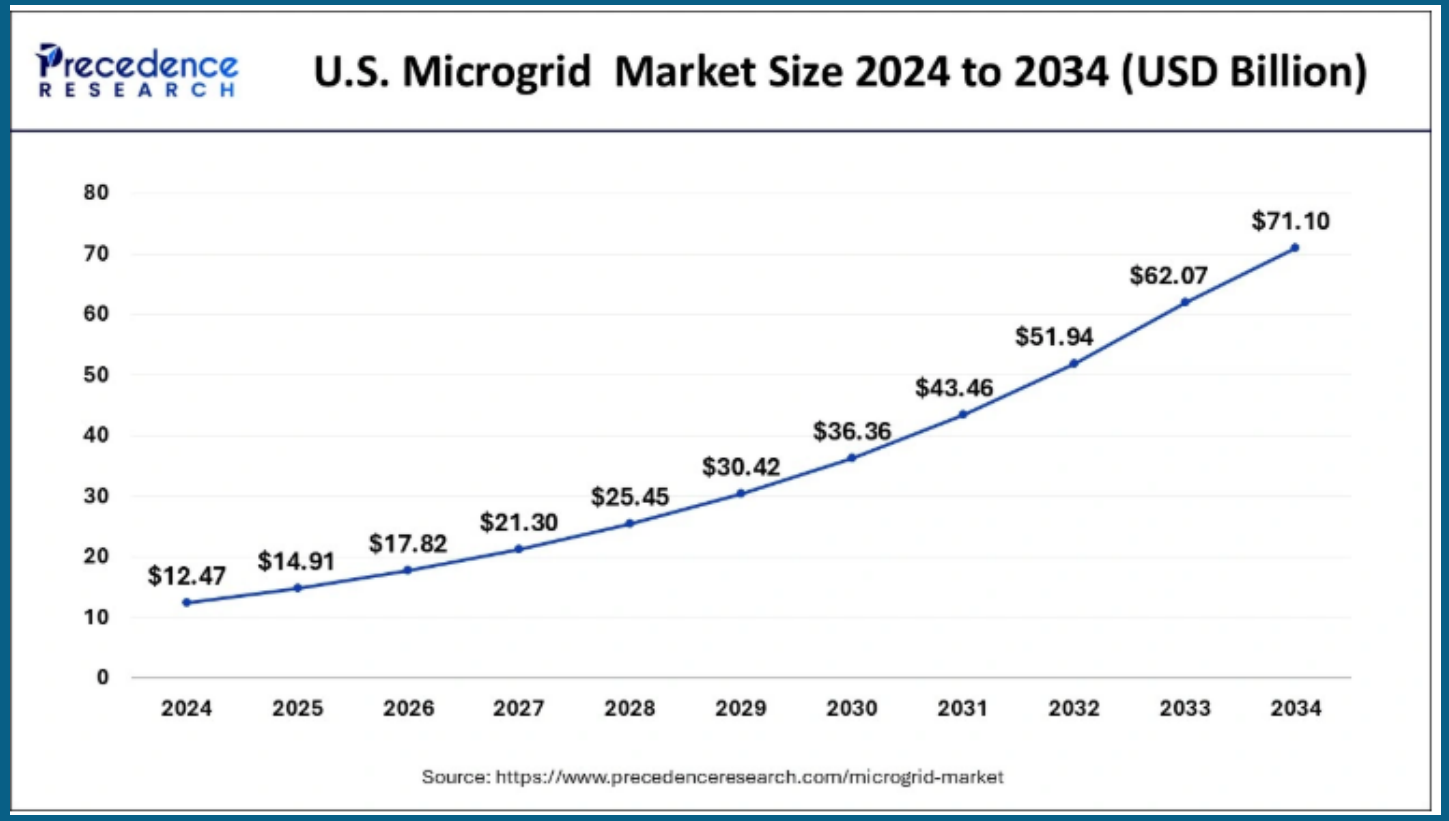
Strategy · Integrity · Results

Why VPPs?

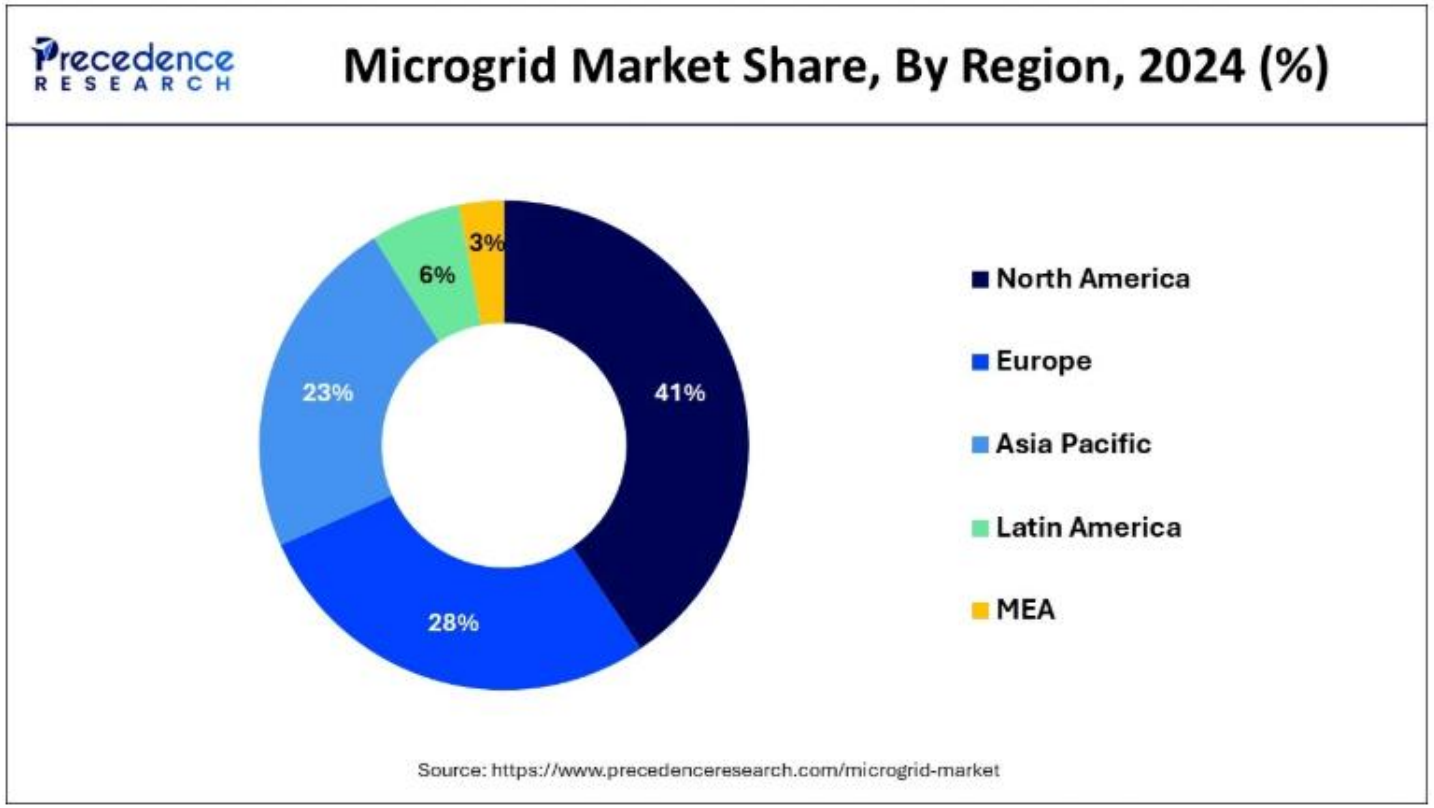
- Advances in controls and grid optimization technologies, including AI
- Explosion of DER types ranging from rooftop solar PV, battery energy storage systems, electric vehicles, smart thermostats, heat pumps – and small wind -- all of which can be managed through advanced software
- Policy innovations such as FERC Order 2222, which allows aggregations of as small as 100 kW of mixed DER portfolios to sell services into wholesale markets
- VPPs are among the lowest cost resources available to a utility/grid operator since assets are typically already paid for by residents or businesses
- VPPs can meet the demands of the grid in real time, reducing reliance upon dirty and expensive fossil fuel peaking plants

The Microgrid Opportunity for Distributed Wind

The U.S. Is *THE* Leading Microgrid Market



Microgrid Regional Market Shares



Pathfinder Communications
Strategy · Integrity · Results

U.S. Microgrid Distributed Wind Case Study

- First deployed AOC 66-kW wind turbines in mid-90s,
- Then deployed Northern Power Systems 100-kW wind turbines, which became the go-to wind technology in Alaska microgrids
- Then shifted to 900-kW EWT wind turbines, the current preferred wind turbine in Alaska
- Now adding solar PV and new batteries to the microgrid

It’s All a Matter of Scale – But Still is Distributed Wind

Key to Being Pioneer? Partnerships & Collaborations

- Worked with DOE, NREL and State of Alaska when nobody else took wind seriously in Alaska
- Cooperative structure allowed for flexibility and patience with technology nurturing
- First larger scale machine went up in 2012, with continued experimentation with battery storage devices
- First utility-scale solar project in Alaska also installed in Kotzebue in 2015, growing from 300 kW to 1 MW today

Wind Enables 100% Renewable Energy Microgrid at Kodiak Island

- The second largest island in the U.S., also located in Alaska
- Electricity load ranges from 18 to 28 MW, with the latter peak occurring during peak fishing season
- Three kinds of energy storage allow the microgrid to rely upon ~100% renewable energy

Renewables Can Reduce Cost and Price Volatility in Rural Areas

- Price volatility, not environmental values, was primary driver to go all-in on renewables
- Hydro provides long-term energy storage – taking ownership from the State of Alaska optimized operations for this rural cooperative
- First battery failed, but 3 MW li-ion battery works well
- Perhaps most noteworthy innovation was flywheel being directly interconnected to huge crane representing 2 MW of instantaneous load

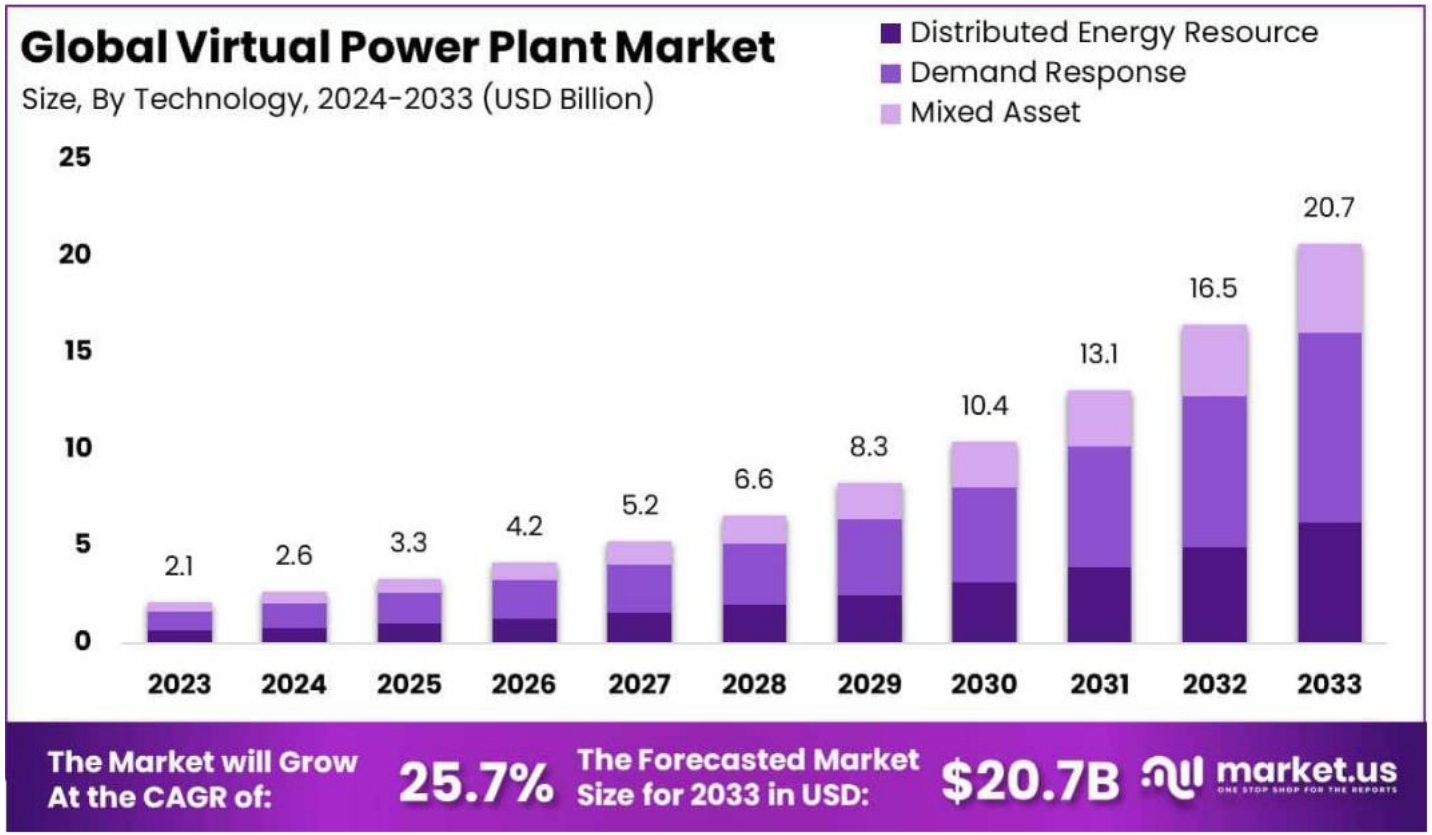
Microgrids are Also a Huge Global Market

Pathfinder Communications

Strategy · Integrity · Results

VPPs and Distributed Wind

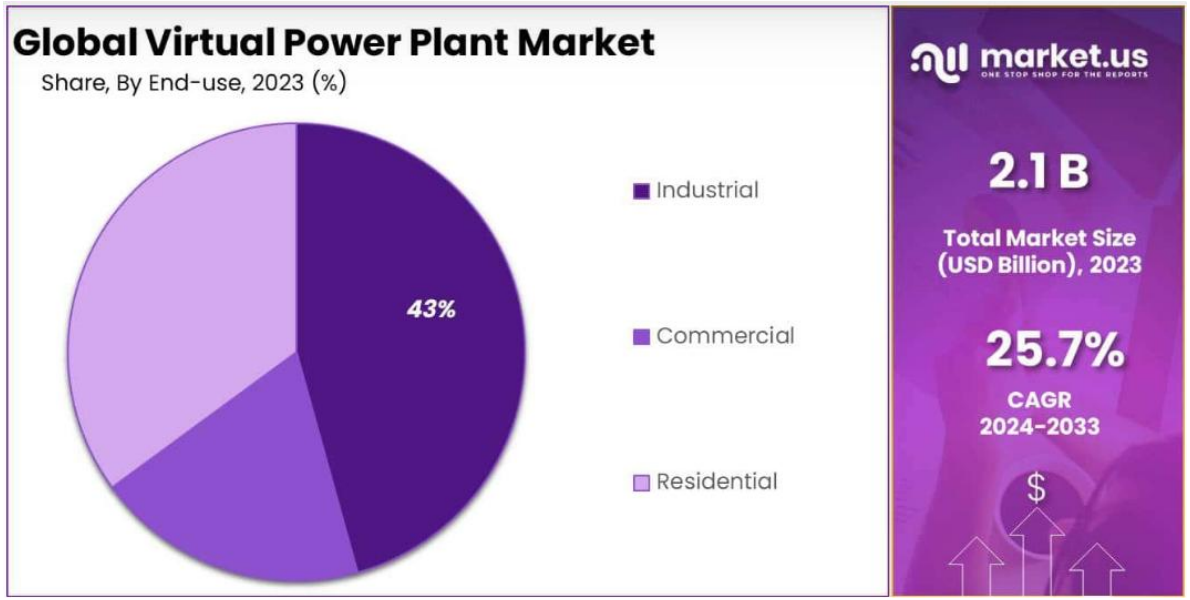
VPPs Are Also a Global Market (U.S. and Europe the Pioneers)



Pathfinder Communications

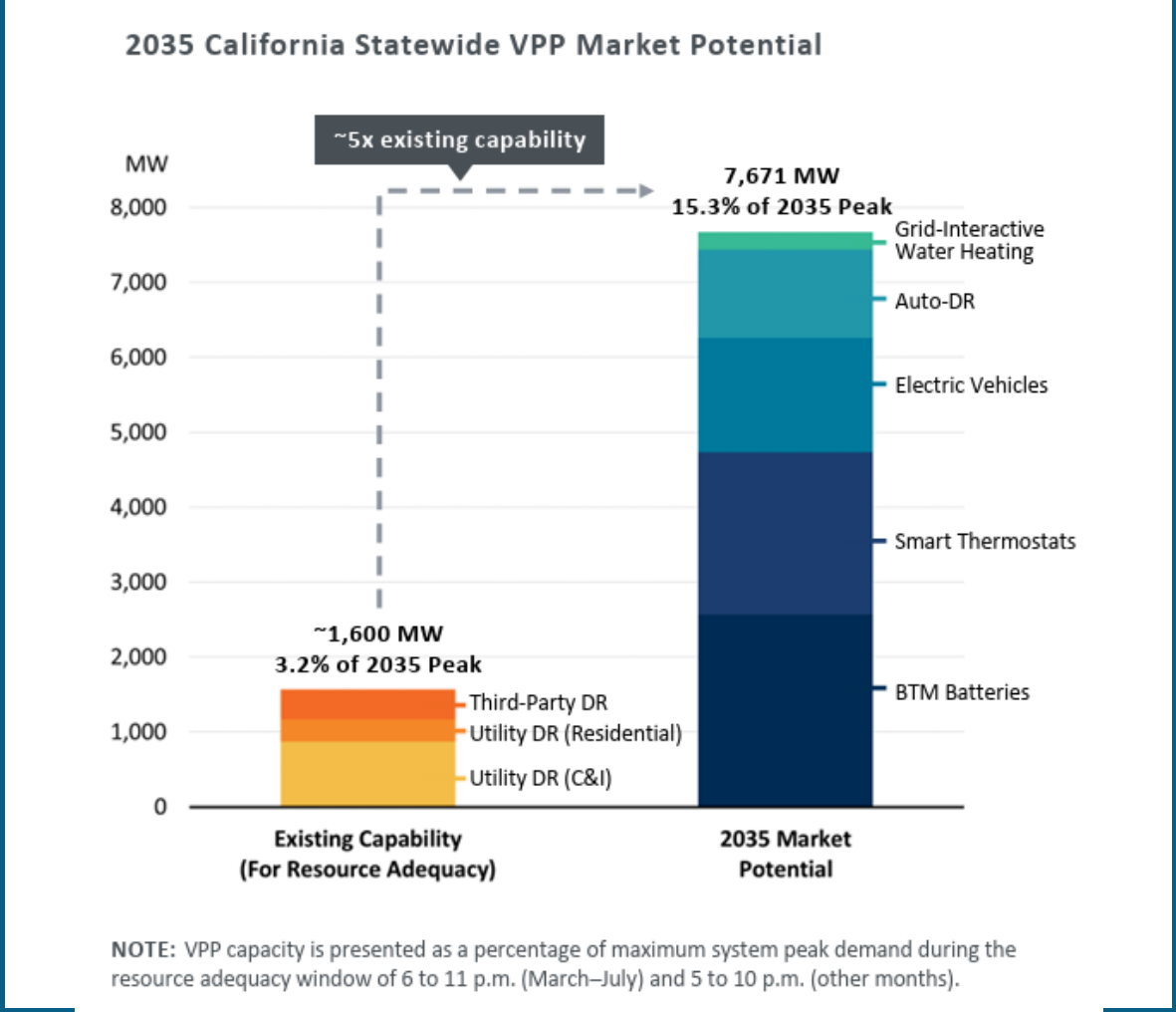
Strategy · Integrity · Results

Residential & Small Commercial Best Bets



- Most VPP aggregators have not seriously considered distributed wind as a DER asset
- New advanced software with AI can integrate distributed wind into mixed asset DER portfolios
- Rural cooperatives in Midwest are best prospects

Spotlight on California VPP Market



By 2035, California's VPP potential will exceed 15% of peak demand, which is five times existing capability, according to the Brattle Group.

A key DER asset will be EVs, which could be charged at night via Distributed Wind (as the sun is no longer shining and most lithium-ion batteries last 2 to 4 hours.)

Roughly $500 million annually would flow to CA consumers via incentives.

All four residential VPP policy pathways could net up to $1,000 per participant annually.

Other VPP Examples

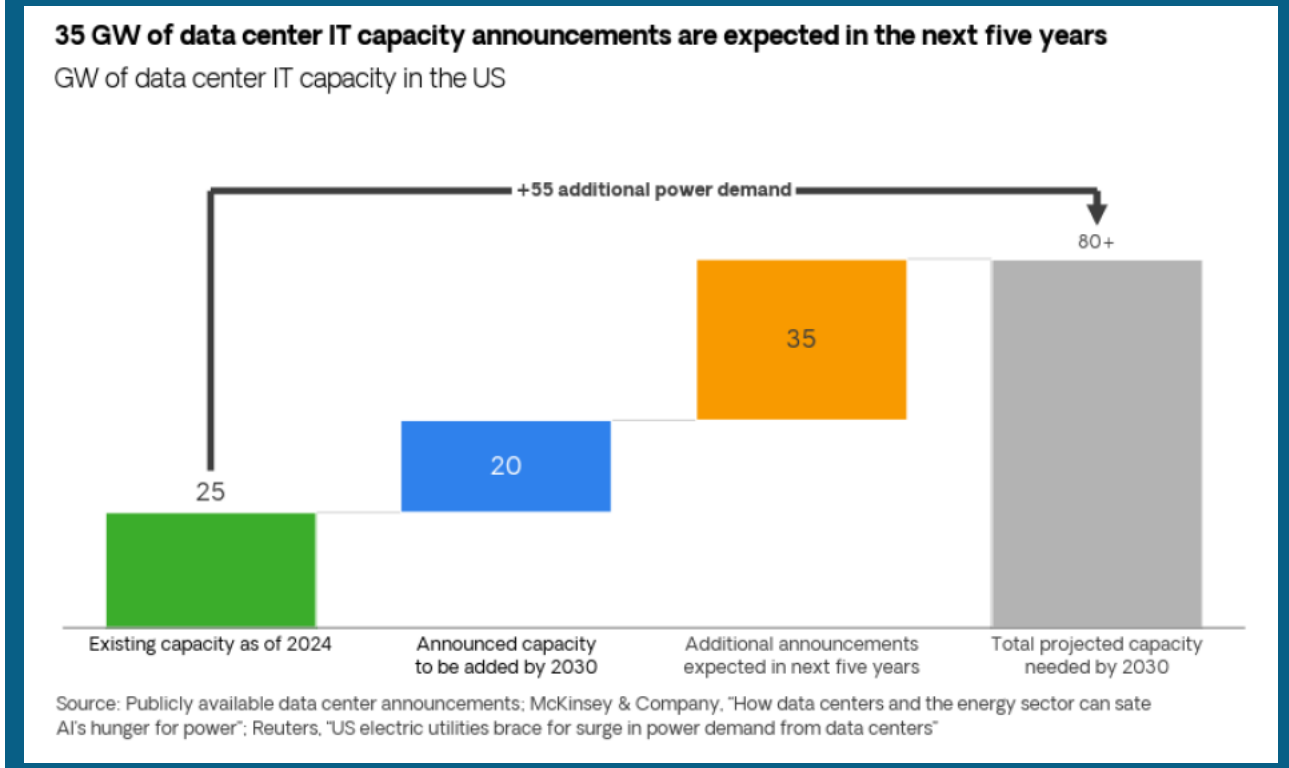
- **Vermont is a promising market for both Distributed Wind and VPPs.**
- Many of the early pioneering small wind turbines started in Vermont
- Green Mountain Power's "Bring Your Own Device" and Tesla Powerwall VPP programs reduced peak demand charges, saving the utility $3 million

- The North Carolina Electric Membership Corporation (NCEMC) is partnering with OATI – a software company -- to enable real-time optimization of customer-owned DERs as well as five utility microgrids.
- Distributed Wind assets could be integrated into this rural cooperative fleet aggregation.

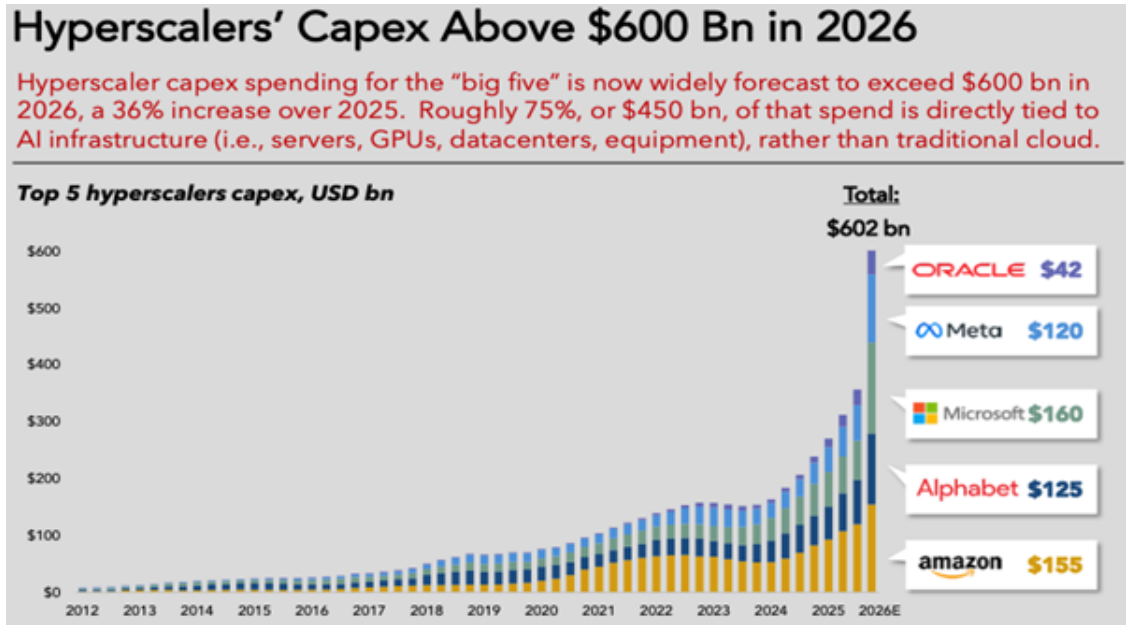
What About Data Centers and AI?

Data Centers Are the Focus of Energy Industry Today

- Utilities cannot meet the energy demand for data centers, so data centers are seeking new flexible interconnections in key markets such as Texas and California for bridge solutions
- Already, 48 GW of new data center load will be served by on-site generation and fully islanded microgrids, the latter of some of which could be 1 GW each!
- Industry moving away from diesel for back-up, but natural gas (and fuel cells) dominate choices so far
- What about Distributed Wind? Urban data center sites are becoming scarce so rural areas are likely next



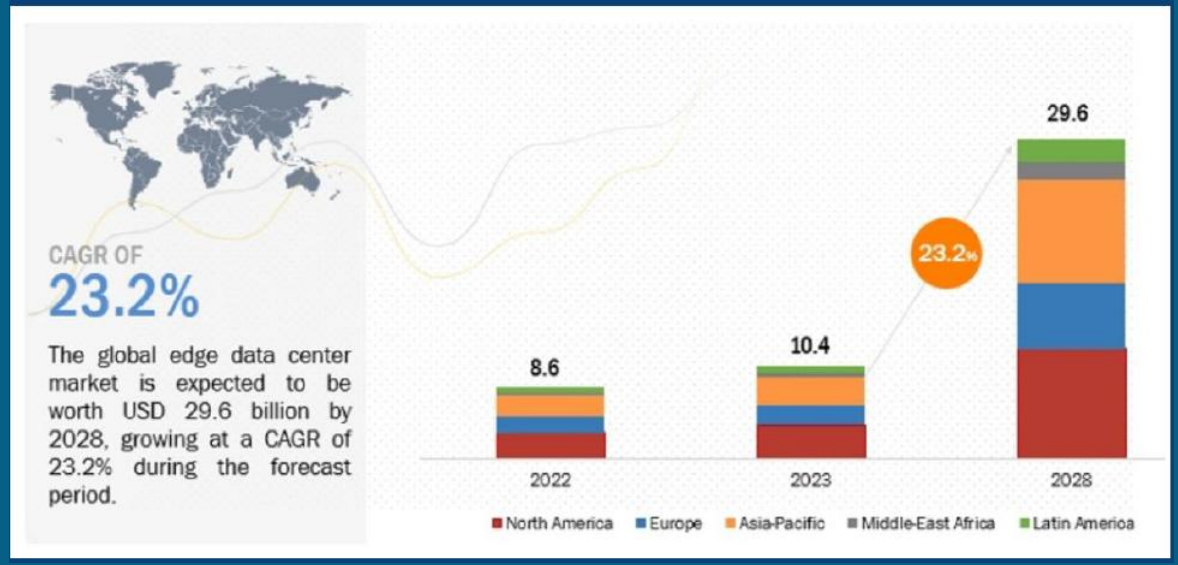
Hyperscale Data Centers Dominate News Cycle



The five largest hyperscale data center companies are spending $600 billion on infrastructure this year, much of it on energy supplies and grid upgrades.

Small, Modular Data Centers Could Be a Better Fit

- In remote parts of the world, a new form of data centers is emerging
- These small, modular, edge data centers are mimicking trends evident with DERs
- Smaller can be better
- Alaska again a trendsetter
- Cordova, Alaska has installed a 150-kW edge data center inside of a microgrid by a San Francisco-based company: Greensparc
- The company has identified 240 MW of potential edge data center sites in Alaska alone, each site to be powered by a diverse set of renewable energy resources including existing Distributed Wind installations



Copper, Clams and then Salmon

The Story of Cordova, Alaska

- 100% hydro utility microgrid in 1907
- Transitioned to 100% diesel after copper ran out
- Transitioned to run-of-river hydro, diesel & battery system today
- Load increases from 3.5 to 9 MW during summer seafood processing season
- Reliance upon 75% renewable energy resources at half the cost of previous all diesel system

Bottom Line Takeaways…

- Distributed Wind is often forgotten as a key DER choice in the U.S.
- This is true for many microgrid developers and utilities and independent power producers seeking to create VPPs
- Rural cooperatives remain the best bets – since the best wind resources are in rural areas
- Remote microgrids – such as those in Alaska – are a good fit

- Yet Alaska lacks load growth, so that market is limited
- However, the edge data center opportunity is a nascent movement and Distributed Wind companies would be wise to position themselves to be a part of this segment of data center market
- Latin America may be the best region, especially the Caribbean, where fleets of microgrids are being deployed in the Bahamas
- Africa and Asia Pacific also good, but more competition and logistical challenges there

Don’t Be a Stranger!

Peter Asmus
President, Pathfinder Communications
PO Box 1422
Bodega Bay, CA 94923
(415) 250-8685
peter.h.Asmus@gmail.com

Pathfinder Communications
Strategy · Integrity · Results