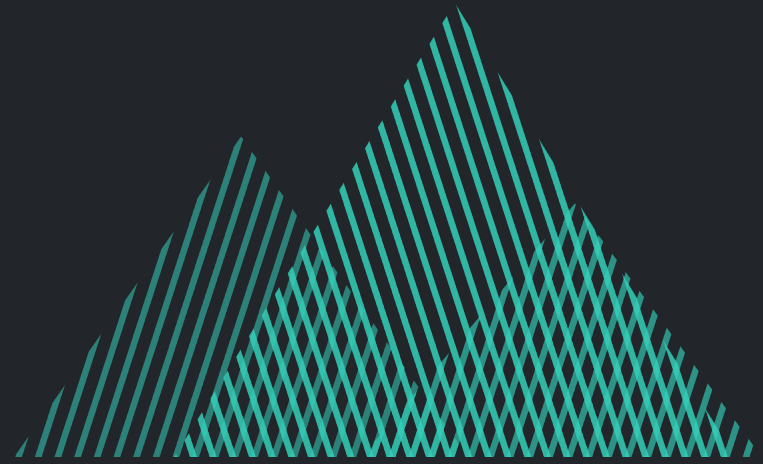
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SAARC ENERGY CENTRE · WEBINAR SERIES 2026

Exploring the Virtual Power Plant (VPP) Concept

Designing, deploying and operating VPPs: insights for SAARC utilities and regulators



Mrs. Angela Long · Founder & CEO, Rockcress Consulting

Tuesday, 17 November 2026 · 10:00–11:30 PKT

Angela Long

Founder & CEO, Rockcress Consulting

Nearly 20 years in clean energy and grid modernization: distributed energy resources, virtual power plants, distribution system planning and energy equity, with utilities, governments and national laboratories.

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Angela Long

Lead author, *Virtual Power Plants: Insights, Profiles and Inventory* (U.S. DOE and Berkeley Lab, 2025)

Helped the U.S. Virgin Islands Energy Office create the territory's first VPP, VIBES 2.0

Work with utilities to scale VPPs: Avista Utilities' 10-year DER strategy to scale its VPP

Former Senior Manager, Portland General Electric; Planning Manager, PacifiCorp

Steering Committee, VPP Convergence Project; DER Advisory Council for Pew; Advisory Group, National Standard Practice Manual for DERs

A note on context and language

Different contexts

Every Member State's grid is different

- Grid conditions, markets, tariffs and regulation vary by country
- U.S. examples are shared for learning, not copying

Different words

The same idea goes by many names

- VPPs may be called demand-side management, demand response or aggregation
- Utilities may be DISCOs, distribution licensees or electricity boards

Different norms

Trust and customer relationships vary

- How customers engage with utilities differs by country and community
- Program design should reflect local norms and priorities

Figures and terms are mostly from the U.S. Please **translate them to your own context**, and share how these ideas apply in your country during Q&A.

What we will cover

01		What a VPP is, and what it does
02		Three VPP profiles: Aggregated, Integrated, Orchestrated
03		Benefits for the grid, consumers and the economy
04		Lessons from existing programs
05		Challenges to adoption
06		Actions for utilities and regulators

What is a virtual power plant?

Software that aggregates many distributed energy resources (DERs) and operates them as one resource, delivering grid services like a conventional power plant.

DISTRIBUTED ENERGY RESOURCES

- Rooftop solar
- Home & business batteries
- Electric vehicles & chargers
- Smart ACs & water heaters
- Commercial & industrial loads

VPP platform

- Forecast
- Enroll & aggregate
- Dispatch
- Measure & settle

GRID & CUSTOMER SERVICES

- Peak demand reduction
- Balancing solar & wind
- Local network relief
- Backup power & resilience

Definition adapted from U.S. DOE, Pathways to Commercial Liftoff: VPPs (2025)

From bulk power to the grid edge

BULK POWER SYSTEM | **DISTRIBUTION SYSTEM** | **GRID EDGE**



Generation
Large power plants: thermal, hydro and utility-scale solar and wind

Transmission
High-voltage lines carry power over long distances

Substation
Steps voltage down for local delivery

Distribution
Feeders and transformers serve neighborhoods

Grid edge
Homes and businesses with solar, batteries, EVs and smart loads

Power has traditionally flowed one way, from left to right. With DERs at the grid edge, it now flows both ways.

Grid operator
VPP services: energy, capacity and essential reliability services
All three VPP profiles

Distribution operator
VPP services: local capacity, reliability and voltage support
Orchestrated VPPs

Customers and aggregators
VPP services: energy and local resilience
Orchestrated VPPs

Grid services by VPP profile: Long, Long & Mims Frick, VPP Profiles and Inventory (Berkeley Lab, 2025)

Three types of aggregated DERs (aDERs) a VPP can use

Demand

Uses less, or uses it at a different time

- Smart ACs, thermostats and water heaters
- Managed EV charging
- Commercial, industrial and agricultural loads, such as pumps

Storage

Stores energy and releases it on command

- Home and business batteries
- EV batteries (vehicle-to-grid)
- Thermal storage, such as pre-cooling buildings

Generation

Produces electricity at or near the customer

- Rooftop and captive solar
- Small wind, fuel cells and combined heat and power
- Backup generators, within emissions limits

Most VPPs start with **demand**, the most widespread and lowest-cost resource, then add storage to make solar dispatchable.

What VPPs do: shape, shift, shed, shimmy

Our research found more than 30 published definitions of a VPP. Agreeing on what a VPP *does* is a practical first step for utilities and regulators.

Shape



MONTHS-TO-DAYS NOTICE

Reshape load profiles through prices or behavioral campaigns.

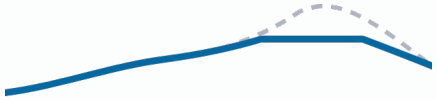
Shift



TOWARD RENEWABLE SURPLUS

Move consumption from high-demand hours to hours of surplus solar or wind.

Shed



PEAKS & EMERGENCIES

Curtail load to cut peak demand or support the system in contingencies.

Shimmy

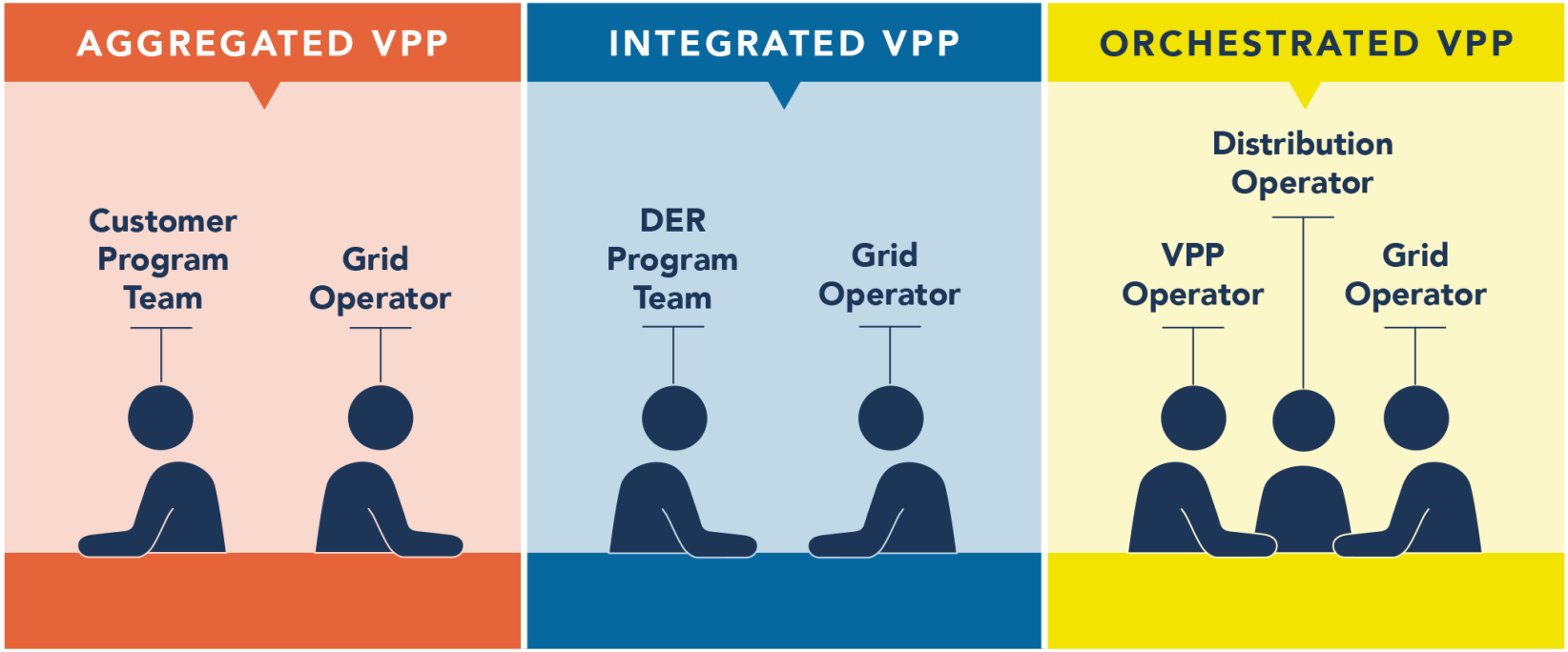


SECONDS UP TO AN HOUR

Adjust demand dynamically to smooth short-run ramps and disturbances.

Dashed gray: daily load without a VPP · Blue: with a VPP · Source: Long, Long & Mims Frick (Berkeley Lab, 2025)

Not linear, but a spectrum



Multiple profiles can operate simultaneously. Start with a simple approach while building a team and platform that can scale over time.

Source: Long, Long & Mims Frick, VPP Profiles and Inventory (Berkeley Lab, 2025)

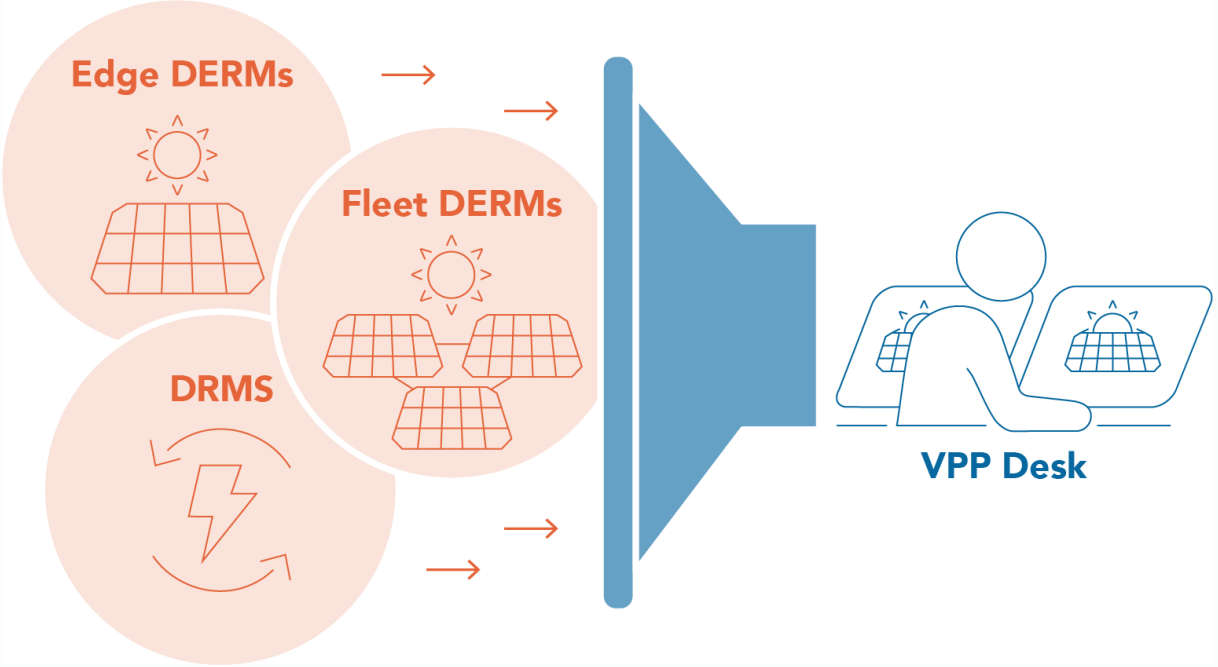
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Three VPP profiles

	Aggregated	Integrated	Orchestrated
Purpose	Shape, shift	Shape, shift, shed	Shape, shift, shed, shimmy
DERs	One device type, e.g., smart thermostats	Mixed DERs; bring-your-own batteries, microgrids	Diverse DERs, incl. third-party resources
Response & dispatch	Day-ahead; manual	Hour-ahead; partly automated	Seconds; fully automated
Platform	DRMS or edge DERMS	Adds centralized DERMS	ADMS with centralized DERMS
Grid services	Energy & capacity, bulk system	Adds reliability services	Adds distribution & grid-edge services
DER share of distribution peak	Under 5%	5–15%	Over 15%

Source: Long, Long & Mims Frick, VPP Profiles and Inventory (Berkeley Lab, 2025)

The software platforms behind a VPP



Device-level systems

DRMS runs demand response programs

Edge DERMS controls customer devices at the grid edge

Fleet DERMS manages fleets of similar DERs, such as solar or EVs

Centralized DERMS

The VPP desk: coordinates the device-level systems as one platform, with near real-time visibility and two-way control

ADMS

Advanced distribution management system: adds real-time, location-specific dispatch alongside grid operations

Aggregated VPP
one device-level system, dispatched manually

Integrated VPP
adds a centralized DERMS

Orchestrated VPP
adds an ADMS

Source: Long, Long & Mims Frick, Insights into Scaling VPPs and VPP Profiles and Inventory (Berkeley Lab, 2025)

Who benefits from a VPP

The grid

- Lower peak demand
- Fast-acting capacity and flexibility
- Non-wires alternatives (NWAs) that defer costly upgrades

Consumers

- Payments or bill credits for flexibility
- Backup power during outages
- Energy independence

The economy

- Displacing fossil peakers and lower emissions
- Less imported oil and liquefied natural gas (LNG) burned for peak power
- Fast to launch: basic VPPs can go live in under six months

VPPs are a **demand-side tool to cut costs related to fuel imports and investments to the grid** using assets customers have already paid for.

Source: U.S. DOE, Pathways to Commercial Liftoff: VPPs 2025 Update

VPPs are scaling in the United States

33 GW

VPP capacity across North America, per the U.S. DOE (2025)

80–160 GW

DOE's U.S. goal for 2030, enough to serve 10–20% of peak load

180

VPP programs in our national inventory, with about 19 GW of potential capacity

27 GW

of existing demand response and net-metered solar-plus-battery: a solid foundation

Sources: U.S. DOE VPP Liftoff 2025 Update; Long, Long & Mims Frick, VPP Inventory (Berkeley Lab, 2025)

Three things successful VPPs get right

Leadership

- A clear vision and measurable goals
- Executive support from utilities and regulators
- Dedicated VPP staff across siloed teams
- Shared terminology

Grid & technology

- Software matched to grid needs
- Clear DER participation rules for manufacturers
- Standards such as IEEE 1547-2018 and IEEE 2030.5
- Visibility, monitoring and control

Program design

- Customer-centric programs
- Clear performance metrics and valuation
- A defined procurement process
- Pilots with clear goals and endpoints

Source: Long, Long & Mims Frick, Insights into Scaling VPPs (Berkeley Lab, 2025)

What leading utilities did differently

PORTLAND GENERAL ELECTRIC · OREGON

Appoint a VPP leader

A dedicated VPP director acts as “translator” across teams. Today’s VPP delivers 225 MW from 225,000+ enrolled customers; the goal is 2,000 MW by 2030.

PACIFICORP · SIX WESTERN STATES

Set clear device standards

Published battery requirements using IEEE 2030.5. Its VPP of up to 400 MW runs around the clock and drops load within 30 seconds for frequency response.

NATIONAL GRID · MA & NY

Build on what customers own

ConnectedSolutions enrolls existing thermostats and batteries and can remove about 350 MW at peak; income-eligible customers receive free batteries.

Source: Long, Long & Mims Frick, Insights into Scaling VPPs (Berkeley Lab, 2025)

U.S. Virgin Islands: a first VPP on an island grid

- Builds on customers already in WAPA's net-metering and net-billing programs who own home batteries
- Pays up to $2,000 for signing up, plus payments tied to participation
- Customers stay in control: they set a backup reserve and can opt out of events
- Runs as a three-year pilot to develop design and dispatch protocols with the utility

~20 MWh

of home battery storage estimated territory-wide for grid operators to draw on

$22.5M

potential annual savings to WAPA from a territory-wide VPP offsetting fossil fuel, per an RMI study

Source: Virgin Islands Energy Office, VIBES 2.0 VPP program (energy.vi.gov/vibes2)

What slows VPP adoption

Visibility

Behind-the-meter solar and batteries are often unregistered and invisible to planners.

Data & definitions

No common terms or data that separate demand response, net metering and VPPs.

Business models

Falling sales and unclear cost recovery give utilities little reason to invest.

Interoperability

Meters, inverters and devices that cannot talk to a common platform.

Enrollment & trust

Complex sign-up, unclear value and concern about control of home devices.

Cybersecurity

Every connected device widens the attack surface for the grid.

Design, deploy, operate

Design

- Start with grid needs: peaks, evening ramps, constrained feeders
- Inventory DERs already connected, including net-metered solar
- Build access and equity into eligibility and incentives

Deploy

- Launch fast with bring-your-own-device and behavioral programs
- Partner with aggregators and equipment makers; keep sign-up simple
- Verify performance with smart-meter data

Operate

- Bring VPP dispatch into control-room and distribution planning
- Stand up a dedicated DER program team
- Automate dispatch as volumes grow

Drawing on Long, Long & Mims Frick, Insights into Scaling VPPs (Berkeley Lab, 2025)

Create the conditions for VPPs to scale

1

Define VPP services

In tariffs and regulations, using a common profile vocabulary.

2

Plan for flexibility

Require load-flexibility studies in resource and distribution plans.

3

Pay for performance

Time-of-use and peak pricing, plus performance-based VPP payments.

4

Align incentives

Let utilities recover costs and earn on VPPs as they do on poles and wires.

5

Open up DER data

Register connected DERs so planners and aggregators can see them.

6

Adopt standards

Such as IEEE 1547-2018 for smart inverters and IEEE 2030.5 for device communications.

An illustrative path for SAARC utilities

PHASE 1 · 0–12 MONTHS

Aggregated

- Register and map DERs, starting with net-metered solar
- Pilot behavioral demand response and time-of-use rates

PHASE 2 · 1–3 YEARS

Integrated

- Enroll customer batteries and EV charging
- Deploy a centralized DERMS
- Dispatch hour-ahead with the system operator

PHASE 3 · 3+ YEARS

Orchestrated

- Dispatch by location to relieve feeders
- Open VPP participation in electricity markets
- Share results across SAARC Member States

Start with a DER strategy. For Avista Utilities, we are building a **10-year DER strategy**: assessing DER readiness and prioritizing use cases before scaling its VPP.

Four things to remember

1. VPPs turn resources customers already own into a dependable grid resource.
2. Identify the profile being developed: Aggregated, Integrated or Orchestrated.
3. Start simple and fast, but choose platforms and teams that can grow.
4. Regulatory requirements shape the pace of progress through DER data, compensation and planning.

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Thank you

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FURTHER READING

Virtual Power Plants: Insights, Profiles and Inventory

Reports and the downloadable VPP Inventory from Berkeley Lab and the U.S. DOE

emp.lbl.gov/publications/virtual-power-plants-insights