



# From Concept to Capability

How APS Is Turning Virtual Power Plants into Real Grid Assets

By ARIZONA PUBLIC SERVICE'S KERRI CARNES

**V**irtual power plants (VPPs) have long occupied a curious space in the utility industry – widely discussed, often theorized, but historically difficult to operationalize at scale. For AEIC member company, Arizona Public Service (APS), that narrative is changing.

What began as a forward-looking demand-management strategy is evolving into a targeted, locationally precise grid support tool – one that is delivering measurable reliability, affordability, and customer engagement benefits.

At its core, APS's VPP journey reflects a broader industry shift: from conceptual exploration to operational integration. And the lesson is clear – VPPs are no longer just an idea. They are an essential component of the modern grid.

## The Imperative: Managing Peak Demand in a Changing Grid

APS's VPP initiative traces back to the mid-2010s, when the utility began confronting a familiar but intensifying challenge: extreme summer peak demand. In Arizona, summer load can double compared to winter or shoulder months, placing significant strain on

infrastructure and increasing costs for both utilities and customers.

At the same time, the growth of distributed energy resources (DERs) – including smart thermostats, rooftop solar, energy storage, and electric vehicles – introduced new opportunities. The question became not just how to meet demand, but how to shape it.

Regulatory support helped accelerate this shift. Arizona regulators encouraged APS to expand demand-side management programs, prompting the utility to invest in scalable, customer-focused solutions. The result was the launch of the Cool Rewards program in 2018 – a residential smart thermostat initiative that would ultimately serve as the backbone of APS's VPP.

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## Scaling the Asset: From Pilot to Portfolio

What distinguishes APS's approach is not just program design, but execution at scale. By 2025, the utility had grown its thermostat-based VPP resource to approximately 160 megawatts – a significant operational asset.

This growth was not accidental. APS prioritized accessibility and simplicity for customers, recognizing that adoption hinges on ease of participation. A key innovation was the APS Marketplace, which allows customers to purchase smart thermostats that ar-

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rive pre-enrolled in demand-response programs. This eliminates traditional enrollment barriers and accelerates participation.

The results were immediate. Adoption followed a hockey stick trajectory, transforming a modest pilot into a meaningful grid resource. But scale alone was not enough. The next challenge was precision.

### From System-Wide to Locational Value

Early VPP implementations often functioned as broad, system-wide resources – valuable but limited in their ability to address specific distribution constraints. APS set out to change that.

The utility's transmission and distribution leadership articulated a clear need: locational demand response. In other words, the ability to deploy VPP resources exactly where they are needed on the grid.

To advance these capabilities, particularly in data and analytics, APS's IT organization and Distribution Planning team collaborated to develop advanced tools that integrate feeder-level data, enabling the utility to identify where demand response would deliver the greatest impact.

This transformation – from generalized load reduction to targeted grid support – marks a critical evolution in VPP maturity. It also sets the stage for real-world validation.

### Proving the Model: A Storm Response Case Study

That validation came in the summer of 2024, when a severe monsoon storm caused significant infrastructure damage and extended outages in parts of West Phoenix. Faced with a four-day outage affecting specific feeders, APS

turned to its VPP. Using newly developed locational tools, the utility identified approximately 2,600 thermostats within the affected area and deployed targeted demand response.

The outcome was significant: APS was able to maintain service for impacted customers without broader disruptions. This event demonstrated several critical capabilities including precision targeting at the feeder level, customer-centric dispatch to minimize unnecessary impacts, and operational reliability, with VPP resources performing as forecasted.

Perhaps most importantly, it changed internal perceptions. What was once seen as a supplemental or “nice-to-have” resource became a trusted operational tool.

### Organizational Alignment: The Hidden Enabler

Technology alone does not deliver transformation. APS's success reflects a deliberate organizational strategy that integrates customer programs, operations, IT, and regulatory functions.

Embedding VPP efforts within the operations organization proved particularly impactful. This alignment ensured that demand-side resources were treated with the same rigor as traditional generation assets – subject to performance expectations, forecasting requirements, and real-time operational needs.

Equally important was the establishment of a dedicated data transformation team within IT. This group became a critical partner, enabling the analytics and visibility required for locational deployment.

Across the enterprise, APS adopted a crawl, walk, run approach – building foundational capabilities, demonstrating value, and scaling incrementally.

This disciplined progression helped secure executive support, including an ambitious goal to grow the VPP to one gigawatt by 2033.

### The Customer at the Center

While grid benefits are significant, APS's VPP strategy is fundamentally customer centric. Participation is voluntary, and maintaining a positive customer experience is essential to long-term success.

This requires a shift in mindset. Unlike traditional generation assets, VPP resources are owned and controlled by customers. Dispatch strategies must therefore balance grid needs with customer comfort and satisfaction.

APS is addressing this challenge through smarter orchestration, including plans to leverage artificial intelligence and machine learning. These technologies will enable more nuanced dispatch decisions, rotating events across different assets and customers to minimize fatigue and maximize engagement.

The payoff is twofold: improved reliability and enhanced affordability. By reducing peak demand, VPPs help avoid costly infrastructure investments while giving customers tools to manage their energy costs.

### Lessons for the Industry

APS's experience offers five key takeaways for utilities exploring VPPs: Start with the customer. Adoption depends on simplicity, accessibility, and clear value.

Build organizational alignment. Cross-functional collaboration is essential.

Invest in data and analytics. Locational capability is the next frontier.

Prove performance. Reliability builds trust and confidence – internally and externally.

Scale deliberately. A phased approach enables sustainable growth.

Perhaps the most important lesson is this: VPPs are not a silver bullet, but they are a critical part of an all-of-the-above strategy. As electrification accelerates and load growth intensifies, utilities must leverage every available tool – generation, transmission, distribution, and customer-side resources – to meet demand.

### **From Possibility to Practice**

For years, VPPs were discussed as a future state. At APS, they are now a present-day reality, delivering targeted grid support, enhancing customer engagement, and redefining how utilities think about demand-side resources.

The journey is far from over. But one thing is clear: the utilities that succeed in the coming decade will be those that move beyond theory and embrace the practical, scalable potential of VPPs. In doing so, they will not just modernize the grid, they will transform it. [PwF](#)