NARUC
National Association of Regulatory Utility Commissioners

Regulators' Financial Toolbox: Considerations in Evaluating ADMS/DERMS Investments

The National Association of Regulatory Utility Commissioners (NARUC) Center for Partnership and Innovation (CPI) Regulators' Financial Toolbox series explores the types of financial tools utility regulators can use to support integration of electricity system technologies that benefit the public interest. This brief was prepared by Jamie Scripps of Hunterston Consulting LLC and is based upon work supported[1] by the Department of Energy under Award Number DE-OE0000925. The speakers' presentations and recording can be found at www.naruc.org/cpi-1/electricity-system-transition/valuation-and-ratemaking/.

On October 12, 2022, NARUC presented a Regulators' Financial Toolbox Webinar on ADMS/DERMS. The webinar featured remarks from moderator Vice Chair Joseph Sullivan, Minnesota Public Utilities Commission; Chris Villarreal of Plugged in Strategies on behalf of the U.S. Department of Energy (DOE); Ali Ipakchi, Executive Vice President, Open Access Technology International, Inc. (OATI); Ted Burhans, Director of DER Technology, Smart Electric Power Alliance (SEPA); and Commissioner Katherine Peretick of the Michigan Public Service Commission.

The panel and this accompanying brief address:

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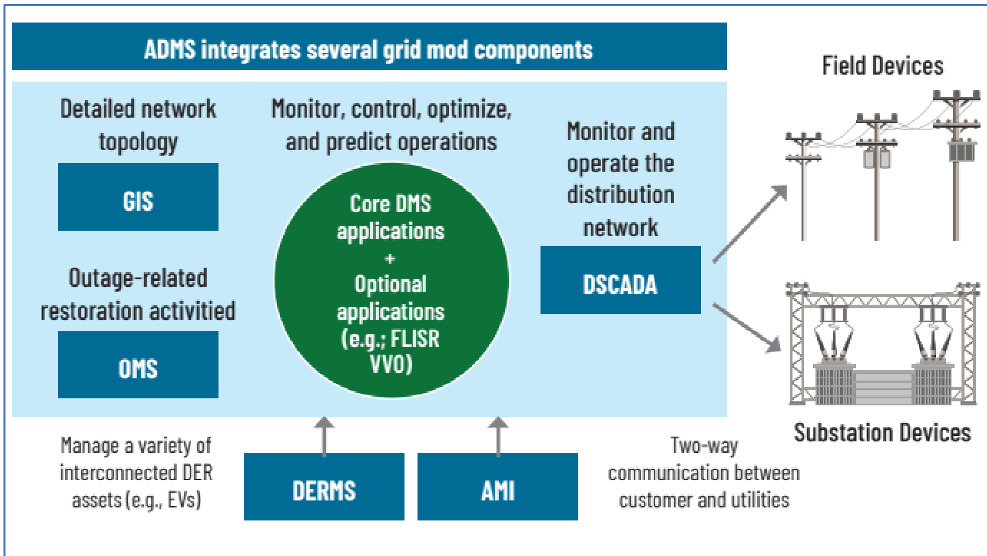
Defining ADMS/DERMS

With the deployment of distributed energy resources (DERs) on the rise, utilities are increasingly focused on the use of distribution control technologies, such as an advanced distribution management systems (ADMS) and distributed energy resource management systems (DERMS).

ADMS is "a software platform that integrates numerous utility systems and provides automated outage restoration and optimization of distribution grid performance."[2] ADMS gives utilities "the capability to proactively manage day-to-day maintenance, peak demand, optimization, and repair efforts. It acts as a centralized repository of data and functions, and it will prescribe and coordinate actions utilizing information from across the utility's distribution system, taking into account renewables or DERs on the system."[3]

A peer of ADMS, DERMS is "a software-based solution that increases an operator's real-time visibility into the status of distributed energy resources and allows distribution utilities to have the heightened level of control and flexibility necessary to more effectively manage the technical challenges posed by an increasingly distributed grid."[4]



Source: Adapted from a DOE Grid Modernization Lab Consortium presentation for Distribution Systems and Planning Training from Tim Wolf March 7-8, 2019. https://e9radar.link/9et

Figure 1: ADMS Integrates Grid Modernization Components. Source: Chris Villarreal, Plugged In Strategies on behalf of U.S. DOE.

Deploying ADMS/DERMS

According to Ali Ipakchi, OATI, before deploying ADMS/DERMS, utilities should lay the appropriate groundwork, including:

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[2] See ADMS/DERMS Webinar, NARUC, Presentation by Chris Villarreal, Plugged In Strategies on behalf of U.S. DOE, at slide 6 (October 12, 2022).

[3] Ibid

[4] Ibid

- Identifying the projected requirements (*i.e.*, functions, scale, performance, cybersecurity), taking into account load growth and customer DER adoption rate, integrated resource plan (IRP) projections, and resiliency needs
- Systems integration requirements and data availability, taking into account operations and customer facing requirements, process and data Integration, and GIS data and distribution network parameters
- Organizational/operational alignment, taking into account distribution system operations, customer services, system and commercial operations, and business process coordination.[5]

Across the country, ADMS/DERMS have been deployed by utilities in a variety of ways. Typically, ADMS and DERMS have been deployed as two separate but integrated systems. A distribution management system (DMS) typically covers the primary distribution circuits focused on flows, voltages, and network configuration. DERMS typically deals with grid-edge and behind-the-meter (BTM) assets, programs, contracts and tariffs, as well as microgrids. FERC Order 2222, and the integration of DERs with bulk power markets, has enhanced the need for integration of DMS and DERMS in support of Distribution System Operator (DSO) operations.[6]

Systems Integration of ADMS/DERMS

With the growing integration of DERs and electrification, and the increased value of demand-side flexibility for reliable power system operations and enhanced customer resilience, it is important that a utility's selected solution architecture support the required expansion in functionality, scale and performance.[7] Figure 2 illustrates systems integration of ADMS/DERMS:

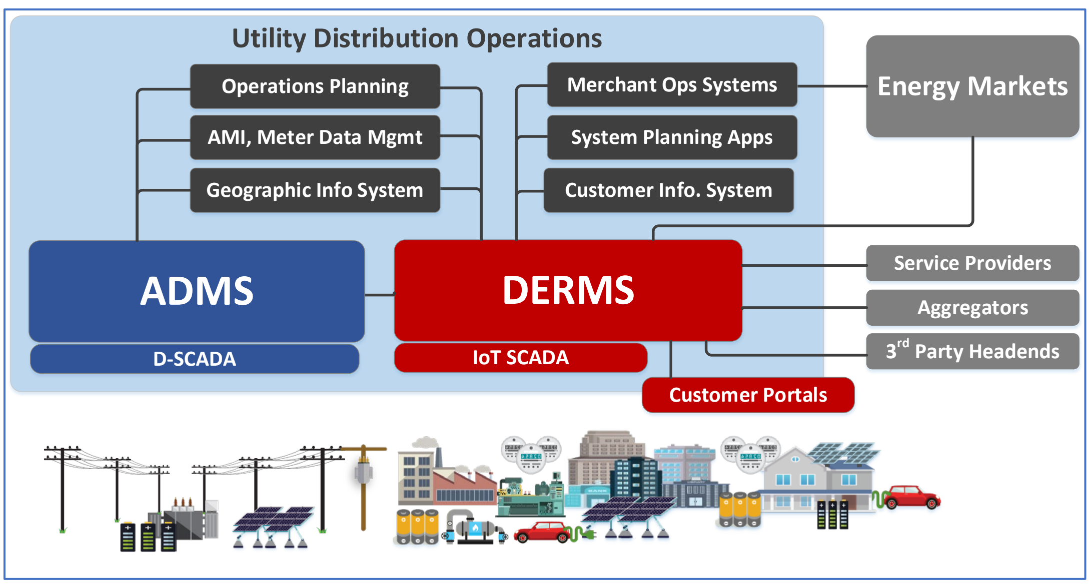

Figure 2: Utility Distribution Operations with ADMS and DERMS. Source: Ali Ipakchi, OATI.

[5] See ADMS/DERMS Webinar, NARUC, Presentation by Ali Ipakchi, OATI, at slide 4 (October 12, 2022).
[6] Ibid at slide 8.
[7] Ibid at slide 9.

For systems integration, secure Web services are a common method for integration across enterprise systems.[8] Depending on the system, various model standards are used. For example, ADMS/DERMS integration could be based on the CIM (IEC61968-70) standard. Integration with external devices is typically based on DNP3.0, with IEEE2030.5 emerging as the standard for DERs.[9]

Costs of Deploying ADMS/DERMS

A variety of initial and ongoing costs are associated with deployment of ADMS and DERMS.

For ADMS, which typically involves on-premise deployment, utilities should plan for the following initial costs:

- License: Platform and selected applications
- Hardware Costs: Servers, data communications
- System Staging: Hardware, software and telecom Integration
- Systems Integration: GIS, Asset Management, AMI, etc.
- System configuration: Network modeling, One-lines, etc.
- Field deployment, Integration and Configuration: RTUs, Alarming, etc.
- Training and Acceptance Testing[10]

For ongoing costs related to the deployment of ADMS, utilities should plan on the following:

- System Maintenance
- Functional and Software upgrades
- Help-Desk Support[11]

Unlike ADMS, DERMS typically involves cloud-based deployment. Utility cost considerations related to the deployment of DERMS include internal resources and budgets; current or planned software deployments; available key personnel; regulatory environment; rate base (pre- or post-test year); customer programs; regulatory asset; ownership of devices; third party aggregators; utility-owned and market-driven DERs (*e.g.*, FERC Order 2222).[12]

For initial costs, utilities should plan on the following:

- License fee
- Solution configuration and initial set-up
- Systems integration with computer information systems ("CIS"), AMI, meter data management systems ("MDMS"), geographic information systems ("GIS"), supervisory control and data acquisition ("SCADA"), ADMS
- Field integration scope and requirements
- Training and Acceptance Testing

For ongoing costs related to the deployment of DERMS, utilities should plan on the following:

- Cloud-based system access (monthly fee)

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[8] See ADMS/DERMS Webinar, NARUC, Q&A Transcript, Ali Ipakchi, OATI (October 12, 2022).
[9] Ibid.
[10] See ADMS/DERMS Webinar, NARUC, Presentation by Ali Ipakchi, OATI, at slide 6 (October 12, 2022).
[11] Ibid.
[12] Ibid at slide 8.

- Secure field integration (telecom fees)
- Data storage and special performance requirements
- System Maintenance
- Functional and Software upgrades
- Help-Desk Support[13]

Often, DERMS is considered an extension of a demand response management system ("DRMS"). The threshold for justifying the costs of deploying DERMS tends to be crossed when it is deemed cost-effective to combine existing demand response values and requirements with opportunities to expand the available dispatchable capacity by integrating DERs. However, specific justifications vary based on a variety of considerations, including prevailing retail rates, renewable portfolio standard ("RPS") and electrification targets.[14]

Paying for ADMS/DERMS

The method of paying for ADMS and DERMS depends on the type of utility. For example, to pay for ADMS, investor-owned utilities (IOUs) tend to seek cost recovery through the rate base, using a system reliability justification that relies on data from the utility's distribution supervisory control and data acquisition (DSCADA) system, and the distribution and outage management systems (DMS/OMS).[15] Cooperative and municipal utilities may perform a cost-benefit assessment, with consideration of the targeted scope and functions of the proposed investment in ADMS.[16]

To pay for DERMS, IOUs may rely on a supply economics and reliability justification.[17] DERMS can be combined with the utility's approach to paying for DRMS applications, with consideration of the targeted scope and functions of the proposed investment.[18] For cooperative utilities, there may be an opportunity for shared implementation of DERMS at the generation and transmission ("G&T") level, with the justification of supporting customer resilience needs, such as with microgrids.[19]

Utility Perspectives on DERMS: SEPA Collaborative Study

SEPA recently undertook a collaborative study related to the deployment of DERMS. The project convened a cohort of utilities to review the DERMS landscape, identify and compare the many emerging variants of DERMS and DERMS modules, develop use cases to create a menu of DERMS modules, articulate alternatives to DERMS to streamline discussions on the value of DERMS internally and with regulators, and identify key DERMS implementation considerations.[20]

The study identified the following drivers of DERMS deployment by utilities:

1) DER adoption
2) Existing types of technology deployed by the utility for reasons of grid visibility and security

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[13] Ibid at slide 6.
[14] See ADMS/DERMS Webinar, NARUC, Q&A Transcript, Ali Ipakchi, OATI (October 12, 2022).
[15] Ibid at slide 7.
[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] See ADMS/DERMS Webinar, NARUC, Presentation by Ted Burhans, SEPA, at slide 2 (October 12, 2022).

3) Existing types of technology deployed by the customer, such as solar PV, smart thermostats, and batteries
4) Costs
5) Customer expectation for green power
6) Regulations (*e.g.*, FERC Order 2222).[21]

Utilities see significant room for improvement in the current state of DER management, which is passive and involves legacy energy efficiency and demand response visibility. The current state is dominated by low-yield programs; if a program has not shown to produce large reductions or grid benefits, it is ignored in favor of higher values.[22]

By contrast, the future state of DER management involves combining DERs into grid-wide resources to simplify control, monitoring, and management of those systems. In the future, DER management will consist of streamlining settings and data; employing algorithms to take actions, often in coordination with a distribution management system ("DMS"); supplying operational information for individual or aggregated DER assets to the DMS; and providing forecasts of DERs.[23]

Depending on the utility, DER penetration levels may not be ready for deployment of full-scale DERMS. In the interim, many utilities are using individual solutions (*e.g.*, demand response and smart thermostats). Currently, visibility tends to be a primary goal, with expanded control being a future state objective. Timelines for DERMS deployment may be phased, and are unique to each utility.[24]

For utilities considering a phased approach, the use of an energy management system (EMS), followed by integration of energy efficiency and demand response, followed by deployment of ADMS, followed by deployment of DERMS, may be worth considering.

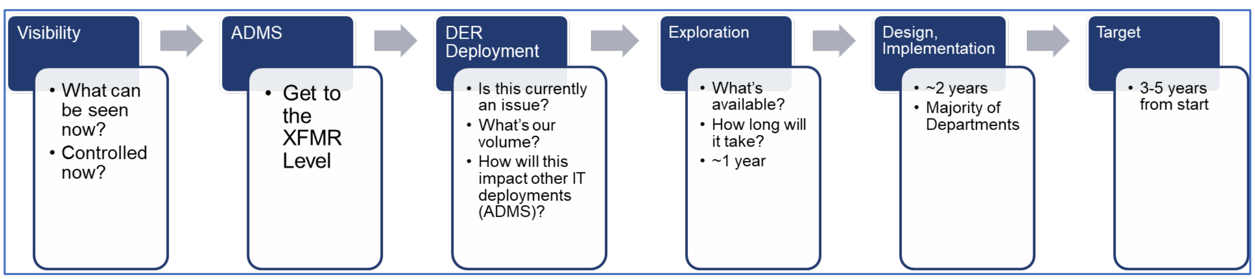

Figure 3: DERMS Deployment Timeline. Source: SEPA.

Overall, as utilities contemplate the deployment of DERMS, the SEPA study recommends that utilities start early, regardless of utility sophistication (see Figure 3). Planning can start immediately, while implementation may be many years out. Customer adoption of DERS will not wait and will only increase in light of the incentives in the Inflation Reduction Act ("IRA") and overall declining costs. Utilities looking to deploy DERMS would also benefit from reviewing the use cases of similar utilities, such as IOUs, cooperatives, and municipal utilities.[25]

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[21] Ibid at slide 6.
[22] Ibid at slide 7.
[23] Ibid.
[24] Ibid at slide 9.
[25] Ibid at slide 10.

State Snapshot: Michigan

The Michigan Public Service Commission has recently evaluated ADMS and DERMS investments and found them to be a reasonable and prudent response to industry trends and system requirements. Michigan's distribution grid infrastructure is nearing end-of-life throughout the state, and the state's major utilities need to replace and upgrade the distribution grid while simultaneously preparing for the future. As DER penetration continues to grow, so does the need for smart distribution grid management systems (see Figure 4).

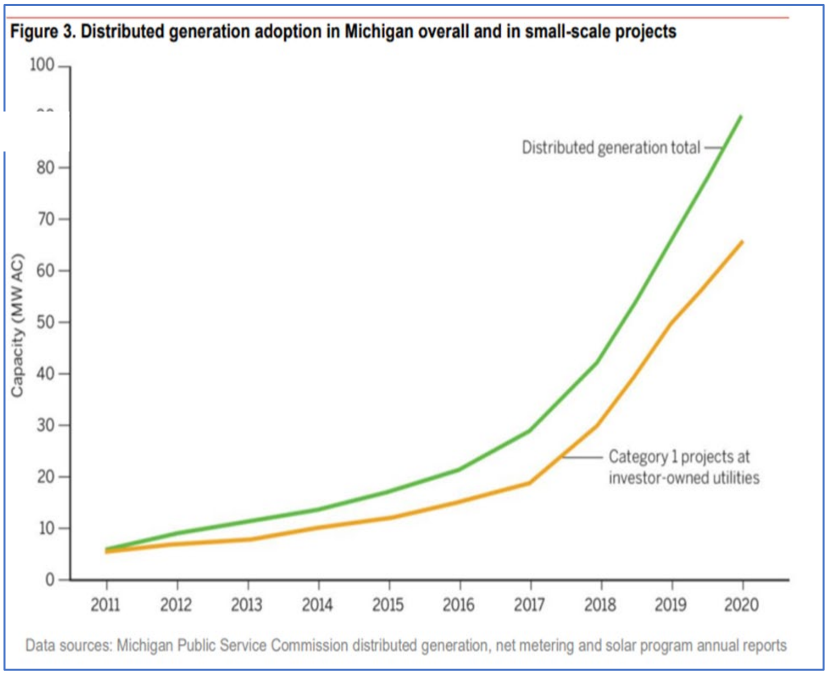

Figure 4: DER Adoption in Michigan. Source: Michigan Public Service Commission.

Severe Weather and Outages

In recent years, Michigan has been hit with a significant number of severe storms. For example, in summer 2022, an 8-minute storm took out power for hundreds of thousands of Michigan residents and resulted in downed wires that led to multiple fatalities. The frequency of these severe storms is expected to increase due to climate change. The Commission sees the potential for a fully scaled ADMS and outage management system to help make the system more resilient by streamlining data tracking and making downed-wire responses more efficient.

The 8-minute summer storm occurred during the first week of school for many and affected schools were out of power for multiple days. It is clear that better management of outages, with more of an ability to isolate the problem and prioritize critical facilities like schools, is urgently needed. The Commission sees the deployment of ADMS systems in Michigan as a start. [26]

[26] See ADMS/DERMS Webinar, NARUC, Presentation by Commissioner Katherine Peretick, Michigan Public Service Commission, at slide 2 (October 12, 2022).

ADMS/DERMS in Rate Cases and DSPs

The Commission has approved ADMS and DERMS investments in previous utility rate cases. It is important to note that these investments required proper planning and integration with distribution system plans (DSPs). Michigan has two major electric utilities that are approximately equal in size, covering 80 percent of the state's customers. Both of these utilities are currently in the process of deploying ADMS.

Michigan utilities have included outlines of their ADMS and DERMS planning in multiple venues, such as in integrated resource planning and DSPs. The Commission first directed the utilities to file five-year DSPs in late 2017. Given the level of investment being made in the electric distribution system, it was important to understand the longer term investment strategies aimed at the distribution system, as well as the cost, benefits, and other effects on customers.

Michigan's two largest utilities have filed two iterations of these DSPs. The process includes heavy stakeholder engagement. Additionally, the Commission recently issued an order refining the inputs that are required as a part of the DSPs. The updated requirements call for more reporting, more measurement, and demonstration that measurable improvements will result from the distribution system investments.

Approving ADMS

For example, a measurable improvement that could result from ADMS deployment is a reduction in System Average Interruption Duration ("SAIDI") minutes. ADMS data tracking has the potential to improve downed wire response and work order management, which should translate to fewer SAIDI minutes (minutes of non-momentary electric interruptions per year) that the average customer experiences. In its proposal for funding ADMS, one of Michigan's major utilities claimed that ADMS would reduce All-Weather SAIDI (the average minutes of interruption for all customers served, regardless of weather conditions) by 29 to 60 minutes. Overall, the utility's projected reduction in SAIDI minutes was significant in the Commission's approval of the ADMS investment.[27]

In the utility rate case, the Commission authorized the creation of a regulatory asset for the ADMS.[28] As happens in any rate case, there was a lot of testimony back and forth for approving such a large investment, especially because the technology was relatively new and not yet proven. Some argued that a 5 percent reduction in SAIDI minutes was insufficient to justify the cost. In the end, the basis for approval was the significant improvements in reliability that would come with integration with DERs, as well as the reduced substation outage risk that was offered by ADMS. It was important that the justification for the costs be contextualized within the longer-term scope of the utility's DSP.[29]

Rejecting DERMS

The Commission issued an order against funding a major utility's first DERMS proposal, stating that the company failed to explain how reliability would benefit from the DERMS program.[30] The utility also failed to explain how the information that would be generated from the program would be integrated

[27] Ibid.
[28] Michigan Public Service Commission, Case No. 20162, Order dated May 2, 2019.
[29] See ADMS/DERMS Webinar, NARUC, Presentation by Commissioner Katherine Peretick, Michigan Public Service Commission, at slide 5 (October 12, 2022).
[30] Michigan Public Service Commission, Case No. 20697, Order dated December 17, 2020.

into system operations. At the time, DER penetration was simply too low. As a result of that order, the Commission encouraged the utility to include additional detail about how DERMS and other technologies would be sequenced and utilized for the benefit of its customers in future plans.[31]

Questions for Consideration

As the Commission evaluated whether it was a reasonable and prudent decision to fund these ADMS/DERMS projects, it considered the following questions:

- What are the benefits to the customer? Are they measurable and quantifiable?
- How does ADMS improve reliability/outage management?
- Describing requests for funding: what are the individual components of an ADMS plan and their associated costs?
- What is the timeframe, and what could impact that timeframe?
- What is the selection process for a specific ADMS vendor over another vendor?
- Further, why use a vendor as opposed to an in-house project?
- What additional data functionality is required for the project? What additional data will become available as a result of the project?
- Is ADMS/DERMS part of a longer-term plan, and if so, what is that plan? What other costs/investments will be needed in the future to support ADMS? How will DERMS and other technologies be sequenced and utilized to the benefit of customers?
- What is the life of the investment? When will the technology become obsolete? What updates will be required?
- Has similar technology been used and worked in other states?[32]

In addition to the questions listed above, key considerations have included the potential for scalability, DER penetration and gross projection, as well as the cost to customers and the data requirements required to roll out the ADMS/DERMS projects, such as SCADA and AMI. The timing of the investment must be reasonable and prudent. With DERMS, the Commission found that there must be sufficient DER penetration to justify the investment.[33]

Regulatory Consideration of ADMS/DERMS

Building from the foundation established in its *Voices of Experience* series, the U.S. Department of Energy (DOE) recently published a report titled A System in Transition: An Overview of Newest Voices of Experience Report: Focus on Distribution Controls.[34] Informed by a review of over 100 dockets and multiple conversations with state energy regulators, the report's findings share priority topics identified by regulators, representing the complexity and the opportunity that grid modernization presents to them.[35] The report focuses on distribution control technologies, advanced metering infrastructure

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[31] See ADMS/DERMS Webinar, NARUC, Presentation by Commissioner Katherine Peretick, Michigan Public Service Commission, at slide 6 (October 12, 2022).
[32] Ibid at slide 4.
[33] Ibid at slide 5.
[34] U.S. DOE, A System in Transition: The Influence of Next Generation Technologies (May 2022), available at https://e9radar.link/DOE/NxGen
[35] See ADMS/DERMS Webinar, NARUC, Presentation by Chris Villarreal, Plugged In Strategies on behalf of U.S. DOE, at slide 2 (October 12, 2022).

(AMI), and electric vehicles (EVs),[36] with an additional focus on data and coordination between state agencies to support EV deployment.[37]

While distribution control technologies offer a number of potential benefits, the report highlights the following potential challenges related to the effective use of ADMS and/or DERMS:

- Identifying needed functionality
- Determining timing for implementation
- Obtaining the necessary technical expertise
- Learning from other jurisdictions[38]

In light of both the potential benefits and challenges related to distribution control technologies, Commissions are asking a number of important questions about ADMS/DERMS, as illustrated in Figure 5.

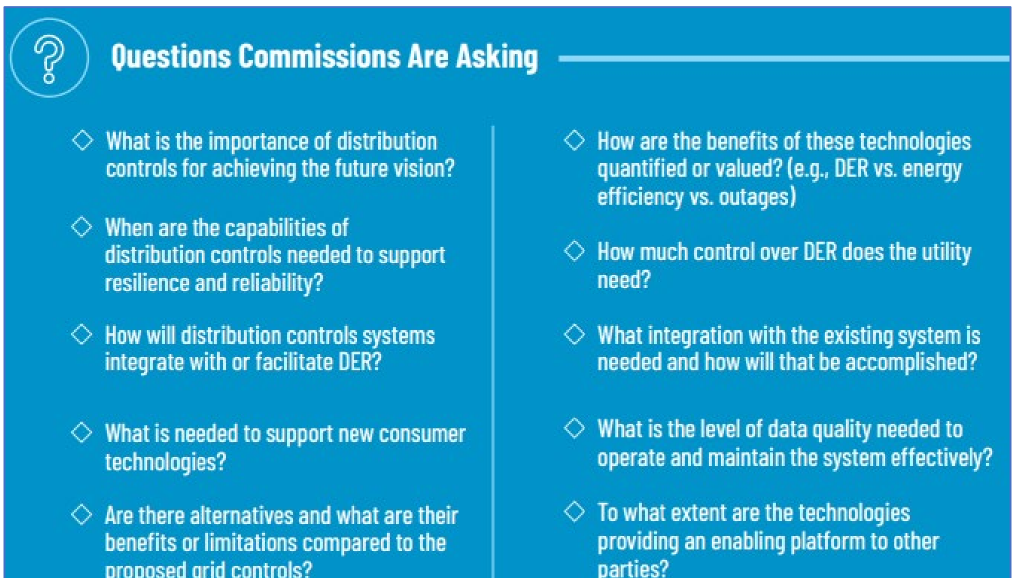

Figure 5: Questions Commissions are Asking re: ADMS/DERMS. Source: Chris Villarreal, Plugged in Strategies on behalf of U.S. DOE.

The report notes that the following four considerations are important when evaluating proposals for distribution control technologies:[39]

- What other utility and/or customer systems or technologies will interact with the investment?
- How will the technology seamlessly integrate with other systems?
- What other investments do the benefits for the investment depend on?
- Will the other systems and technologies be able to communicate with each other?

Kentucky provides an illustrative example. There, due to low solar adoption, the Kentucky Public Service Commission sought more information from the utility about the need for ADMS/DERMS. The

[36] Ibid, at slide 4.
[37] Ibid.
[38] Ibid, at slide 8.
[39] Ibid at slide 7.

Commission was also interested in whether other technologies might be more appropriate, given the circumstances.[40] Taking a slightly different tack, the Virginia State Corporation Commission conditionally approved a DERMS investment, with subsequent reporting requirements, including confirmation that the DERMS would meet the requirements of FERC Order 2222 and PJM.[41] The Michigan Public Service Commission has approved both ADMS and DERMS investments by the major utilities in its state (see State Snapshot).

Distribution control technologies provide greater visibility into operations of the distribution system, which can help utilities, regulators and stakeholders better understand the impacts of DERs on the distribution system. However, the potential benefits of ADMS/DERMS are conditional upon the current and future amount of DERs on the distribution system.[42] Aligning these technologies with broader distribution system planning efforts can help identify when and where these technologies are needed.[43]

Resources for More Detailed Information

Smart Electric Power Alliance. (2019). DERMS Requirements: Distributed Energy Resource Management System, Version 2.0. Retrieved from https://sepapower.org/resource/distributed-energy-resource-management-system-derms-requirements/.

Smart Electric Power Alliance. (2021). DERMS Terms – Going Beyond the Buzzword. Retrieved from https://sepapower.org/knowledge/derms-terms-going-beyond-the-buzzword/.

U.S. Department of Energy. (2015). Voices of Experience: Insights into Advanced Distribution Management Systems. Retrieved from https://www.energy.gov/sites/prod/files/2015/02/f19/Voices%20of%20Experience%20-%20Advanced%20Distribution%20Management%20Systems%20February%202015.pdf

U.S. Department of Energy. (2022). A System in Transition: The Influence of Next Generation Technologies. Retrieved from https://www.energy.gov/sites/default/files/2022-05/A%20system%20in%20transition_5.13.22_web.pdf

[40] Kentucky Public Service Commission, Case No. 2020-00349, Order dated September 24. 2021, available at https://psc.ky.gov/pscscf/2020%20cases/2020-00350/20210924_psc_order.pdf.

[41] Virginia State Corporation Commission, Case No. PUR-2021 -00127, Order dated January 7, 2022, available at https://scc.virginia.gov/getattachment/e8e72f65-b3a7-45b3-a395-1f34431715c5/DEV-Grid-Transformation-Final.pdf.

[42] See ADMS/DERMS Webinar, NARUC, Presentation by Chris Villarreal, Plugged In Strategies on behalf of U.S. DOE, at slide 7 (October 12, 2022).

[43] Ibid.