

NRECA's New Energy Resource Model Initiative Case Study Series

NRECA's new case study series brings into focus a new energy resource model that is coming to fruition at many electric cooperatives — a traditional utility model turned inside out and upside down. The fuel mix for electric generating units is changing. It includes wind generation, energy storage and solar — both utility-scale and behind-the-meter.

The ways in which consumers interact with these resources also are changing, with electric vehicle charging, consumer-installed smart thermostats and innovative rate plans coming into play. As these resources become an integral part of the supply and demand portfolio, their combined effect will be to displace energy produced by traditional power plants and disrupt the utility status quo.

The changing generation mix impacts grid operations in many ways. System load patterns, changes in daily, monthly and seasonal electricity usage that have remained stable for decades, are becoming inverted as solar reaches higher penetration levels and offsets more consumer demand. Economic dispatch of power plants is shaped by “must-run” assets such as solar and wind, whose output is continuously fed into the grid when the sun is shining or the wind is blowing.

Power flows across the grid are now bi-directional. Because of these changes, the relationship between wholesale power suppliers, including generation and transmission (G&T) cooperatives, and their distribution members is also changing. Adapting to this new model and managing the associated business disruption are key challenges faced by distribution co-ops and G&Ts alike.

The following is a case study of a G&T cooperative, Old Dominion Electric Cooperative (ODEC), working closely with its members to transition its power supply toward sustainable, low-carbon resources by building a portfolio of distributed solar projects across three states.

Find out more about NRECA's New Energy Resource Model initiative and additional case studies on our website: <https://www.cooperative.com/topics/power-supply-wholesale-markets/Pages/New-Energy-Resource-Model-Initiative.aspx>.

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Creating Value by Working Together: Old Dominion Electric Cooperative and Its Members Develop a Portfolio of Distributed Resource Projects

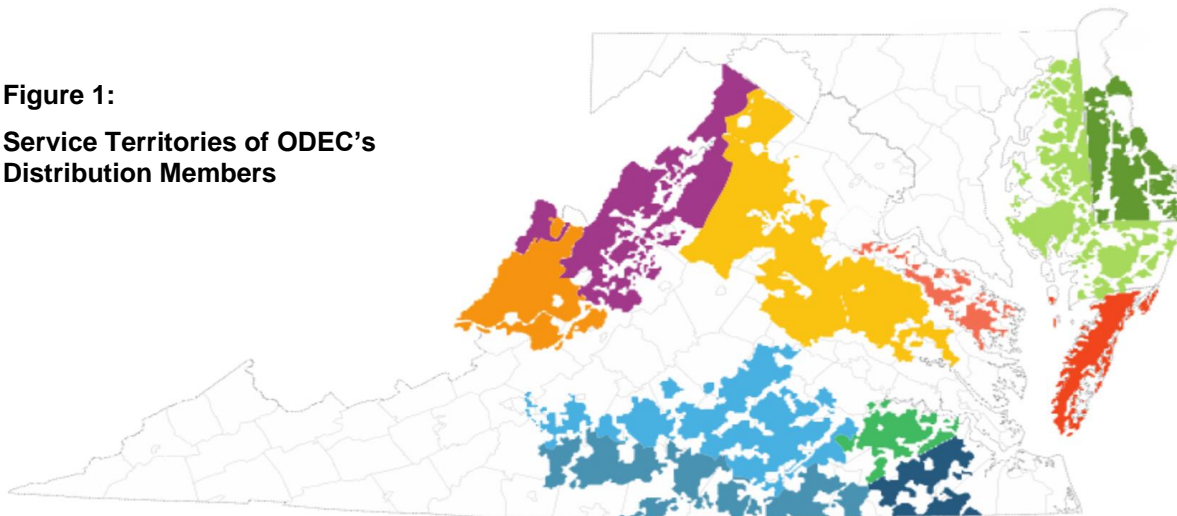


ODEC and Its Member Cooperatives

Old Dominion Electric Cooperative (ODEC) is a not-for-profit, generation and transmission (G&T) cooperative that supplies power, transmission, and other services to eleven distribution cooperatives in three mid-Atlantic states. Eight of ODEC’s member cooperatives are on the Virginia mainland and three are on the Delmarva Peninsula – one each in Virginia, Maryland, and Delaware. The population of consumer-members of the distribution cooperatives totals approximately 1.5 million, spread across seventy counties that stretch from the outer suburbs of Washington, D.C. to the North Carolina border, and from the Atlantic shore to the Appalachian Mountains. Figure 1 shows the wide, geographic coverage of ODEC’s member distribution cooperatives. Approximately 90 percent of ultimate consumers’ meters and 64 percent of megawatt-hour (MWh) sales are residential.



Figure 1:
**Service Territories of ODEC’s
Distribution Members**



ODEC itself is not typical of NRECA member G&Ts in several key ways. It supplies power to a multistate network of cooperatives, is rate-regulated by the Federal Energy Regulatory Commission (FERC), is a Securities and Exchange Commission (SEC) registrant, and is not a USDA Rural Utilities Service (RUS)

borrower. Moreover, ODEC’s nine distribution cooperatives in Virginia are rate- regulated, while Delaware Electric Cooperative has been member-regulated since 2006 and Choptank Electric Cooperative in Maryland recently changed from state rate regulation to member regulation.

In other ways, the co-op is very much a mainstream G&T. In the words of Kirk Johnson, ODEC’s Senior Vice President of Member Engagement, “We are member-driven and member-centric. We are always looking for ways to demonstrate the value of working with our members. Together, we can achieve results none of us could achieve individually.” ODEC’s distributed solar, battery and strategic electrification projects, highlighted in this case study, are good examples proving the point that working together creates value for the members of the G&T, and ultimately for the communities and people they serve.

ODEC has also made significant changes to its power supply by actively pursuing renewable energy and significantly reducing its carbon dioxide emissions. Between 2005 and 2019, the co-op reduced CO₂ emissions by more than 40%. How? Figure 2 illustrates the significant shift in ODEC’s resource mix that has taken place, with energy from coal-based resources being replaced by natural gas and renewable energy.

“ODEC is proud to be keeping our members’ power affordable and reliable, while increasing our use of renewable energy sources and reducing greenhouse gas emissions,” said Marcus Harris, CEO of ODEC. “Our CO₂ emissions rate is lower than national and regional averages, and we expect continued progress as we work with our members to develop additional solar projects.”

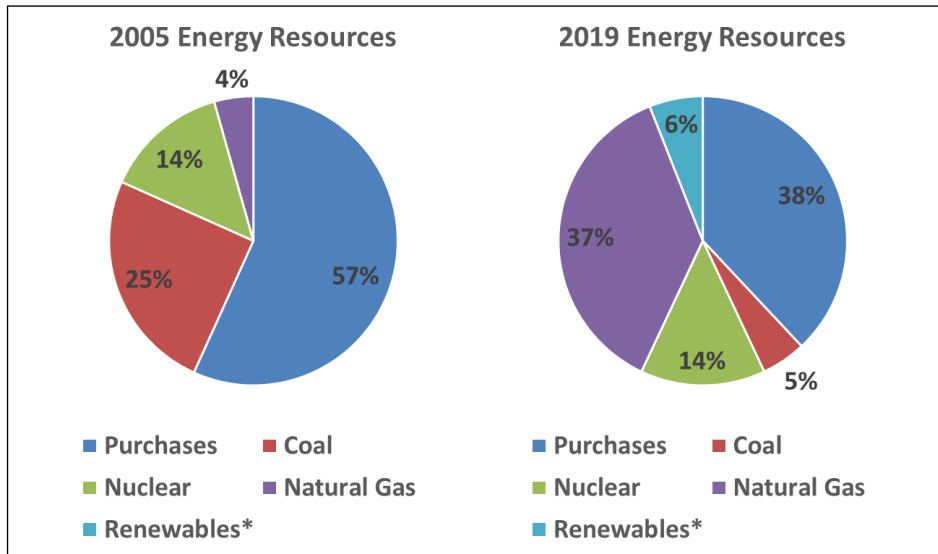


Figure 2.
Changing ODEC
Energy Resource Mix

* Renewable resources are through PPAs, not ownership and ODEC sells renewable energy credits related to these purchases to its members and non-members.

Strategic Thinking: Power Planning at ODEC

For most of its early years, ODEC had relied on bilateral and market purchases to meet its load obligations. That changed in 1983, when ODEC’s membership agreed to purchase a portion of an existing nuclear power

plant¹ and evolved further when the members decided to build a large, state-of-the-art coal plant² in 1995 and natural gas-peaking plants in 2003 and 2004.

After deciding against building a new coal-based power plant in Virginia in 2010, ODEC reviewed with its members the relative benefits and risk of owning resources or continuing to rely on the market (which still supplied more than half of ODEC's load at that time). ODEC participates in the energy, capacity, and ancillary services markets of the PJM Regional Transmission Organization. ODEC and its members made a strategic decision several years ago to reduce its reliance on market purchases, a shift evident in Figure 2. After a thorough evaluation of market bids solicited through a Request for Proposals, ODEC's members agreed that building a new, combined-cycle natural gas-fired plant was the right strategic move to diversify ODEC's power supply while hedging against electricity market risks. The investment decision was made, and the cooperative's new plant came online in 2018. The Wildcat Point generation facility is one of the cleanest natural gas plants in the country, with roughly 1,000 MW of generating capacity, enough to power 390,000 homes in the region.

One question pondered during the decision-making discussion has continued in ODEC's board room ever since: "Will we ever build another large-scale power plant?" The question has no definitive answer at present, as the G&T continues to evaluate a portfolio of diverse resources that includes ownership and purchases. However, further renewable resource development, energy storage evaluation, strategic electrification, and further de-carbonization are among ODEC's strategic planning goals, along with a raft of other, equally important objectives:

- Maintaining power reliability.
- Managing price volatility.
- Assuring financial strength.
- Promoting economic development.
- Supporting cooperative growth in membership and electric load.
- Maintaining stable, competitive rates.

ODEC's board room discussions now focus on much more than traditional power supply, and meeting these strategic priorities requires a careful balancing act on the part of ODEC and its member cooperatives. Each element of the strategic plan carries risks, as well as member benefits. ODEC and its members are managing this transition through an inclusive, member-focused planning process, which has been an effective strategy delivering tangible results. Its growing portfolio of distributed solar projects is a case in point. However, the closeness between ODEC and its distribution members gives rise to many other innovations as well, as the experience of Delaware Electric Cooperative indicates (see sidebar).

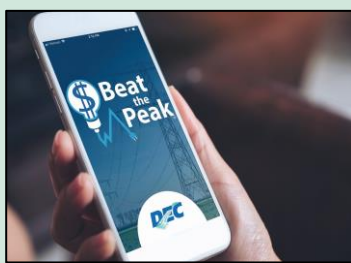
¹ ODEC owns an 11.6% share of North Anna Nuclear plant.

² Clover Power Station is a 848 MW coal plant that ODEC owns 50/50 with Dominion Energy, the neighboring investor owned utility that operates the plant.



Delaware Electric Cooperative Boosts Decision Making with Real-Time Data, Predictive Analytics and Artificial Intelligence

Delaware Electric Cooperative (DEC) is ODEC's only distribution member in Delaware. In fact, it is the only electric cooperative in the state. Serving just over 100,000 meters, the co-op has been a technology leader for a long time. Among its other innovations, DEC created the Beat-the-Peak demand-reduction program that has been widely adopted by utilities nationwide over the past decade.



DEC's CEO and president, Bill Andrew, is the kind of leader likely to thrive when the utility industry fully engages the challenges associated with the new energy resource model. He embraces change and is constantly on the lookout for technologies that will give his staff greater insights into the business of serving members and operational enhancements that will ensure continued high reliability and responsive service.

For DEC this is partly about keeping up with its service territory. Its areas of Delaware are growth-oriented and high-tech, although agriculture remains the most important industry. Internet access is excellent, thanks in large part to DEC's partnership with Lighttower Fiber Networks to install a 250-mile, all-fiber network across the Cooperative's service territory in Kent and Sussex Counties. The network enables DEC to access electrical monitoring and control devices across its electrical system during power outages as well as peak-demand periods.

Andrew's relationship with his G&T goes well beyond power supply. As Andrew says, "Marcus Harris and his team at ODEC are very receptive to new ideas. Plus, ODEC has come to us with several options to expand solar and other renewable energy resources and share the economic benefits. This gives us agility as we seek to create opportunities with our own members." Andrew and his staff are now working closely with the G&T on what he calls "data technology strategies" to determine what resources, strategies and modes of operation will be most economic. Significant technology tools being applied include:

- **Artificial intelligence** to identify subtle usage and operational patterns and decision making thresholds.
- **Predictive analytics** using data from automated data systems such as Meter Data Management (MDM), Supervisory Control and Data Acquisition (SCADA) and Distribution Automation (DA).
- **Dashboards** that present granular, real-time data in an understandable way to draw a high-resolution picture of what is happening across the distribution system.

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One of DEC's largest costs comes from coincident peak demand – the cooperative's system-wide demand at the time of the regional transmission zone's peak. Since DEC's consumer-member population is 92 percent residential, the co-op's peak tends to be strongly coincident and significant demand-reduction potential exists. Coincident Peak events determine demand costs each month, so there is an economic and financial incentive to moderate them with load control measures and [Beat-the-Peak](#) alerts. However, given the limited number of load control events available to DEC under its programs, there is also an incentive to avoid calling for demand reductions unnecessarily. The use of predictive analytics helps refine the decision making in three ways:

- One-to-two week ahead predictions of likely peak and non-peak days.
- Twenty-four hour ahead predictions of type of peak and timing.
- Specific recommendations for when to trigger a load control event.

Andrew sums up his relationship with ODEC in broad and thoughtful terms, “ODEC understands the impacts its decisions have on its members. They work with us continuously on issues where value intersects with cost. This has transformed ODEC from being a “price taker” in the wholesale energy market to a “price maker.” And as an ODEC member, this enables us to be more creative.”

A Multi-Faceted Solar Development Model

ODEC's current strategic plan envisions 200 MW of solar capacity in the power supply mix by year-end 2023, with further solar development that is economically justified after that. ODEC and its member cooperatives have, for the purpose of developing coherent policies and legislative strategies, grouped solar resources into three, discrete categories as follows:

- **Consumer-owned solar** – Consumer-members of ODEC-served cooperatives that have solar systems on the roofs of their homes and businesses are eligible for net metering subject to certain limitations.
- **Distributed Solar** – Distributed solar is comprised of approximately fifteen projects (3 to 5 MW each) to be built in members' service territories. These projects are located behind the wholesale meter, which provides ODEC, the host cooperative, and all other ODEC members with certain cost savings under PJM's wholesale market rules.
- **Utility-scale solar** – ODEC already has 30 MW of existing solar acquired through power purchase agreements (PPAs). The G&T is working on a 75 MW project to be built on a site previously acquired for a coal plant. In addition, ODEC is working with other developers (at various stages of negotiations) for another 100 MW (+/-) to be acquired through PPAs. All of these projects are rolled into the overall energy portfolio that ODEC provides to its members.

Each of these solar energy resources has different characteristics and, as such, must be approached with specifically crafted policies. Separate development paths exist for net-metered, distributed and utility-scale solar resources. Policies that harmonize with this structure — both at the cooperative and the state-level — are diligently pursued.

Distributed Solar Projects

ODEC and its members developed a strategy in 2018 to add up to 25 MW of distributed solar generation capacity throughout the territories of ODEC's member systems by year-end 2023. As part of this strategy, ODEC enlisted the National Renewables Cooperative Organization (NRCO) to help identify a "strategic partner" that could best deliver these projects. The RFP was sent to 26 potential bidders. In 2019, ODEC signed an agreement with EDF Renewables, the winning bidder, to develop 30 MWac³ of solar power on 10 to 12 prospective sites across ODEC member service areas. EDF Renewables is responsible for project development, including permitting, design, engineering, construction, and site commissioning. Earlier this year, the partnering plan target was increased to 60 MWac across 15 sites. ODEC will buy the output of these solar installations at a fixed rate under PPAs.

ODEC will offer these projects to members subject to several pricing options:

- As a **component of the overall energy mix** with any PJM capacity value savings (due to the projects all being behind-the-wholesale-meter) shared between ODEC and the host distribution co-op.
- As "**community solar**" resources that ODEC's member distribution co-ops can offer their member-consumers at a fixed price.
- Or as a **combination** of the above.

Utility-Scale Solar Projects

The bulk of solar capacity in ODEC's resource plan will come from larger utility-scale solar projects being developed by third parties and made available to ODEC's members through PPAs. ODEC plans to have more than 100 MW of utility-scale solar online by the end of 2023. This approach provides the predictable revenue stream that projects need to obtain financing, while limiting project risk to ODEC and its members. In 2017, ODEC entered two, long-term PPAs to buy 30 MW of solar power from projects owned by Dominion Generation. Both projects began commercial operations that year.

- The Clarke County Solar project is a 10 MW solar power plant located in Rappahannock Electric Cooperative's service territory.
- The Cherrydale Solar Project is a 20 MW solar power facility in A&N Electric Cooperative's service territory.

³ MWac is a measure of generating capacity after the transformation of DC power to AC power through inverters.

A year later, ODEC entered a long-term PPA to buy power from the Cabin Point Solar Facility in Sussex County, VA, a 75 MW solar-power facility, with an anticipated commercial operations date in 2022. As part of that arrangement, ODEC plans to sell to the developer land that was previously purchased to build a coal-fired power plant. ODEC has also entered a PPA to purchase solar energy from a utility-scale project to be constructed adjacent to its Clover coal-fired power plant and is evaluating several potential projects submitted following its recent Request for Proposals.

A Multi-faceted Battery/Energy Storage Development Model

Like ODEC's development of its distributed solar program, its efforts to develop batteries began with a multi-tiered strategy developed as part of the co-op's strategic planning process. During one meeting in 2019 to discuss how to move forward on batteries, ODEC executives asked the distribution system CEOs whether they wanted to deal individually with battery developers or have ODEC serve as a central clearinghouse for any efforts. All distribution member CEOs agreed that working through ODEC would provide economies of scale, coupled with the G&T's staff expertise, to provide value to its members.

As with other cooperative efforts, ODEC formed a working group to identify various business cases for battery development and to present staff from its member cooperatives with up-to-date information on the state of utility-scale battery installations. As a result of these and other conversations, at least five of ODEC's members have identified use cases for batteries on their systems, and ODEC will coordinate the purchase and installation of the batteries. The question of who is best able to operate the batteries will be a part of continuing discussions between ODEC and its members.

Accelerating Strategic Electrification Efforts

ODEC and its members have accelerated their work on beneficial electrification efforts, which they call "Strategic Electrification." Once again, the effort is part of ODEC's strategic plan developed between the co-op's management and its Board of Directors.⁴

Earlier this year ODEC partnered with the Beneficial Electrification League, the Virginia-Maryland-Delaware Association of Electric Cooperatives and Virginia electric cooperatives to host a virtual Electrify!Virginia conference to bring a diverse group of stakeholders together. Future efforts will involve identifying common public policy objectives among the groups that participated and finding other opportunities to bring value to consumers and the environment.

In the transportation area, ODEC provides an electric vehicle educational tool – ChooseEV – to all ODEC members to use on their websites. The tool gives member-consumers an easy-to-navigate web portal to help them decide whether to buy an EV, and if so, which model(s) might best meet their needs. The tool will be expanded in 2021 to include a car dealer locator module. ODEC has partnered with three other G&Ts (Central Electric Power Cooperative, Inc. in South Carolina, Cooperative Energy in Mississippi, and North Carolina Electric Membership Corporation in North Carolina) and Advanced Energy to provide a seven-part webinar series for cooperative staff (both at the distribution and G&T levels) with up-to-date information on

⁴ The ODEC Board of Directors is made up of the CEO of each member cooperative, along with one director-director from each member cooperative.

all-things EV, including the state of the market, charging infrastructure, and EV impacts on the grid, among other topics. The intent of these sessions is to enable cooperative staff to serve as the EV expert for their end-use members.

ODEC and Central Electric Power Cooperative are partnering with NRECA and a major research university to develop and utilize an EV Planning Tool that will identify ideal locations for chargers in electric cooperative service territories.

ODEC is supporting Delaware Electric Cooperative with a work-place charging pilot and is in discussion with other distribution cooperative member-owners on similar pilot programs. ODEC held an EV ride-and-drive event at the Richmond Raceway in 2018 and is planning to hold another event in (depending on the state of the COVID pandemic).

To help member-consumers save on home heating costs, ODEC and its members will be launching a pilot HVAC replacement program in 2021. Working with local weatherization agencies, this pilot program will assist homeowners switch from fuel oil or propane to electric heat pumps, which will save on home heating costs as well as reduce overall greenhouse gas emissions.

What the Experience of ODEC and Its Members Tells Us

There are several novel aspects of this case study that should not escape the attention of the reader:

- Partnering with a major renewable project developer to distribute solar projects across eleven distribution cooperatives, relying entirely on PPAs instead of direct ownership.
- Wholesale rate options for how solar projects are handled between the G&T and its distribution members.
- Development of state-of-the-art data systems that enable near-real-time decision making.
- Partnering with non-traditional organizations ranging from environmental NGOs to major research universities can leverage the co-op's work on behalf of its members.

Yet, the most remarkable aspect of this case may be the question ODEC managers posed a few years ago: "Will we ever build another large-scale power plant?" These are compelling, thought-provoking words that require thinking outside the box. ODEC and its member cooperatives have adopted a resource planning strategy that moves in a new direction and their collaborative approach appears to be effective. Part of the value that comes from a G&T working side-by-side with its distribution members on policy matters is in overcoming limitations that might otherwise exist. Distribution members need not understand all the intricacies of participation in a complex, real-time, electricity market such as PJM. G&Ts need not understand all the nuances of day-to-day, retail operations and state regulations governing retail distribution services. As ODEC's Johnson puts it, "You really need to know the market and operating environment you are in, and design programs around those realities to be successful." The success to date of these cooperatives' solar and battery development strategy seems to bear this out.

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