Grid Modernization Cost-Benefit Frameworks and Tests

Examples and Results

January 2022

Smart. Focused. Done Right.®

scottmadden
MANAGEMENT CONSULTANTS

COST-BENEFIT FRAMEWORKS IN GRID MODERNIZATION: AN INTRODUCTION

The electric grid in the United States is on the precipice of significant change. Increasing penetration of distributed generation and rapid expansion of intermittent renewable generation to meet decarbonization commitments will bring increasing complexity to core utility planning and operational functions. Further, as transportation and heating are increasingly electrified in the coming years, the essential nature of uninterrupted electric service for customers will become paramount. These trends will require a more flexible, reliable, and resilient grid. Utilities are turning to modernization initiatives to proactively prepare for these changes and build tomorrow's grid.

In a prior publication, ScottMadden outlined four key principles that utilities considering grid modernization programs should keep in mind to best position their proposals for success with regulators. These principles in that paper stress the importance of outlining the benefits to customers. To gain approval for these programs, utilities must demonstrate the value of the program through cost-benefit analysis to justify program costs to regulators and customers. The specific methodologies and the application of cost-benefit tests vary widely across jurisdictions, and there is not an "industry standard." In this paper, we will define commonly used cost-benefit tests, examine examples where these tests have been used in a cost-benefit framework, and highlight key takeaways from these examples.

THE FIVE COST-BENEFIT TESTS

A cost-benefit framework typically consists of one or more cost-benefit tests and guidance on how to apply them to various investments or programs. In most cases, these tests were initially developed for energy efficiency (EE) or demand side management (DSM) programs, and they have been adapted for grid modernization technologies. There are five frequently used cost-benefit tests to assess grid modernization programs. Regulators may define the tests to be used in their cost-benefit framework (e.g., New York defined a framework consisting of three tests as part of its Reforming the Energy Vision proceeding), or utilities may have the flexibility to select the test(s) that best fit the investments being considered.

Each test measures different aspects of cost-effectiveness and assesses the program's impact on different stakeholders. In the same way that key financial metrics like net present value, internal rate of return, and payback period are used in combination to provide insights into different aspects of an investment decision, a combination of these tests provides a holistic view of a grid modernization program's impact beyond just costs and direct savings. A value equal to or greater than 1.00 for each of these tests indicates the program has positive value for the program stakeholders. A summary of each test based on the Environmental Protection Agency's definition[1] is provided in the table on the next page:

[1] "Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers," U.S. Environmental Protection Agency, November 2008

Cost-Benefit Test	Description
Utility Cost Test (UCT)	The UCT measures the cost-effectiveness of a program from the viewpoint of the sponsoring utility or program administrator. It measures direct cost savings to the utility compared to the costs to design, deliver, and manage projects or programs.
Total Resource Cost (TRC)	The TRC assesses the cost-effectiveness of a program by assessing whether the total cost of energy in the utility's service territory decreases. It compares program benefits to avoided supply costs, program administration, and equipment upgrade costs.
Societal Cost Test (SCT)	The SCT is a variant of the TRC and expands the TRC by incorporating the point-of-view of all of society, including externalities like the societal cost of carbon or land/water usage. The TRC and the SCT differ in that 1) the TRC uses a cost of capital discount rate while the SCT uses a lower societal discount rate, and 2) the SCT also includes quantifiable benefits attributable to a program that would otherwise be considered externalities, such as avoided pollutants and other indirect benefits.
Ratepayer Impact Measure (RIM)	The RIM assesses the impact a program will have on the average power price paid by ratepayers. It compares utility costs and bill reductions with avoided electricity and other supply-side resource costs.
Participant Cost Test (PCT)	The PCT measures benefits and costs to customers participating in voluntary or opt-in programs and compares bill savings against incremental program costs. This test evaluates a program's economic attractiveness to customers and can be used to set rate and rebate levels as well as forecast participation.

EXAMPLES: THE COST-BENEFIT FRAMEWORKS IN ACTION

ScottMadden analyzed select successful utility grid modernization efforts from the last decade to determine how cost-benefit tests have been implemented and highlight key takeaways from these case studies for utilities to consider as they are planning grid modernization efforts in their territories. Adopting the takeaways presented in each case study will help utilities support grid modernization proposals in regulatory filings.

nationalgrid

Case Study: Niagara Mohawk Power Corporation (d/b/a/National Grid)

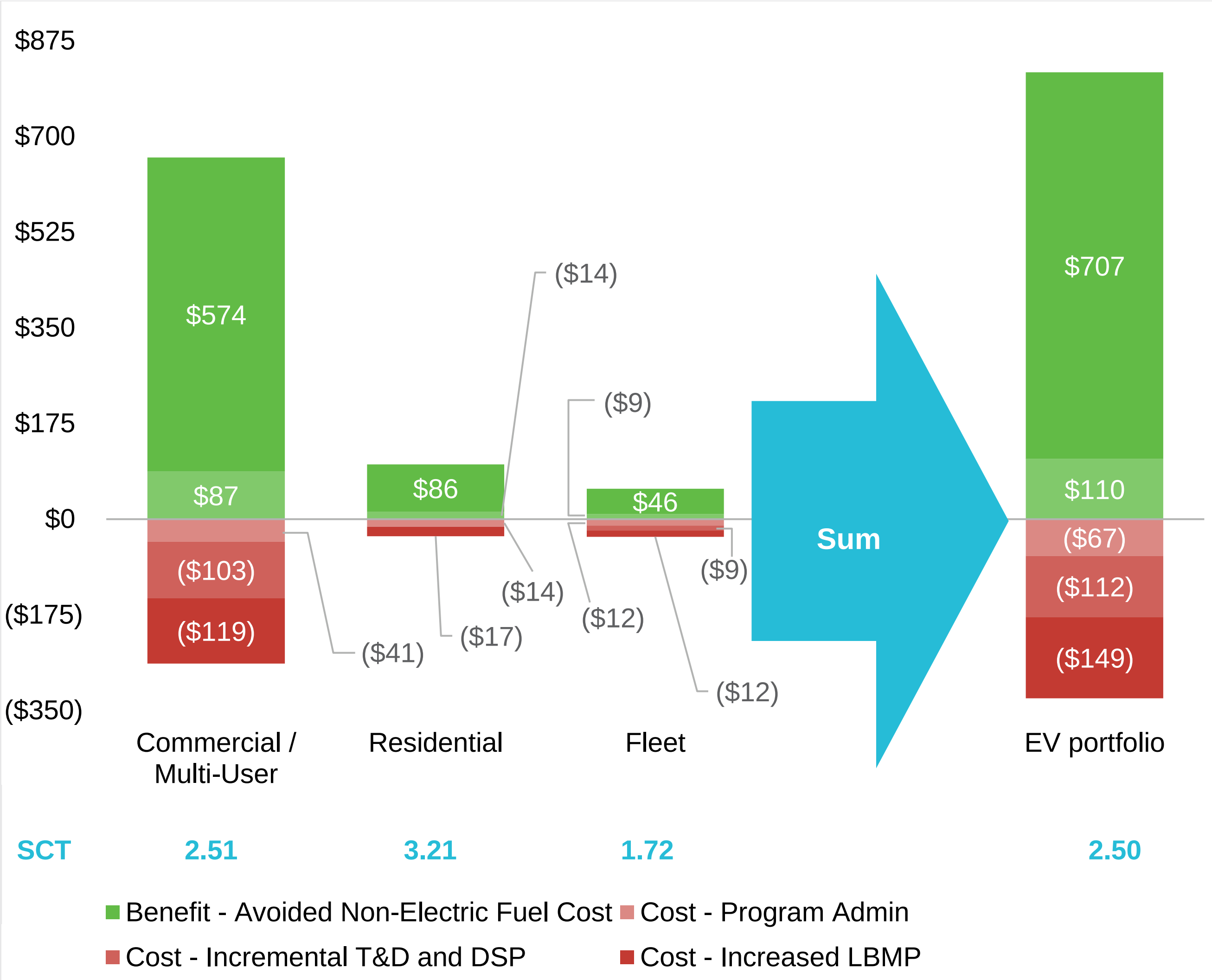
Cost-Benefit Test Used:

National Grid proposed several projects with discrete cost-benefit analyses in its 2020 New York rate case filing, including Volt/Var Optimization and Conservation Voltage Reduction (VVO/CVR) and electric vehicle (EV) programs. These investments highlight the impact of the environmental benefits of the SCT, the application of these tests at different levels of granularity, and the use of multiple benefit cost analysis (BCA) tests for a complete picture of the investments' cost-effectiveness.

National Grid's proposed EV offerings consist of three separate programs—a commercial/multi-user program, a residential program, and a fleet program. National Grid applied the SCT, the primary cost-benefit test under New York's BCA framework,[2] which accounts for the societal benefits of reduced carbon, SOx, and NOx emissions and non-electric fuel costs. These benefits, which would be treated as externalities and not contemplated in the UCT or TRC, more than offset the increased infrastructure, program administration, locational based marginal price (LBMP), distributed system platform (DSP), and transmission and distribution (T&D) costs, as shown in the graphic below. The results are shown at both the individual program level and the overall portfolio of EV programs, which provides transparency to which program(s) are most influential to overall results. For instance, in the example below, the influence of the commercial program in driving the overall portfolio results is apparent. It is also meaningful in cases when there are synergies between programs (e.g., shared infrastructure or shared administrative teams).[3]

Program	Program Components
Commercial/Multi-User	Make-ready infrastructure and charging station rebates
Residential	Smart charging plan, Level 2 charger rebates, turnkey installation services, and a program website and marketplace
Fleet	Make-ready infrastructure, fleet assessment services, and electric school bus incentives

[2] Order Establishing the Benefit-Cost Analysis Framework, NY PSC Docket 14-M-0101, issued January 21, 2016
[3] Direct Testimony of the Electric Vehicle Panel, NY PSC Docket 20-E-0380, filed July 31, 2020, Exhibit EVP-13



Another example from National Grid's rate case filing shows the application of multiple BCA tests at different levels of granularity. For its VVO/CVR program—which includes the capacitors, voltage regulators, sensors, and systems integration to manage voltage on a more granular basis—National Grid provided the BCA results for the SCT, UCT, and RIM, scored as 1.92, 1.59, and 1.59, respectively.[4]

Here again, the expanded scope of societal benefits increases the cost-benefit score. More importantly, while the SCT improves the business case by also presenting UCT and RIM scores that are greater than one, National Grid presents a business case that is improved by environmental benefits but is not reliant on them. The case stands alone on the merits of reducing customer costs. Furthermore, though the circuit level results are not presented in the rate case exhibit, the circuits were assessed individually, and only those substations/feeders with positive BCA results were included in the program. This ensures the overall program has a positive BCA result and demonstrates the value of running BCAs both at a granular level and at the portfolio/program level.

[4] Testimony of the Electric Infrastructure and Operations Panel, NY PSC Docket 20-E-0380, filed July 31, 2020, Exhibit EIOP-10 at page 212

Case Study: Entergy Mississippi

Cost-Benefit Tests Used:

In November 2016, Entergy Mississippi proposed an advanced metering infrastructure (AMI) plan to the Mississippi Public Service Commission (MSPC) to implement technology upgrades that would support network modernization efforts. Specifically, the company planned to invest in advanced meters and a two-way data communication network, as well as supporting systems including a meter data management system, an outage management system, a distribution management system, and information technology integration services.

Entergy included a cost-benefit analysis in its request and identified the primary drivers of program value as 1) electricity consumption reduction, 2) peak capacity reduction, and 3) reduction in costs associated with routine meter-reading services.

A key condition in MSPC's approval was that Entergy re-run the cost-benefit analyses on a semi-annual basis in order to track program progress and incorporate new market conditions into existing cost-benefit tests.[5] The updates filed indicate the AMI program is still cost-effective and that actual cost estimates are in line with original estimates.

Recent filings for both the AMI plan and other grid modernization initiatives include cost-benefit analyses at the portfolio and individual program level. Entergy included a TRC, SCT, UCT, and PCT analysis with portfolio results of 1.41, 6.99, 1.63, and 1.66, respectively, highlighting that these programs are continuing to create positive net value for the utility and its customers.[6]

[5] Docket No. 2016-UA-261, at 17
[6] Docket No. 2020-UA-171, at 7

Case Study: Xcel Energy

Cost-Benefit Tests Used:

In 2016, Xcel Energy sought to expand its grid modernization efforts through its Conservation Improvement Program (CIP). Similar to other Xcel grid modernization programs ScottMadden has reported on, this multi-year initiative created energy savings through investments in EE and DSM technology that would reduce peak demand and marginal energy costs. The program sought to expand deployment of EE technology in residential and commercial applications ranging from water heating to data center operation to food service production. The program also aimed to increase EE technology in new construction projects.

When Xcel presented its plans to the Minnesota Public Service Commission, it built a cost-benefit analysis for the entirety of its CIP-related grid modernization portfolio efforts. Notably, Xcel included all five cost-benefit tests and cited a variety of non-quantifiable program benefits. In addition, the utility included a robust scenario analysis to consider a variety of market conditions. The results were greater than 1.00 for the majority of scenarios and tests, including those scenarios with conservative assumptions. In 2017, the Minnesota Public Service Commission approved Xcel's requested portfolio of grid modernization efforts.

KEY TAKEAWAYS

In the National Grid example, the significant impact of the environmental benefits included in the SCT are evident. These benefits justify the investment for its EV programs, which will be an important part of supporting the state's zero-emission vehicle (ZEV) commitments and improve the already positive results of its VVO/CVR program. Utilities can bolster their cases for grid-modernizing investments by presenting cases with quantified environmental benefits. Depending on the policy environment, these results may be sufficient on their own to justify the investment, or they may provide additional support for a business case that has results near the approval threshold. In addition, showing the results at both the program and individual investment level can demonstrate the synergies across grid modernization investments (e.g., common resources across EV programs) or identify the subset of investments that are cost-effective (e.g., the set of circuits where VVO/CVR are most impactful).

As seen in the Entergy case, opting to include periodic reporting requirements can create transparency for regulators and stakeholders and strengthen utilities' commitments to these initiatives in the eyes of a Public Service Commission (PSC). Also, the Entergy case illustrates how including societal benefits in the evaluation of a program can drastically improve the cost-benefit results (e.g., the difference between the TRC of 1.41 and the SCT of 6.99 is stark).

Finally, as seen in the Xcel case, deploying as many positive cost-benefit tests as possible to present a complete picture of a grid modernization proposal strengthens the overall narrative for a PSC. Moreover, including scenario analysis that considers a range of conservative and aggressive assumptions can inspire greater confidence that the proposed investment will provide value in an uncertain future.

CONCLUSION

Grid modernization efforts will play a critical role in today's changing energy landscape. Demonstrating the value of grid modernization investments is necessary to gain regulatory approval of the program. As has been witnessed recently in some jurisdictions, a grid modernization program will only proceed if it can demonstrate positive outcomes to utility customers and regulators. The cost-benefit frameworks and key takeaways described above can guide the development of grid modernization proposals by ensuring benefits are taken into account and will improve the probability of regulatory approval of your grid modernization program.

HOW WE CAN HELP

Across the United States (and the world), utilities are modernizing the distribution grid both to increase reliability and resiliency and to accommodate greater amounts of distributed energy resources. ScottMadden has worked with utilities across the country to (i) build solid business cases justifying grid modernization programs and (ii) successfully present their programs to regulators.

At ScottMadden, we help our clients understand new grid technologies' impact on utility operations and business models, and we help them understand cost-benefit relationships while balancing the need for reliability. We have also helped our clients establish frameworks and then worked alongside them to make the strategic decisions and manage the implementation of the technologies at the heart of grid modernization. We can help you prioritize the capabilities your system needs to address customer expectations and resource requirements, tell the story to the regulator, and implement these investments.

ABOUT SCOTTMADDEN'S ENERGY PRACTICE

We know energy from the ground up. Since 1983, we have served as energy consultants for hundreds of utilities, large and small, including all of the top 20. We focus on Transmission & Distribution, the Grid Edge, Generation, Energy Markets, Rates & Regulation, Enterprise Sustainability, and Corporate Services. Our broad, deep utility expertise is not theoretical—it is experience based. We have helped our clients develop and implement strategies, improve critical operations, reorganize departments and entire companies, and implement myriad initiatives.

ABOUT THE AUTHORS

Kevin Hernandez is a partner and co-leads the grid edge community of practice. Chris Sturgill is a director and focuses on grid modernization. Mike Kerrigan and Sarah Vondracek are senior associates.