SCORE YOUR SMART GRID IQ (INVESTMENT QUOTIENT)

EVALUATE YOUR UTILITY'S INVESTMENT PLANNING PROCESS

Within a decade every utility will have incorporated at least some aspects of smart grid technologies in their distribution system. While several rating systems benchmark utility success at achieving smart grid functionality none evaluate the effectiveness of the investment planning process required to achieve the most cost-effective investment strategy. The Smart Grid Research Consortium was formed at Texas A&M University in 2010 and established as an independent Consortium in January 2011 to support electric cooperative, municipal and other public utility smart grid investment analysis. The Consortium's experience developing and applying the Smart Grid Investment Model™ at 15 member utilities provides the basis for the Smart Grid IQ "test" presented here.

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BENCHMARKNG UTILITY SMART GRID FUNCTIONALITY

Several rating systems are available to evaluate utility smart grid functionality relative to an ideal standard. The Smart Grid Maturity Model, was developed by IBM and turned over to Carneige Mellon University to maintain and extend in 2009. The model provides a framework to evaluate the current state of smart grid development in eight separate domains (e.g., grid operations, work and asset management, societal and environmental, etc.) using six levels of maturity ratings. The model has been applied at more than 120 utilities as of August, 2011.

The Environmental Defense Fund (EDF) recently published a smart grid benefits rating system based on four categories: empowering consumers, creating a smart grid technology/services platform, facilitating sales of demand-side resources in wholesale markets and reducing the environmental footprint. The EDF has applied this framework to evaluate several California utility smart grid programs.

While the above benchmarking systems provide a useful aid in comparing current smart grid functionality to an ideal, they were not designed to (1) identify specific technology/program details of the "ideal," which depend on each utility's service area, customer characteristics and current infrastructure or (2) how to develop an investment and planning process to achieve the utility-specific ideal smart grid system.

BENCHMARKING UTILITY SMART GRID INVESTMENT ANALYSIS AND PLANNING

Distribution system smart grid investments include sensors, controls, communications, and other digital technologies from substations, through feeders and into customer premises. Legacy IT and various management systems must be updated and expanded and new programs must be developed to engage customers and reengineer utility management practices and employee functions in virtually every utility department. The process required to accomplish a smart grid transition can be expected to take a decade or more.

Smart grid investment analysis and planning should be viewed as a quantitative process that identifies specific technologies, programs, applications and investment timing to provide maximum net benefit; that is, the maximum stream of benefits minus costs, over the planning horizon. The analysis must reflect each utility's unique infrastructure and customer characteristics, financial considerations and risk preferences.

Smart grid investment analysis and planning is required to identify appropriate utility-specific functionality and a roadmap to achieve that functionality with minimum cost.

THE SMART GRID IQ (INVESTMENT QUOTIENT)

An investment analysis and planning process that ignores some smart grid applications areas or a "one-off" investment approach that considers one application area at a time will almost certainly result in a smart grid system that provides fewer benefits at greater cost compared to a smart grid system based on comprehensive financial investment analysis and planning.

The Smart Grid Research Consortium, which was formed at Texas A&M University in 2010 and established as an independent Consortium in January 2011, has developed and applied comprehensive utility-specific investment models for 15 member utilities. Consortium utilities include electric cooperatives, municipal utilities and other public utilities ranging in size from 1,800 to over 600,000 meters. This white paper draws the Consortium's experience applying these models to provide a scorecard that can be used to assess the status of investment analysis and planning processes at individual utilities.

The Smart Grid IQ or Investment Quotient is a scorecard composed of six categories with category scores that total to a maximum IQ score of 100. It is important to note that the smart grid IQ scores only the smart grid investment planning process and not the actual costs and benefits of a smart grid strategy. A high smart grid IQ indicates that a utility is applying "best practices" with respect to smart grid investment analysis designed to identify appropriate technology, software and program investments with maximum return on those investments.

The scorecard reflects the Consortium's view of a "best practice" investment analysis/planning process along with "typical" weightings for two subjective issues considered by decision-makers. Since utilities have different perspectives on financial benefits of reliability and environmental benefits, some scorecard users may want to make small adjustments in these two subjective items in the scorecard. These modifications should be limited since the scorecard is designed to evaluate only the financial planning process, not costs/benefits of these two items.

The scorecard is designed to reflect current, past or future investment analysis. If a utility has not yet developed an investment analysis or planning capability, enter characteristics of the expected approach.

Smart Grid Investment Quotient Scorecard

Description	Points
I. AMI/DA Investment/Planning Scope (Maximum Category Points: 27)	
Does your investment analysis/planning process: a. Include AMI/smart meters costs and benefits? If yes, add 10 points b. Include CVR costs and benefits (conservation voltage regulation)? If yes, add 8 points c. Include other distribution automation options costs and benefits? If yes, add 4 points d. Consider interactions/synergies between individual AMI/DA technologies and programs (e.g., communications systems, smart meters as voltage sensors for CVR, demand response as a distribution resource)? If no *subtract* 6 points e. Consider IT legacy integration and new IT investments required to take full advantage of AMI/DA data and related management systems? If yes, add 5 points	
II. Customer Engagement* Investment/Planning Scope (Maximum Category Points: 20)	
Does your investment analysis/planning process: a. Consider reductions in power costs (purchased and/or generated) associated with customer engagement technologies and programs? If yes, add 5 points b. Consider financial benefits of deferred capital investments associated with customer engagement technologies and programs? If yes, add 3 points c. Use information on <u>your utility's</u> customer class/end-use (e.g., residential AC) hourly loads (rather than generic estimates) to model peak period hourly load impacts over the planning horizon? If yes, add 10 points d. Reflect changes in future hourly loads over the planning horizon as a result of changes in customer counts, equipment saturations and efficiencies and other factors? If yes, add 2 points *Includes PCTs, monitors, pricing, information programs, etc	
III. Other Financial Items (Maximum Category Points: 12)	
Does your investment analysis/planning process: a. Consider customer value of increased reliability and power quality by customer class? If yes, add 5 points b. Quantify environmental benefits? If yes, add 3 points c. Quantify management and retraining cost, pilot program and other costs? If yes, add 2 points d. Quantify potential secondary smart-grid related financial benefits (e.g., municipal	

communications services, other potential utility provided value-added services)? If yes, add 2 points	
IV. Other Utility Customer Detail (Maximum Category Points: 10)	
Does your investment analysis/planning process: a. Apply your utility's detailed cost data to quantify expected AMI and DA savings associated with meter reading, billing, uncollectables, ect. ? If yes, add 5 points b. Include changes over the planning horizon in number of customers by customer class and rate class, saturations of air conditioning, electric space and water heating, swimming pool and well pumps, etc? If yes, add 3 points c. Take into account hourly load Impacts of existing demand response, load control and energy efficiency programs to avoid double-counting benefits? If yes (of if no programs), add 2 points	
V. Investment Analysis Quantitative Framework (Maximum Category Points: 23)	
Does your investment analysis/planning process framework: a. Apply an analysis/forecast horizon of 10 years or more? If no, *subtract* 3*(10-number of years in your analysis) b. Include all of the following calculations: net present value, internal rate of return, cumulative costs and benefits, cumulative discounted costs and benefits, break-even period, discounted break-even period, payback and discounted payback? If yes, add 2 points c. Automatically incorporate changes in customer characteristics over the planning horizon including number of customers, electric equipment saturations, equipment efficiency and other characteristics? If yes, add 2 points d. Include user-selectable technology/program parameters that automatically reflect alternative technology characteristics, program penetrations and impacts, and other related flexibility. If yes, add 9 points e. Automatically reflect multiple technology/program scenario analysis and technology/program interactions? If yes, add 5 points f. Automatically reflect alternative customer engagement, CVR and other technology/program parameters on customer class/end-use and system-wide hourly loads? If yes, add 5 points	
VI. Ease of Use/User Interface/ Results Presentation (Maximum Category Points: 8)	
Does your analysis/planning software provide: (add 1 point for each "yes" answer below) a. Menus, check boxes, etc to allow easy application and experimentation? b. Default values for all parameters? c. Push-button selections of single and multiple technology and program scenarios? d. In-program help and guidance? e. Easy access to results at any detail level? f. Graphical representations that reflect intuitive results such as breakeven periods? g. Clear presentation of cost and benefit components (tabular and graphical)? h. The ability to modify and add new tabular and graphical results presentations?	
TOTAL POINTS (100 Points Maximum)	

INTERPRETING A SMART GRID IQ SCORE

A score of 100 reflects, based on the Smart Grid Research Consortium's experience developing, estimating and applying a utility-specific Smart Grid Investment Model ™ for 15 utilities, an investment analysis and planning process that as closely as possible meets an ideal investment analysis/planning process. The ideal process identifies specific technologies, programs, applications and investment timing to provide maximum net benefit while recognizing each utility's unique infrastructure and customer characteristics, financial considerations and risk preferences.

The scores in the scorecard were developed by starting with 100 points and allocating points across each capability to reflect our view of its contribution to an investment analysis and planning process ideal. The objective of the process was not to provide "letter grades;" however, after evaluating different combinations of investment analysis characteristics, a traditional A,B,C,.. grade seems to fit reasonably well with the 90-100, 80-90, 70-80 etc. scoring.

For example, an investment process that excludes distribution automation limits the grade to at most a “B” which is reasonable considering the fact that conservation voltage regulation can provide benefits equal to AMI for many utilities and can utilize some of AMI systems capabilities. Similarly, an investment planning process that includes no information on utility-specific hourly loads can score no better than a 90 or a “B” reflecting the importance of utility-specific hourly load data on individual utility costs and benefits.

SUMMARY

The objective of the scorecard is to assist utilities in evaluating the adequacy of their current investment analysis and planning process in identifying specific technologies, programs, applications and investment timing to provide maximum net benefit, that is, the maximum stream of benefits minus costs, over the planning horizon. The ideal investment/planning framework reflected by a score of 100 considers each utility's unique infrastructure and customer characteristics, financial considerations and risk preferences.

For utilities who have not yet started the smart grid investment process, the scorecard provides guidance on issues to consider when developing in-house investment analysis/planning capabilities or when engaging consultants.

The scoring is somewhat subjective, of course, since it is based on the Smart Grid Research Consortium's experience developing, estimating and applying a utility-specific Smart Grid Investment Model ™ for 15 electric cooperatives, municipal and public utilities.

A more detailed presentation and discussion of issues associated with the Smart Grid IQ process will be presented at the “2nd Annual Evaluating the Business Case for Smart Grid Investments", October 20-21, 2011 in Orlando.”

The conference, hosted by the Smart Grid Research Consortium, is open to all interested parties (Consortium members and nonmembers, regulators, manufacturers, vendors, etc) and is the only conference to focus on electric coop and public utility smart grid investment analysis and planning issues.

A 3-hour Smart Grid Investment Model Workshop is included in the event.

Early-bird registration is available through September 15. Additional details are available at:http://www.smartgridresearchconsortium.org/smartgridconference.htm

Questions regarding the Conference may be directed to the Conference Organizer (Jerry Jackson, jjackson@smartgridresearchconsortium.org or Amy Heineman, Conference Coordinator at aheinemand@smartgridresearchconsortium.org).

ABOUT THE SMART GRID RESEARCH CONSORTIUM

The Smart Grid Research Consortium is an independent research Consortium open to electric cooperatives, municipal and other public utilities. Consortium members contribute input on project direction and receive benefits of a large-scale research project while sharing costs with other Consortium members. Each Consortium member utility receives a Smart Grid Investment Model customized for their utility including monthly customer class/end-use kWh, peak kW and load profile forecasting and smart grid impact models, a User and Resource Guide and two complementary passes to the October 20-21, 2011 conference in Orlando. Additional details including membership information is available on the Consortium Web site: http://smartgridresearchconsortium.org/

ABOUT THE AUTHOR

Dr. Jerry Jackson, leader and research director of the Smart Grid Research Consortium, is an energy economist with more than thirty years experience in utility forecasting, utility program development and analysis, and new energy technology market analysis. He was previously a professor at Texas A&M University and Chief of the Applied Research Division at Georgia Tech Research Institute. He is also president of a Jackson Associates where he has worked with utilities, state regulatory agencies, equipment manufactures and others in addressing energy industry issues. His clients include more than fifty utilities ranging from small coops and municipal utilities to the largest investor owned utilities in the US and Canada. He has assisted leading technology companies including United Technologies, Ingersoll Rand, Toyota, Sungevity, Ice Energy and others in analyzing and evaluating markets for new energy-related technologies including fuel cells, microturbines, combined heat and power, solar technologies, cool storage, flywheel and demand response programs. Email: jjackson@smartgridresearchconsortium.org