WHITE PAPER

The new era of integrated resource planning in California and beyond

Expanding the Integrated Resource Plan framework

Make the most of your portfolio

With the passage of Senate Bill 350 (SB350) in September 2015, California finally joined the group of states that require their utilities to submit an Integrated Resource Plan (IRP). A 50 percent renewable generation target and the state's ambitious plans to cut the CO_2 emissions by 2030 give the IRPs a vital role in the state's environmental policies.

IRPs require a significant amount of informational input from a wide variety of sources and stakeholders, making them labor-intensive. What's more, there are many new developments in the market today that can – and certainly should – be factored into the IRP process. A new paradigm is needed to make the most of your IRP portfolio.

What is an IRP?

Integrated resource planning is defined as a critical business process that determines a mix of supply-side and demand-side resources to achieve economic efficiency. Economic efficiency is measured as the lowest possible cost to serve customers while explicitly addressing the impact and risk of future uncertainty.

An Integrated Resource Plan (IRP) process requires comprehensive public involvement, including public utility commissions, state agencies, consumer advocacy groups, industry groups, power project developers and several other stakeholders.[1] Customers, regulators and interested parties demand a thorough and exhaustive evaluation of alternatives beyond the traditional supply side resources, such as demand-side management (DSM), distributed generation and renewable resources.

The new paradigm

Although "integration" is implied in its name, many utilities prepare their IRPs separately from their transmission and distribution planning. In the traditional IRP framework, the IRP determines the future generation expansion plan, and transmission and distribution plans follow; however, with new developments in the industry such as those described below, the IRP process needs to significantly improve and better integrate generation, transmission and distribution plans.

New transmission investments due to new renewables
Large amounts of additional transmission capacity are expected to be built to transmit energy from remote areas where the renewable generators are located to major load centers. For example, with some investment in transmission, wind generation in Wyoming and Utah can be directly served to California residents. This makes assessment of potential transmission investments more significant than in the past.

Increasing value of flexible and rapid capacity
As it was famously depicted by the California Independent System Operator's (CAISO) "duck chart," rapid changes in renewable generation, such as solar generation, during the mid-day hours is likely to cause over-generation and sharp changes in the real-time ramping needs in California and other parts of the US. Therefore, new IRPs need to carefully assess the value of flexible and fast-ramping capacity from gas turbines and other technologies such as energy storage during these needy times.

Rise of distributed energy resources (DERs)

There are several types of DERs, including rooftop DSM and energy storage. Given the relatively small sizes of these projects compared to traditional resources, their contribution to the system generation capacity is rather limited; however, the large presence of intermittent generation makes these resources vital. DERs have critical roles in the grid such as stabilizing renewable generation and providing reserves for ancillary services such as regulation up and down.

In particular, energy storage deployment has been growing rapidly. Figure 1 shows the forecast energy storage deployment in the US over the next five years. Energy storage deployments will be approximately 10 times higher in 2021 compared to 2016.

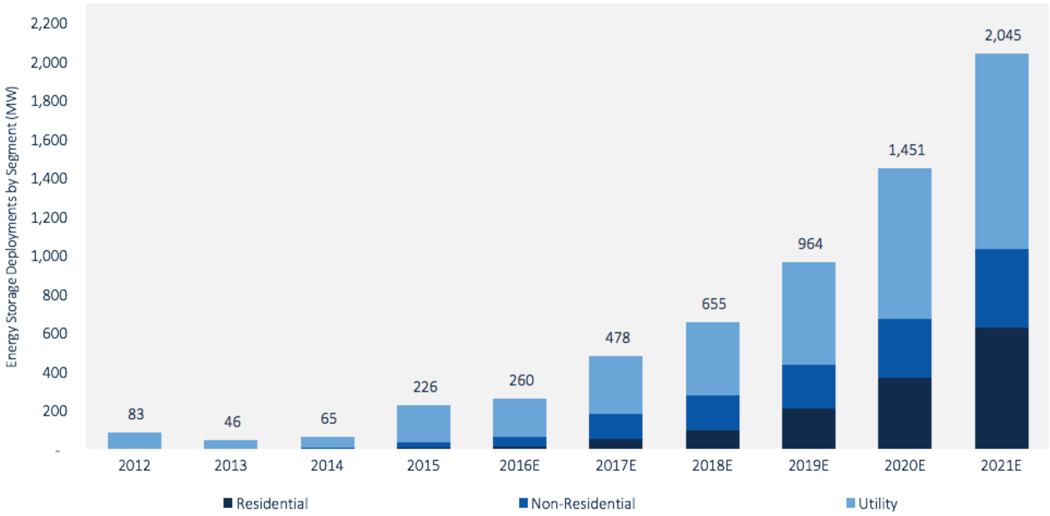
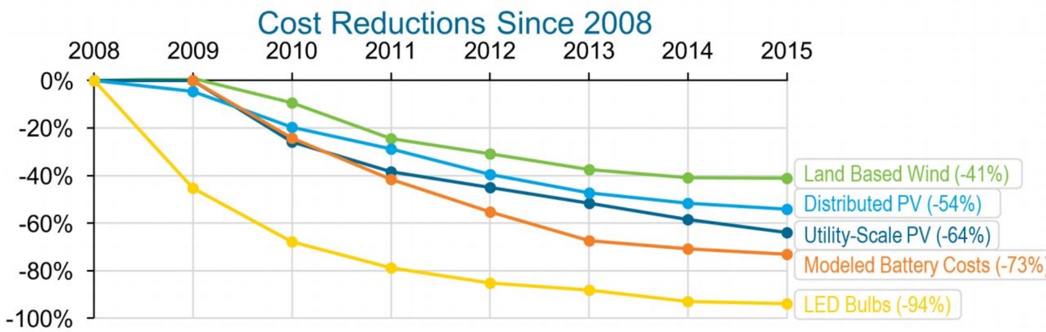


Figure 1: US Annual Energy Storage Deployment Forecast, 2012-2021 (MW)[2]

Figure 2 shows the levelized costs of energy from select renewable and DER technologies between 2008 and 2015. With the decreasing trend, levelized energy storage (battery) costs may decline significantly over the years. Therefore, one may expect that energy storage technologies can be more economic than the natural gas combustion peakers in the next decade.



Notes: Land based wind costs derived from levelized cost of energy from representative wind sites from references [1] and [2]. Distributed PV is average residential installed cost from reference [3]. Utility-Scale PV is median installed cost for utility-scale PV systems from reference [4]. Modeled battery costs are at high-volume production of battery systems, derived from DOE/UIS Advanced Battery Consortium PHEV Battery development projects. LED bulbs are for A-type bulbs from reference [5].

Figure 2: Levelized costs of energy from select renewable and DER technologies, 2008-2015[3]

Decreasing loads and changing load shapes

Use of load-decreasing instruments such as DSM and energy efficiency is becoming more widespread. For example, California SB350 and New York REV (Reforming the Energy Vision) have ambitious energy efficiency targets for 2030. Also, several other states have policies on energy efficiency resource standards, and a great majority of the states have energy standards for public buildings. As such, IRPs need to thoroughly evaluate expected load changes in their load forecasting studies.

Large utilities generally have little control over DERs such as rooftop solar and household batteries, and their share in total generation is rapidly increasing in places such as Hawaii and California. This situation has two impacts on the overall load: First, it decreases the overall load in the long run. Second, it changes the load shape. Peak load times and load levels will likely change notably over years; for example, in some areas like California, late afternoon summer load peaks will likely switch from around 4:00 p.m. to after 6:00 p.m. when households and businesses using self-generation turn to the grid for their electricity needs. Getting an accurate load forecast for the new IRPs may therefore become more complicated.

Need for statistical risk analysis

Risk assessments over IRP portfolios using complex statistical analysis are not officially required by some public utility commissions yet but several utilities already perform such assessments anyway as a matter of good practice and it's likely that many more utilities will soon follow suit. Nevertheless, with all of the developments outlined above and the uncertainties in load, renewable generation profiles, fuel prices, forced generation outages, etc., it can be difficult and overwhelming trying to ensure that you've fully considered all the variables.

How do you survive – and thrive – under the new paradigm?

There are several moving parts in an IRP process; utilities need new ways of thinking and analytical approaches as well as significantly more detailed data inputs to efficiently integrate these moving parts into an IRP study. Unless the new IRP process is efficiently designed, integrating disparate data into an IRP study may bring significant increases in the scope of the study. ABB offers extensive market intelligence experience and integrated software solutions that can help your organization effectively consider and incorporate generation, transmission and certain distribution aspects into an IRP.

For example, ABB's Capacity Expansion and PROMOD are robust solutions that can analyze the economics of additional generation and transmission investments, and potential transmission congestion issues from intermittent generation.

PROMOD, the industry standard for production cost modeling, offers the ability to perform truly detailed analyses to determine the long term economic value of a DER investment. This will enable an IRP to include detailed chronological simulations of generation and ancillary services contributions from both DERs and conventional and renewable resources. Location of a DER is critical, as it determines its congestion relieving and reliability improving benefits in the grid. PROMOD can also analyze the long-term effects of DERs on the transmission systems to evaluate the economic feasibility of their locations for inclusion in an IRP.

ABB can also help utilities get accurate load forecast for their IRPs. North American Simulation Ready Data is ABB's unique, independent, subscription-based database for power markets. It contains a comprehensive database of power markets in the United States and Canada, including peak and energy forecasts with hourly load profiles for over 200 zones. ABB also offers similar databases for power markets in Mexico and Europe .

When it comes to risk assessments, ABB's Portfolio Optimization tool is used by many large utilities for its ability to utilize complex statistical analysis techniques to quickly and reliably perform risk analyses over their IRP portfolios.

As the utility industry evolves to embrace renewables and microgrids and to adapt to ever-changing regulations, the IRP process will continue to become more complex. But by taking advantage of industry-proven solutions and support from a leader in utility market analytics and intelligence, your IRPs will be effective and reliable roadmaps for long-term success.

References

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[3] US Department of Energy. Revolution…Now: The Future Arrives for Five Clean Energy Technologies – 2016 Update. Retrieved from: https://www.energy.gov/sites/prod/files/2016/09/f33/Revolutiona%CC%82%E2%82%ACNow%202016%20Report_2.pdf

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Erdal is an industry solutions executive at ABB, providing technical sales activities for ABB's Capacity Expansion, Portfolio Optimization and PROMOD software solutions. He has detailed knowledge of the CAISO tariff and FERC regulations and expertise in energy market analysis, forecasting, economic modeling and power plant valuation.

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