VARENTEC'S COMMENTS REGARDING FUNDING PRIORITIES FOR THE FIRST TRIENNIAL INVESTMENT PLAN OF THE ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC) PROGRAM

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Introduction and Summary

Varentec is a California-based startup funded by Khosla Ventures to develop advanced energy solutions. Varentec provides the following comments to help prioritize CEC use of EPIC funds over its first triennial period (2012-2014) to achieve state RPS, energy efficiency, climate change, and economic objectives. Varentec's comments are summarized below:

1) The California electric sector is facing unprecedented challenges which cannot be overcome without new solutions.
2) In the near-term, new solutions are required for the integration of distributed photovoltaics (DPV). Without these solutions, California's policy or economic development goals may be delayed or unfulfilled. Given that problems associated with DPV are expected to increase dramatically, EPIC should focus on funding technology demonstration and deployment projects that address these problems before the problems become widespread.
3) EPIC-funded efforts to integrate DPV should show the potential for:
    a. Much lower cost than existing solutions
    b. Rapid, wide-scale deployment within the time-frame of California's policy objectives

c. Incremental rollout, allowing coordination of investment with localized differences in DPV adoption

d. Preservation of existing initiatives that may be undermined by DPV

e. Compatibility with future initiatives

DETAILED DISCUSSION AND RECOMMENDATIONS

Background

The California electric sector is facing unprecedented challenges. Utilities are simultaneously managing a 33% RPS mandate, AB32 compliance, and the energy efficiency savings goals. Meanwhile, average retail rates among the California IOUs are among the highest in the US. Average retail rates at SDG&E, PG&E and SCE rank in the bottom 2%, 6%, and 10% respectively of utilities in the contiguous US [1]. The rates of the three California IOUs are 33%-69% higher than the national average. Economic theory suggests that high retail rates will impede future economic development. These high costs have limited the ability of IOUs to pursue rate increases, delaying the replacement of assets. Collectively, the factors above jeopardize the state's ability to simultaneously achieve competitive electric rates, state policy goals, and reliability. Varentec was founded in response to evidence that existing technologies are unable to address existing problems cost-effectively. California utilities require new solutions that address the problems holistically and able to be deployed quickly. EPIC funds, properly prioritize, can accelerate the deployment of critical solutions and ensure that the state will not be forced to choose between economic growth and policy goals.

[1] Average retail rate by utility for 2010 collected by EIA http://www.eia.gov/electricity/sales_revenue_price/xls/table10.xls

Supporting the Grid Integration of Distributed Photovoltaics

Distributed photovoltaics (DPV) support a number of the state's energy goals yet there are technical barriers. Subsidies and favorable policies for DPV have reduced the levelized cost of energy from DPV by roughly 75% over the last decade. Due to net metering, tiered pricing structures, and relatively high retail rates, DPV is now cheaper than retail electricity for many electric customers in California. While not perfectly coincident with peak demand, DPV in California has an effective load carrying capacity (ELCC) of 61%-31% for scenarios varying from DPV ranging from 2%-20% of total generation capacity [2]. So each MW of PV averts the installation/upkeep of roughly 0.6 MW to 0.3 MW respectively of conventional generation capacity. In addition, the distributed nature of DPV reduces the loading of many distribution system assets and subsequently increases the lifetime of these assets. Given the above and the CPUC's recent ruling on net-metering [3], DPV capacity in California is expected to continue to increase.

The existing distribution system was not designed for DPV. At the existing penetration level, DPV on some feeders result in ten times faster aging of existing electromechanical controls, such as on-load tap changers (OLTCs) and switched capacitors. Even with accelerated aging, existing controls are unable to maintain the steady-state feeder voltage or fault currents within specification [4,5]. Finally, since the deployment of DPV leads to widely varying feeder voltages, it is opposed to conservation voltage recovery (CVR), one of the most cost-effective methods to meet the California energy efficiency goals.

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[2] R. Perez, R. Margolis, et al., "Update: Effective Load-Carrying Capability of Photovoltaics in the United States: Preprint," to be presented at Solar 2006 Conference, Denver, Colorado, July 8–13, 2006.

[3] CPUC, Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues, Rulemaking 10-05-004, May 6, 2010, http://docs.cpuc.ca.gov/WORD_PDF/AGENDA_DECISION/167171.pdf

[4] E. Liu and J. Bebic, "Distribution System Voltage Performance Analysis for High-Penetration Photovoltaics," NREL NREL/SR-581-42298, February 2008.

[5] Edison Electric Institute, Future of Electric Distribution Dialogue, Webinar Series, Session I: State of U.S. Electric Distribution, July 11, 2012, http://www.eei.org/meetings/Meeting%20Documents/PPT%20Session%20I%20-%20EEI%20Current%20State%20of%20Distribution.pdf

Utilities are actively searching for low-cost solutions to accommodate DPV. Existing solutions include installing fast VAR sources on the feeder (i.e. STATCOMs or SVCs), informing OLTC control with bellwether voltage sensors, and increasing the intelligence of protection schemes. Existing solutions are extremely expensive and time intensive to deploy, due to burdensome communication and system integration requirements. Given the sensitivity of the ratepayers to rate increases, alternative solutions are necessary. Emerging solutions include next generation fast VAR sources and dynamic balancing of power flows across distribution networks [6].

Based on the preceding discussion, Varentec recommends that CEC fund the demonstration and deployment of new solutions capable of mitigating the impacts of distributed PV. A sample solution would regulate the feeder voltage within specification during periods of high intra-hour DPV generation variability while maintaining usage of traditional electromechanical controllers at rated levels. Varentec recommends the following metrics be used to judge proposals related to the grid integration of DPV:

1) Low cost
2) Quickly deployable without imposing significant burdens on existing utility business divisions or owners of DPV
3) Incremental in nature, allowing investment deferral until the penetration level of DPV on a given feeder warrants investment
4) Supportive of other utility initiatives, some of which may undermined by DPV in the absence of a holistic solution
5) Compatible with future initiatives

[6] The compact dynamic phase angle regulator (CD-PAR) is one potential method to realize dynamic power balancing across networks. Varentec, EPRI, Waukesha Electric, and Georgia Tech are developing the CD-PAR with the support of ARPA-E. While mitigating the impact of DPV, the CD-PAR also increases reliability and slows the deterioration of distribution system assets.

Closing Discussion

The California electric sector is facing a number of challenges. With current technology, it seems the state faces a choice between pursuing public policy goals or economic growth. To avoid compromise, technologies are required in the near-term to better integrate DPV with the distribution grid. To ensure solutions are able to avert these near-term challenges, EPIC funds should be targeted toward the demonstration and deployment of solutions which have already completed the applied R&D stage.