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Additional submitted attachment is included below.

REQUEST FOR INFORMATION – DIRECT CURRENT POWER SYSTEMS

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The following questions are designed to elicit information that will help CEC structure solicitations related to this topic. Stakeholders are not required to respond to every question of this Request for Information (RFI). In fact, stakeholders are encouraged to respond specifically to the questions they feel most suit their knowledge and background.

DC Components, Equipment, End-Use Devices, and Technologies

1. What DC components and equipment are needed to enable more efficient integration of DC devices with other DC devices? What is the current technology readiness level (TRL) of these devices? What specific research is needed to advance the TRL (e.g., design work, laboratory testing, pilot and/or commercial demonstration)?
    a. To make DC devices work well with other DC devices on the grid, utilities may have to provide DC service to customers who want it. This can help them connect their DC devices more efficiently and allow the utility to serve more customers with existing infrastructure. The US Department of Energy has developed a Solid-State Power Substation (SSPS) Technology Roadmap that outlines the steps that need to be taken in the short, medium, and long term to integrate DC components into the distribution network. One of the first steps is to design a grid structure that supports the SSPS vision. This structure includes these elements:
        i. power converters for high, medium, and low voltage levels
        ii. controllers to manage various functions
        iii. communications between these devices and a grid control center
        iv. protection devices inside or outside these devices.
    b. SCE agrees with the DOE's roadmap on DC Power Systems, which covers the topics of this RFI. SCE suggests that the CEC consult the DOE's SSPS roadmap, as it shares many of the DOE's views on DC power systems. SCE has also submitted a project proposal under the DOE'S Grid Resilience and Innovation Partnerships (GRIP) FOA (DE-FOA-0002740 Topic Area 2) to explore the best use-case for offering DC as a service voltage to customers. SCE's proposed project aims to identify the most practical implementation of DC power systems on the distribution network in the near-term, where it provides the most benefit to the grid and the customers it serves. The project is being presented in three phases: modeling and simulation, lab unit testing, and field deployment.
    c. In terms of existing projects SCE is involved in, SCE is exploring the potential of solid-state converter systems in its EPIC 3 Storage Based Distribution DC link project to investigate the usage of solid-state power converters more on the grid and their capabilities to improve

power quality and perform functions such as phase balancing, voltage regulation, and power factor correction. SCE is also collaborating with EPRI on a solid-state transformer project, where they are piloting a 25 kVA 7kV to 240V single-phase solid-state transformer for Grid Forming Inverter Modeling and Applications. This project aims to demonstrate the feasibility and benefits of using solid state transformers for grid support and resilience and evaluate its benefits over conventional distribution transformers in this class.

2. What are the TRL, cost effectiveness, efficiency, and availability of the following technologies?
    a. SCE does not currently track the technology readiness for DC power systems. SCE suggests that the CEC consult the DOE's SSPS roadmap, as it shares many of the DOE's views on DC power systems.

    SCE does have prior experience in high-voltage DC (HVDC) power systems and is connected to a HVDC link that terminates in Sylmar. This link is a 500 kV, 3,100 MW, bi-directional HVDC transmission line that connects the Pacific Northwest and Southern California. SCE operates and maintains the Sylmar converter station, which converts AC to DC or DC to AC depending on the direction of power flow. The WEC HVDC link provides benefits such as congestion relief, voltage support, frequency regulation, and renewable energy integration. SCE is committed to ensuring the reliability and efficiency of this link, as well as exploring new opportunities for DC power systems in the future.

DC Adoption Pathways and Use Cases

3. What are the most likely commercial applications for DC-based power systems in the short (3-5 years) and long terms (5+ years)?
    a. In the near-term, DC-based power systems can be used for integrating inverter-based renewables, such as solar photovoltaics and energy storage, into the grid. These systems can provide more efficient and flexible power conversion, as well as voltage and frequency control. They can also enable hybrid AC/DC networks and microgrids that can improve reliability and resilience.
    b. In the long-term, DC-based power systems can be used for creating fully decoupled, asynchronous, and fractal grids that can leverage artificial intelligence and machine learning for autonomous control and optimization. These systems can also enable plug-and-play features across the grid, such as automatic reconfiguration, islanding, and black start. They can also facilitate the interconnection of offshore wind farms, small modular reactors, and flexible combined heat and power plants
4. What are the recommended ideal locations (e.g., where on the distribution grid, geographically, or at particular facility types like electric vehicle supply equipment stations) to deploy DC-based power related demonstrations and what technology(ies) would ideally be demonstrated?
    a. SCE is planning to investigate the feasible locations for deploying DC-based power related demonstrations. SCE will select a site location for the field deployment based on the feasibility of use cases, opportunity to add significant capacity, reasonableness of cost, and

potential to demonstrate other added grid benefits from integrating solid-state technologies compared to traditional utility assets.

5. What kind of buildings/facilities are the best fit for early DC-based implementation and why?
   a. The customer types that benefit most from DC power are those that have high energy and power demand, such as electric vehicle charging stations, data centers, or fully electrified buildings. These customer-types are most likely to invest in technologies that drive energy efficiencies and allow them to serve more customers at lower cost and with whatever land they have available.