



**[6450-01-P]**

**DEPARTMENT OF ENERGY**

Solid State Power Substation Roadmap

**AGENCY:** Office of Electricity Delivery and Energy Reliability, Department of Energy.

**ACTION:** Request for information (RFI).

**SUMMARY:** The Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability (OE), is seeking comments and information from interested parties to inform its development of a Solid State Power Substation (SSPS) Roadmap. An SSPS is defined as the strategic integration of high voltage power electronic converters in substations to provide enhanced capabilities and support the evolution of the grid. SSPS technology can overcome some of the current limitations within substations by enabling control of real and reactive power flows, management of voltage transients and harmonic content, and the ability to increase the flexibility, resiliency, and security of the electric power system.

**DATES:** Comments must be received on or before **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. An informational webinar will be held on Thursday, March 29<sup>th</sup>, 2018 from 1:00 PM to 2:00 PM ET to discuss the draft SSPS Roadmap in more detail and provide information on this RFI.

**ADDRESSES:** Comments can be submitted by any of the following methods.

*Email:* DOE.SSPS.Roadmap@hq.doe.gov, whereas the subject line of the message is “SSPS Roadmap Comment.” Please provide your full name, title, and organization, along with your comments in the Excel spreadsheet provided and name the file “Your first and last name – SSPS Roadmap Comment.”

*Mail:* Kerry Cheung, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy, Forrestal Building, Room 6E-092, 1000 Independence Avenue, SW., Washington, DC 20585. Note: Delivery of the U.S. Postal Service mail to DOE may be delayed by several weeks due to security screening. DOE, therefore, encourages those wishing to comment to submit comments electronically by e-mail.

*Webpage:* The draft SSPS Roadmap, Excel spreadsheet for comments, and information on the upcoming webinar can be found on the following webpage:

<https://energy.gov/oe/articles/solid-state-power-substation-roadmap-request-information>

**FOR FURTHER INFORMATION CONTACT:** Requests for additional information should be directed to Kerry Cheung, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585 at [kerry.cheung@hq.doe.gov](mailto:kerry.cheung@hq.doe.gov), 202-586-4819.

## **SUPPLEMENTARY INFORMATION:**

### **I. Background.**

Substations are critical points within the vast U.S. power grid, serving a number of functions important to the safe, reliable, and cost-effective delivery of electricity. Substations serve as the entry point to the grid for electric power generators as well as the exit point for large industrial customers. Substations also form the boundaries between the high voltage transmission network and the distribution system, enabling the network to reconfigure to ensure stability and reliability, and to regulate power quality for down-stream electricity customers. As the electric

power system continues to evolve, with stakeholders integrating higher amounts of variable renewable generation, deploying electric vehicles and associated charging infrastructure, and connecting more dynamic end-use devices and subsystems, substations will need to evolve as well. These critical nodes will need to continue providing their traditional functions as well as new functions and capabilities required in a future grid.

The SSPS Roadmap will present a path for the strategic integration of high voltage power electronic converters in substations to provide enhanced capabilities and support the evolution of the grid. Ultimately envisioned as a modular, scalable, flexible, and adaptable power block that can be used within all substations, SSPS converters will serve as power routers or hubs that have the capability to electrically isolate system components and provide bidirectional alternating current or direct current power flow control from one or more sources to one or more loads - indifferent to magnitude and frequency. Deployment of SSPS technology within substations can facilitate evolution of the grid by enabling better asset utilization, increasing system efficiency, enhancing security and resilience, and easing the integration of distributed energy resources and microgrids.

## **II. Request for Information.**

The draft SSPS Roadmap was developed by the OE Transformer Resilience and Advanced Components program with support from the Savannah River National Laboratory. The roadmap is structured to provide the context, rationale, and potential benefits of utilizing SSPS technology, and articulates a research and development pathway to accelerate maturation of SSPS. It aims to capture the state-of-the-art in critical enabling technologies, highlight research

gaps and opportunities, and align disparate activities across the stakeholder communities to realize the SSPS vision.

This RFI provides the public, industry, and interested stakeholders, the opportunity to play an important role in defining and refining the SSPS vision and the potential technology development pathway. The intent of this RFI is to solicit input concerning the benefits offered by SSPS technology, the application areas where SSPS technology can provide a value proposition, the current state-of-the-art, and the gaps that are most critical to fill. The information obtained will be public and is meant to be used by DOE to guide and inform research and development activities. Please provide your comments next to the relevant questions in the Excel spreadsheet and supporting information if noted, including studies, reports, references, data, and examples relevant to SSPS.

### **SSPS Roadmap Questions:**

#### **Chapter 1-2: Introduction and Conventional Substations**

What issues and concerns not captured in the roadmap most deeply impact the ability of substations to meet the demands of an evolving grid? What are additional challenges faced by utilities that would necessitate power electronic converters in substations?

Are there any other issues or comments regarding these Chapters?

#### **Chapter 3-4: Solid State Power Substations and SSPS Technology Development Pathway**

Is there evidence of a growing need for power electronic converters in substations? If so, in what capacity? What specific challenges would the use of power electronic converters address?

Comments are requested on the SSPS vision and the three classification of SSPS converters articulated in the roadmap, as well as on the defining feature and functions and the voltage and power ratings.

Comments are requested on the SSPS technology development pathway presented in the roadmap. For each classification of SSPS converters, are there other potential applications that have not been captured?

What are additional benefits of using SSPS converters that should be captured?

Are there any other issues or comments regarding these Chapters?

## **Chapter 5: SSPS Technology Challenges, Gaps, and Goals**

Comments are requested on the R&D challenges identified in the roadmap and their associated goals. Are they sufficiently aggressive and appropriate to realize the defining feature and functions for each classification of SSPS converter? What R&D challenges not yet identified would prevent SSPS technologies from being realized, as envisioned? For these additional R&D challenges, what would be the associated goals for each classification of SSPS converter?

Comments are requested on the state-of-the-art and the research gaps identified in the roadmap for each of the R&D challenges. What on-going work, that can be publicly shared, should be reflected in the state-of-the-art? What additional gaps needs to be highlighted to address the R&D challenges identified? What specific actions will need to be taken in the near-, mid-, and long-term to sufficiently address the gaps identified?

What additional non-technical challenges are there that would prevent SSPS converters from being accepted by industry? What additional standards would be relevant to SSPS technology, as envisioned? What are potential market or regulatory barriers that will need to be addressed?

Are there any other issues or comments regarding this Chapter?

**General Comments**

Comments are requested on the technology topic described in the roadmap. What is the appropriate Federal role in advancing this technology area? What are some organizational roles in helping to advance this technology concept? What amount of resources would be required to fully implement the roadmap?

Issued in Washington, DC on March 16, 2018

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