

SMART GRID INNOVATION PROCESSES AND THE SOCIAL CONSTRUCTION OF TECHNOLOGY IN JAPAN AND THE USA

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ABSTRACT

This study examines the process of smart grid innovation in Japan and the USA. The current status of innovation efforts is investigated in terms of drivers and obstacles of innovation and stakeholder composition and involvement. The commonly held meaning of smart grid within the community that is engaged in smart grid innovation is also investigated to shed light on how social context shapes the way smart grid is interpreted.

Smart grid is an ambiguous concept with many meanings, and scholars have previously observed that there are regional variations in how smart grid is conceptualized. The potential benefits of smart grid range include less environmental impact, higher security of electricity supply, lower cost of energy and higher empowerment of consumers in the electricity system. Regardless of this ambiguity, most analysts think that smart grid will be the future for the electricity grid, and that smart grid is an important tool to achieve sustainability in the energy system. Investigating the different nuances in technology labelled as smart grid is thus an important venture from a sustainability science viewpoint, as a deeper understanding of the shaping of the technology can lead to more sophisticated promotion methods. Especially, the role of end users of electricity in the innovation processes should be investigated as smart grid has the promise of becoming a transformative technology that remakes the way in which the electricity system is governed by empowering the end users. Interviews with key stakeholders in both

countries inform the bulk of the analysis, with support from social network analysis of smart grid projects and semantic analysis of discourses around smart grid in both countries.

The study found differences and similarities in the innovation process in Japan and the USA. In both countries government support is an important driver of activity, and in both countries the existing market structures are seen to be slowing the innovation process. The more fine differences between the two countries are shaped by the way the electricity market is structured, the characteristics of the most involved private stakeholders, and the way smart grid is promoted by the governments. In both countries, there are high hopes for end user participation in the use of smart grid technology, but end users have minimal involvement in the innovation of smart grid technology. End users are largely disinterested, and there seems to be few ways for the end users to interact with the innovation systems other than by demanding products that integrate with smart grid technology or protesting against specific deployments by utility companies.

There is a difference of emphasis in the meaning of the smart grid concept between the two countries. In USA there is a focus on the transmission and distribution related functionalities, as well as a very high importance given to AMI, while in Japan there is a broader focus, and ties in more with smart home innovation and other end user interfacing technology. It seems that this difference is largely explainable due to the market and regulatory structures in both countries, rather than attention to the perspective of end users.

The findings imply that government funding and promotion of smart grid innovation is important as smart grid innovation is still in the early stages and the most important stakeholders in the electricity system, the utility companies, have little incentives to engage with the more integrative and transformative versions of smart grid. The nuances identified in the meaning of

smart grid illustrates that the context in which the smart grid innovation process develops will have an influence on the type of functionalities deployed under the label of smart grid. The findings also imply that end user participation should be actively promoted in smart grid innovation efforts, as end users have little possibilities to interact with the process in the current situation, and because they seem to be disinterested in participating in the innovation process. Nonetheless participation could lead to a better chance for the more transformative versions of smart grid to become reality, which could enable a more sustainable governance of the electricity system. Such participation can be promoted by many stakeholders, but the government has a strong role to play, especially through designing electricity market regulation and through designing the mode of government promotion of smart grid innovation.

Key words: Smart Grid, Technological innovation system, Social construction of technology