

Creating New Energy Solution in a Changing Era

Collaborative Creation with Customers in the US Energy Market

Energy technology innovations under Industrie 4.0 are explosive, fast-paced, and diversified. Technology companies that can adapt to the rapidly evolving digital markets can disrupt the energy industry and quickly gain market share. Vendors are leveraging public grants and external partnerships to speed up the pace of innovation. Co-creation projects with public sector, top research institutes and end-customers including utilities and prosumers can speed up the pace of innovation and validation of solutions to facilitate rapid go-to-market. Hitachi America, Ltd.'s Energy Solution Lab has successfully won several large grants in the past three years and established a new collaboration model with energy stakeholders of different sectors. This article shares Hitachi's work in the North America market through collaborative creation with customers.

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1. Introduction

In the past decades, the energy market is evolving driven by green policy initiatives and arising demands of prosumers. As a result, distributed energy resources (DER) become ubiquitous and increasingly dictate the reformation of power grid resource planning and operation. In parallel, the digital technology innovations in the era of Industrie 4.0 are explosive, fast-paced, and diversified. Novel digital energy solutions and their go-to-market strategies need to be agile and iterative. The competition is so intense that

enterprise products that fail to address the emerging operational challenges will become obsolete.

While a dynamic market provides tremendous opportunities for business expansion, large corporates often struggle to keep up with the velocity. The Global Center for Social Innovation (CSI) was created to address this challenge. Under CSI, Hitachi America, Ltd.'s (HAL) Energy Solution Laboratory (ESL) has been proactively engaging with industry partners and leverage public research grants, to shorten the development time. This article shares ESL's latest achievements on eco-system development, innovation philosophy, and institutional coordination.

2. Co-Creation with External Key Energy Stakeholders

Collaborative creation (co-creation) with top research institutes can improve Hitachi’s visibility in the technical society and influence trends of innovation. HAL ESL has been proactively responding to calls for the public projects and successfully won two research projects with the United States Department of Energy (DOE) and the State of California from 2018 to 2019. These projects are carefully selected to align with Hitachi’s research program on DER integration, allow necessary customer benchmark and boost internal pace of development.

2.1

Creation of Disruptive Innovations

The mission of HAL ESL is set to develop next generation energy solutions, which can address emerging market needs and potentially grow revenue in five years. This goal concentrates its innovation strategy on integration of existing technologies with some forward-looking core applications.

Back in 2017, the power and energy industry observed rapid rising of renewables and the market for inverter manufacture saturates quickly. HAL ESL decides to look one step beyond the infrastructure value chain and focus on addressing operational challenges introduced by DER. Other major vendors also try to address this emerging market through new enterprise software like distribution management system (DMS), distribution energy resources management system (DERMS), etc., but often found that customers were not satisfied. A recent analysis⁽¹⁾ depicts that deployment of DMS and DERMS in the US market

is still in early commercial phase and utility adoptions are slow (see **Figure 1**). Despite the market potential, existing DMS/DERMS vendors couldn’t provide proper products to address customer needs. HAL ESL found the following: (1) The deployment of DMS/DERMS or equivalent energy solutions triggers a wave of analog-to-digital transformation of the distribution grid. There are increasing demands for improved awareness of the current grid configuration, asset information and condition, power flows, and events. (2) Customers are not satisfied with offerings built from legacy systems. Such software is rarely based on latest technologies nor can it address emerging customer needs. In particular, power companies felt new functions designed by software vendors often do not apply to them. The build-and-sell business model no longer works well. (3) There is increasing competition from “non-energy” software vendors. Utility engineers are more familiar with and open to explore new technologies, like cloud and service-based solutions. Leading providers, i.e. Azure¹, Amazon Web Services² (AWS), and Google Cloud Platform³ (GCP), start to grow revenue exponentially with energy customers.

Under these new market trends, HAL ESL decided to focus on creation of a new energy resource optimization solution (see **Figure 2**). This solution includes the following disruptive technologies:

- (1) A cloud-based energy solution, for service business and empowered by data analytical engines based on artificial intelligence (AI)
- (2) An energy app store allowing integrations of eco-partners’ software, which can serve broader customer sectors,

¹ Azure is a trademark or registered trademark of Microsoft Corporation in the United States and other countries.

² Amazon Web Services is a registered trademark of Amazon Technologies, Inc.

³ Google Cloud Platform is a trademark or registered trademark of Google LLC.

Figure 1 — Deployment of Operational Analytics

Based on studies by the United States Department of Energy (DOE), the graph plots key aspects of technological innovation in energy management and shows their relative life-cycle stages.

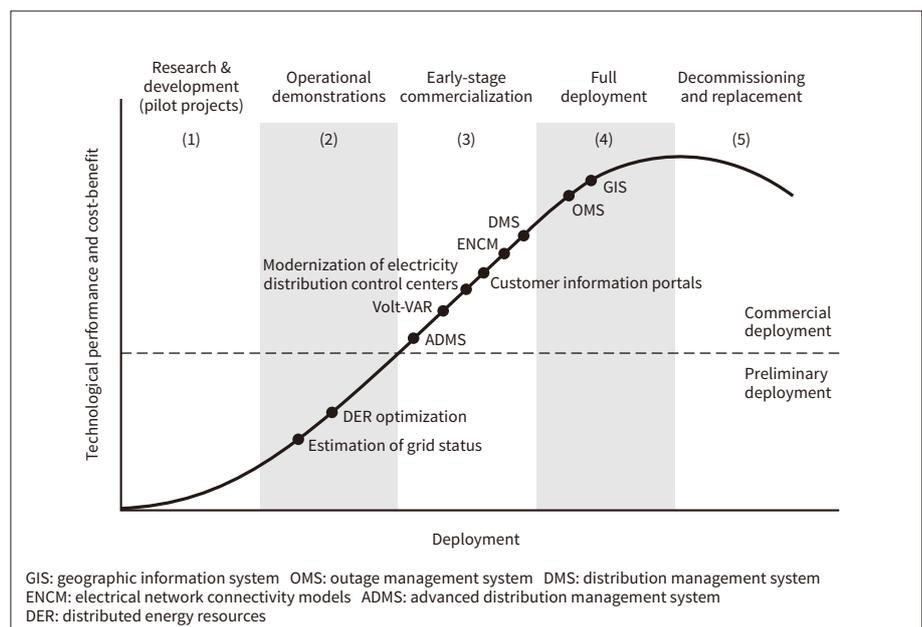
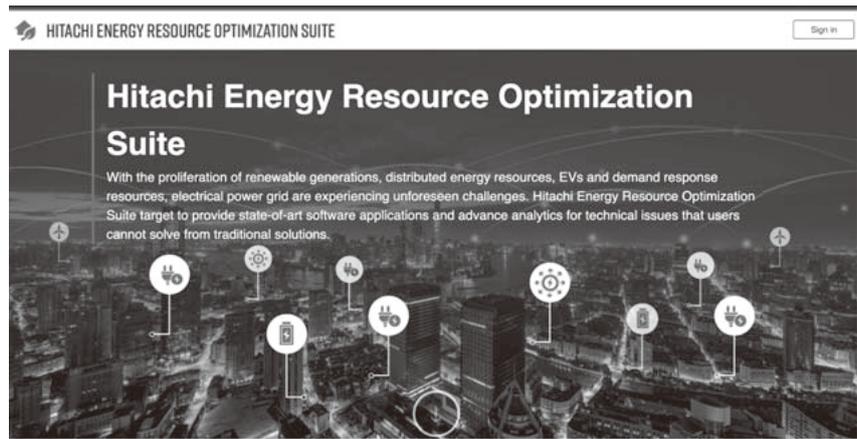


Figure 2 — Login Screen for Energy Resource Optimization Suite Developed by HAL ESL

The latest Internet of Things (IoT) platform for energy from the Energy Solution Laboratory at Hitachi America, Ltd. (HAL ESL) supports the integration, aggregation, and operation of customer DERs from the public service, commercial, and industrial sectors.



including both utilities and commercial and industrial customers

(3) Rich energy applications, which can digitalize the needs of distribution grid operation and serve the emerging needs for modeling and control of DERs

2. 2

Eco-system and Key External Partners

HAL ESL actively pursue opportunities to strengthen the development of its new energy solutions. It participated in two projects in two consecutive years (2018–2019).

In 2018, the California Energy Commission (CEC)⁽²⁾ selected HAL to lead a project on DER modeling, recognizing Hitachi’s pioneer efforts developing the new energy resource optimization solution. When CEC observes the rapid increase of DER penetration in California and the reformation of distribution resource planning policies, it foresees equally rapid evolution of planning simulation models and tools. Under the project, HAL ESL creates an intuitive solution, based on its new energy resource optimization solution technologies, which allow all energy stakeholders in California to accurately model solar inverters, EV charging stations, and smart controllable loads, exchange data via secured cloud infrastructure, and analyze impacts of DERs on distribution circuits collaboratively. HAL ESL also steps beyond technology development and develops an innovative engagement model to facilitate frontier policy reformation. This means that HAL ESL needs to engage with a variety of stakeholders including technology partners (SLAC National Accelerator Laboratory and Pacific Northwest National Laboratory), policy execution facilitators (Gridworks) as well as utilities partners including Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), and National Grid plc.

Then in 2019, the Solar Energy Technology Office (SETO) of the DOE selected 10 project teams to strengthen the integration of solar on the electricity grid⁽³⁾. The project led by Arizona State University (ASU) is one of them, where HAL ESL is a key team member and the

only industry partner. This project will develop a state-of-the-art DER aggregation platform coordinating behind-the-meter (BTM) solar inverters and providing voltage regulation functions to the distribution circuits. Such a platform bridges a gap in industry and compliments existing enterprise systems including DMS and DERMS. The dedicated utility partner, i.e. Arizona Public Services, works closely with Hitachi and provides necessary feedback and system information for technology development.

Under both projects, HAL ESL had opportunities to work with outstanding research institutes, to align with the latest policy initiatives, to develop new applications using its new energy resource optimization solution technologies, and to validate market acceptance with utility customers. The efforts gain great insights at the early technology development stage and greatly shorten tech-to-revenue durations.

2. 3

Rapid Prototype to Mitigate New Production Introduction Risk

The market dynamics in the US energy industry are very different now compared to past decades. To keep up with the rapidly evolving market, HAL ESL adopts a fast-prototype philosophy and leverages participation in public projects to speed up the pace of innovations. Software development cycles are reduced from years to months. Rapid prototypes can obtain customer feedback early on and minimize new product introduction risks. The business product team can then focus on commercial development when initial market exploration is settled and customer requirements for the new product are phased out via the co-creation projects in HAL ESL.

3. Conclusions

HAL ESL has established strong connections with research communities as a member of the Power Systems Engineering Research Center (PSERC), which provides

direct reach to 12 top universities and 26 industry partners. Fortunately, in the latest review with DOE, the HAL project team has received the “All Green” grade, which is considered exceptional for the standard.

HAL ESL will work on research and development of energy solutions to create a sustainable society through co-creation with wide-ranging partners.

References

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