

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAII

----- In the Matter of ----- )  
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 PUBLIC UTILITIES COMMISSION )  
 )  
 Instituting a Proceeding Related to )  
 The Hawaiian Electric Companies' )  
 Grid Modernization Strategy. )  
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DOCKET NO. 2017-0226

DECISION AND ORDER NO. 35268

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DECISION AND ORDER

By this Decision and Order, the State of Hawaii Public Utilities Commission ("commission") directs Hawaiian Electric Company, Inc. ("HECO"), Hawaii Electric Light Company, Inc. ("HELCO"), and Maui Electric Company, Limited ("MECO") (individually, "Company" collectively, "HECO Companies" or "Companies") to implement their Grid Modernization Strategy,<sup>1</sup> consistent with the directives and guidance stated herein.

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<sup>1</sup>"Modernizing Hawaii's Grid For Our Customers," filed in Docket No. 2017-0226 on August 29, 2017 ("Grid Modernization Strategy" or "Strategy").

I.

BACKGROUND

On January 4, 2017, by Order No. 34281,<sup>2</sup> the commission dismissed, without prejudice, the HECO Companies' Application ("SGF Application") for approval to commit funds for the Smart Grid Foundation Project ("SGF Project").<sup>3</sup> The commission identified its concerns with the SGF Application, including: the SGF Project's cost-effectiveness; the nexus between the SGF Project and the primary issues facing the Companies' distribution grids; and the SGF Application's failure to adequately address the risk of redundancy due to the growth of distributed energy resources ("DER"), or obsolescence as a result of technological advancement.<sup>4</sup> The commission also expressed its concern about the timing and sequencing of the substantial

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<sup>2</sup>In re Hawaiian Elec. Co., Inc., Hawaii Elec. Light Co., Inc., Maui Elec. Co., Ltd., Docket No. 2016-0087, Order No. 34281, "Dismissing Application without Prejudice and Providing Guidance for Developing a Grid Modernization Strategy," filed on January 4, 2017 ("Order No. 34281").

<sup>3</sup>"Application of Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., and Maui Electric Company, Limited, Exhibits A-I; Verification; and Certificate of Service," filed in Docket No. 2016-0087 on March 31, 2016 ("SGF Application").

<sup>4</sup>See Order No. 34281 at 3-5.

investments proposed in the SGF Application, and whether, or when, customers would realize corresponding benefits.<sup>5</sup>

The commission emphasized the importance of grid modernization to: (1) enable greater penetration of renewable generation and customer-sited DER; (2) expand energy options for customers to manage their energy usage; and (3) automate system control and operation.<sup>6</sup> The commission cautioned that mistakes today could create lost opportunities and significant stranded assets.<sup>7</sup>

The commission stated its concern that the Companies' strategic vision lacked the detail necessary to effectively evaluate the SGF Project, particularly given that the SGF Project was intended "to implement the initial Smart Grid capabilities that will serve as the platform to support not only immediate customer benefits, but also as the cornerstone for additional projects."<sup>8</sup> Given the magnitude of the proposed investment, and what was at stake, the commission directed the Companies to articulate and submit a well-vetted and detailed strategy that addresses grid modernization in a comprehensive and

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<sup>5</sup>See Order No. 34281 at 41.

<sup>6</sup>See Order No. 34281 at 41-42.

<sup>7</sup>See Order No. 34281 at 41-42.

<sup>8</sup>SGF Application at 2.

holistic manner, and which is informed by input from the community and stakeholders who will be the ultimate beneficiaries of the modern grid platform.<sup>9</sup>

Accordingly, the commission dismissed the SGF Application without prejudice and concluded that there is a need for the development of a well-vetted, overarching strategy for grid modernization that is informed by stakeholder input.<sup>10</sup> In requesting this Grid Modernization Strategy, the commission stated its expectation that the Companies would:

facilitate a process that will provide a forum to convene industry experts and representatives to deliver presentations and advance dialogue on a variety of grid modernization topics that would appear to be most critical in Hawaii. The dialogue generated by this process should inform the Companies as they develop detailed, grid modernization strategies for each island system.<sup>11</sup>

The commission directed the HECO Companies to submit an initial Grid Modernization Strategy for each utility no later than June 30, 2017, and the final Grid Modernization Strategy

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<sup>9</sup>See Order No. 34281 at 42.

<sup>10</sup>See Order No. 34281 at 4.

<sup>11</sup>In re Hawaiian Elec. Co., Inc., Hawaii Elec. Light Co., Inc., Maui Elec. Co., Ltd., Order No. 34436, "Addressing Motion for Partial Reconsideration," filed in Docket No. 2016-0087 on March 9, 2017 ("Order No. 34436"), at 5.

no later August 29, 2017.<sup>12</sup> The Companies filed their initial Grid Modernization Strategy in Docket No. 2016-0087 on June 30, 2017.

On August 29, 2017, the commission opened the instant docket to serve as a repository for the final Grid Modernization Strategy.<sup>13</sup> In opening this docket, the commission solicited public comments on the Strategy.<sup>14</sup> In the following two sections, the commission summarizes the Strategy, and highlights key public comments.

## II.

### THE GRID MODERNIZATION STRATEGY

The Strategy's stated objectives are to:

(1) empower customers' choice and provide safe, reliable, and affordable services; (2) enable distributed resources to become a vital part of Hawaii's renewable portfolio; and (3) leverage the electric grid to spur economic growth in

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<sup>12</sup>Order No. 34436 at 13-14.

<sup>13</sup>In re Public Util. Comm'n, Order No. 34773, "Opening Docket," filed in Docket No. 2017-0226, on August 29, 2017 ("Order No. 34773").

<sup>14</sup>Strategy at 1.

Hawaii's communities.<sup>15</sup> The Companies intend to implement the Strategy at a pace proportional to customer and grid needs.

First, the Companies propose to focus work on "foundational core investments and those investments necessary to resolve the service quality issues" associated with DER growth.<sup>16</sup> Next, the Companies will "identify and assess" grid modernization investments based on the benefits they provide in relation to the Companies' distributed resources forecast and the State's 100 percent renewable energy goal.<sup>17</sup> This approach would evolve the grid using advanced technologies at a pace "consistent with meeting customer needs and deriving customer value while remaining flexible to adopting emerging technologies."<sup>18</sup>

The Strategy "focuses on the near-term approach for the next six years to ensure flexibility over the longer term to adjust to changing circumstances and technological breakthroughs."<sup>19</sup> The Strategy employs a "layered architectural approach" to coordinate resources between customers, the distribution system,

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<sup>15</sup>Strategy at 1.

<sup>16</sup>Strategy at 46.

<sup>17</sup>Strategy at 46.

<sup>18</sup>Strategy at 17.

<sup>19</sup>Strategy at 18.

and the transmission system.<sup>20</sup> The Strategy builds on grid modernization investments in customer- and grid-facing technologies that the Companies have made throughout the past decade.<sup>21</sup>

The Companies intend to employ customer-facing technologies to create value and engage customers by: (1) enabling customers to take greater control over their energy bills; (2) providing contextual electric service information; (3) distributing pertinent operational information via social media; and (4) embracing the opportunity for customers and others to co-create services to manage the power system.<sup>22</sup> The Strategy relies on customer-facing technologies including advanced metering, a customer information portal, online outage maps, customer collaboration, and customer co-creation (i.e. "the act of prosumers providing services to the grid" and including distributed resources, such as demand response ("DR") and customer-sited energy storage).<sup>23</sup>

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<sup>20</sup>Strategy at 20.

<sup>21</sup>Strategy at 49.

<sup>22</sup>Strategy at 63.

<sup>23</sup>Strategy at 64, 70-71.

A.

### System Components

The Companies intend to employ grid-facing technologies including: advanced operational systems (DOC, DMS, DERMS, OMS, GIS, Situational Awareness);<sup>24</sup> distribution system components (advanced meters, fault current indicators, remote intelligent switch, secondary var<sup>25</sup> controllers, substation automation); network components (wide area network, field area network, neighborhood area network); and customer assets (advanced inverters).<sup>26</sup> Advanced operational systems provide the grid with software systems that manage and display information to increase efficiency, increase system control and flexibility, and give critical information to operators.

Distribution system components would provide the hardware necessary to enable two-way communication, advanced sensing capabilities, shifting of circuits for maintenance and restoration purposes, and voltage regulation. Network components provide structure to enable communications between high- and

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<sup>24</sup>These acronyms are defined in the Strategy, Appendix A.

<sup>25</sup>"Var is the standard abbreviation for volt-ampere reactive, written 'var,' which results when electric power is delivered to an inductive load such as a motor." Strategy, Appendix A, at 9.

<sup>26</sup>See Strategy at 79-80.

low-level devices.<sup>27</sup> The Strategy employs an emerging communication flow called "peer-to-peer" whereby "the communicating devices located in the distribution grid, and at the grid edge, directly pass communications traffic without the flow routing through the central operating systems."<sup>28</sup>

Customer assets provide advanced inverter functions that include voltage and frequency regulation (e.g., volt-var, volt-watt, and frequency-watt functions)<sup>29</sup>, all in an autonomous fashion. The Companies state that "[c]ybersecurity standards should be established for DER/inverter managing systems and networks."<sup>30</sup>

B.

System Implementation

The Companies propose a near-term grid modernization roadmap with an initial deployment phase beginning in 2018 and ending in 2023.<sup>31</sup> The goals for this initial deployment phase are to (1) "mitigate existing service quality issues" in order "enable

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<sup>27</sup>See Strategy at 80.

<sup>28</sup>Strategy at 94.

<sup>29</sup>See Strategy at 80, 106, Appendix D at 17.

<sup>30</sup>Strategy at 102.

<sup>31</sup>Strategy at 103.

continued customer adoption of DER" and (2) to "create a grid platform that allows DER to become an important system resource along with grid-scale renewables" to achieve the renewable portfolio standard ("RPS") goals.<sup>32</sup>

The near-term strategy includes: (1) incremental deployment of customer-facing technologies (e.g., advanced meters, related software); (2) deployment of sensing and measurement technologies (e.g., faulted circuit indicators); (3) line sensors; (4) situational awareness software; (5) field operational telecommunications; (6) advanced operational systems to improve customer reliability, operational efficiency, and to monitor for cybersecurity threats; (7) distribution field automation (e.g., intelligent switches); (8) volt-var management (e.g., with secondary var controllers, or advanced inverter functions); and (9) management of data integration and storage.<sup>33</sup>

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<sup>32</sup>Strategy at 103.

<sup>33</sup>Strategy at 104-106.

C.

Cost Estimates

The Companies propose a "conceptual cost estimate" for the near-term roadmap, summarized in the table below.<sup>34</sup>

Investment Category (in millions)	2018	2019	2020	2021	2022	2023	Total
Customer-Facing Technology	\$1.3	\$22.5	\$21.0	\$31.9	\$7.7	\$8.6	\$93.0
Sensing and Measurement	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$12.0
Operational Communications	-	\$1.6	\$1.6	\$1.6	\$1.6	\$1.6	\$8.0
Adv. Operational Systems	-	\$17.7	-	\$24.6	\$8.7	-	\$51.0
Distribution Automation	-	\$1.8	\$4.5	\$4.9	\$4.9	\$4.9	\$21.0
Volt-Var Management	\$3.2	\$3.2	\$3.2	\$4.0	\$3.2	\$3.2	\$20.0
Annualized Total	\$6.5	\$48.8	\$32.3	\$69.0	\$28.1	\$20.3	\$205.0
Cumulative Total	\$6.5	\$55.3	\$87.6	\$156.6	\$184.7	\$205.0	\$205.0

The Companies estimate that the \$205 million initial deployment will result in an average monthly bill impact of \$0.94 for Oahu customers, \$2.07 for Hawaii Island customers, and \$1.93 for Maui County customers.<sup>35</sup>

D.

Next Steps

The Companies propose to: (1) refocus their current grid modernization efforts to align with the Strategy; (2) file an application(s) in the first quarter of 2018 to execute the near-term roadmap; (3) at the commission's direction,

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<sup>34</sup>Strategy at 110.

<sup>35</sup>Strategy at 110.

engage stakeholders in a technical working group on data sharing starting in the first quarter of 2018; and (4) file a proposed integrated grid-planning process by March 1, 2018, consistent with the commission's Order No. 34696, filed in Docket No. 2014-0183.<sup>36</sup>

### III.

#### PUBLIC COMMENTS

As the commission directed in Order No. 34773, stakeholders had an opportunity to comment on the initial grid modernization strategy, and another opportunity to comment on the final Grid Modernization Strategy.<sup>37</sup> The commission received comments from federal, state, and local government agencies, private organizations, and individuals. The commission greatly appreciates the thoughtful comments it received, and the efforts the Companies made to incorporate stakeholder feedback. Indeed, the Companies' incorporation of stakeholder feedback, as discussed below, yielded substantial improvements to the Grid Modernization Strategy. Stakeholder input has been critical to the Strategy's development, and will be just as critical to its implementation.

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<sup>36</sup>Strategy at 113-114.

<sup>37</sup>Order No. 34773 at 1-3.

A.

Stakeholder Input Incorporated into the Strategy

As noted above, and consistent with the commission's directives in Order No. 34773, the Companies conducted a stakeholder process that included a day-long workshop and the opportunity for stakeholders to provide feedback on the Companies' draft strategy. The Companies offer many examples of their efforts to respond to and incorporate feedback and comments received through this stakeholder process.

First, the Companies note that, in response to stakeholder questions about how grid modernization will help all customers, not just customers who have already invested in DER, Section 1 of the Strategy summarizes how grid modernization "will enable continued growth in DER participation consistent with the December 2016 PSIP projections, at a cost that is 32 percent lower than the traditional wires alternative considered in the PSIP."<sup>38</sup> The Companies indicate that without grid modernization, their "ability to integrate DER and extract the greatest value from DER and DR resources will be greatly impeded."<sup>39</sup>

Second, the Companies state that Section 6.5.1 of the Strategy, titled "Electrification of Transportation", responds to

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<sup>38</sup>Strategy at 13.

<sup>39</sup>Strategy at 13-14.

stakeholder questions regarding electric vehicle integration into the grid modernization effort.<sup>40</sup> The Companies indicate that they will file their Electrification of Transportation ("EoT") strategy roadmap with the commission on March 31, 2018.<sup>41</sup> The Companies expect the EoT strategy roadmap to include, at a minimum, "the Companies participation in EoT within their service territories; how the Companies can foster opportunities for third parties in the EV charging market; how the EoT strategy will interface with the Companies' efforts related to DR software, programs, and planning; how the EoT strategy fits in with other dockets, including DR and DER; and how the Companies can ensure that tariffs provide for flexibility as technology, the market, and other factors evolve within the EV landscape."<sup>42</sup> Finally, the Companies state that the "EoT represents a significant opportunity to assist in achieving the 100 percent renewable energy goal, but only if properly planned for and leveraged."<sup>43</sup> In this way, the Companies do not plan to merely accommodate EVs: they plan to harness the EVs as an asset to benefit all customers.<sup>44</sup>

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<sup>40</sup>Strategy at 14.

<sup>41</sup>Strategy at 75.

<sup>42</sup>Strategy at 75.

<sup>43</sup>Strategy at 76.

<sup>44</sup>See Strategy at 75-76.

Third, in response to stakeholder concerns about the health effects of advanced meters, the Companies, in Section 6.1.1 of the Strategy, titled "Advanced Metering", summarize their findings related to the "health effects of advanced meters" and provide a "commitment to explore wired communication alternatives for advanced meters for select customers . . ."<sup>45</sup>

Fourth, in response to stakeholder concerns, the Companies devote Section 3 of the Strategy to more clearly articulate and clarify their approach to "proportional advanced meter deployment."<sup>46</sup> In general, the Companies explain that customers who choose to participate in programs that require the functionality required by an advanced meter, such as a DR program, would receive one as part of their participation.<sup>47</sup>

Fifth, in response to stakeholder questions regarding the ability of existing Supervisory Control and Data Acquisition ("SCADA") systems to perform certain voltage monitoring functions, Section 5.2 of the Strategy, titled "Grid Operational Considerations", illustrates how a line sensor could detect power quality problems that SCADA systems could not.<sup>48</sup>

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<sup>45</sup>Strategy at 14.

<sup>46</sup>Strategy at 14.

<sup>47</sup>See Strategy at 14.

<sup>48</sup>Strategy at 15.

B.

Summary of Commission-Solicited Stakeholder Feedback

In the following sections, the commission summarizes several stakeholder comments related to (1) grid architecture; (2) integrated grid planning; (3) stakeholder engagement; (4) data sharing and access; and (5) adaptive implementation.

1.

Grid Architecture

Several commenters support the Companies' development of the grid as a platform and discuss the Companies' approach to develop a layered grid architecture. For example, Pacific Northwest National Laboratory ("PNNL"), states that the Strategy "references several important architectural concepts," including layering and layered decomposition.<sup>49</sup> PNNL further states that "viewing the distribution grid as a platform . . . is a useful architectural approach reflected in many other kinds of systems and is successful at providing the layer decoupling that leads to flexible management of inevitable future changes to technology."<sup>50</sup> PNNL further states that "[s]tarting from a layered approach leaves open the possibility of

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<sup>49</sup>Comments of Pacific Northwest National Laboratory, Packet #6 page 9, filed on September 12, 2017 ("PNNL Comments"), at 1.

<sup>50</sup>PNNL Comments at 1.

future application of the principle and this assists in achieving a degree of future-proofing of investments in modernization."<sup>51</sup>

The National Renewable Energy Laboratory ("NREL"), observes that the Strategy "aims to integrate all three layers of grid operation", and states that the "layered architecture will allow [HECO] to utilize DERs for better reliability control."<sup>52</sup>

Joseph Paladino, Technical Advisor at the US Department of Energy's Office of Electricity Delivery and Energy Reliability, states that the Strategy "applies many of the concepts conveyed or developed through work sponsored by the U.S. Department of Energy. These concepts include the application of grid architecture as a means to obtain a holistic understanding of structural and functional requirements, as well as the proportional deployment of distribution system platform components to meet anticipated needs."<sup>53</sup>

Ulupono Initiative, LLC ("Ulupono") states its support for the Strategy's vision of "the grid [as] a bidirectional platform that enables the large-scale adoption of distributed

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<sup>51</sup>PNNL Comments at 1.

<sup>52</sup>Comments of National Renewable Energy Laboratory; Packet #6 page 4, filed on September 12, 2017 ("NREL Comments") at 1.

<sup>53</sup>Comments of Joseph Paladino, USDOE; Packet #16 page 13, filed on September 13, 2017 at 1.

resources . . ."<sup>54</sup> The Natural Resources Defense Council ("NRDC") specifically advocates for "[l]evering the grid edge network" in the distribution layer, consistent with the Companies' approach in the Strategy.<sup>55</sup>

2.

#### Integrated Grid Planning

Several stakeholders laud the Companies' proposed approach to integrated grid planning. Cisco Systems, Inc. ("Cisco") commends HECO's approach and states that the Strategy identifies a need for improvement in the planning process, explaining that "some legacy processes, especially planning and control, are rapidly becoming obsolete and ineffective."<sup>56</sup>

NREL emphasizes the importance of an integrated grid planning process and states that an "integrated planning framework allows coordination of resources at both the transmission level and the distribution level for better grid reliability and

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<sup>54</sup>Comments of Ulupono Initiative LLC, Packet #12, filed on September 13, 2017 ("Ulupono Comments"), at 5.

<sup>55</sup>Comments of the Natural Resources Defense Council, Packet #16 page 11, filed on September 13, 2017 ("NRDC Comments"), at 1.

<sup>56</sup>Comments of Cisco Systems, Inc., Packet #16 page 2, filed on September 13, 2017 ("Cisco Comments"), at 1.

operational efficiency. It also allows both the 'wires' and 'non-wires' solutions to be considered uniformly in the process."<sup>57</sup>

Environmental Defense Fund ("EDF") expresses support for the Strategy's planning approach and the "focus on grid investments required to enable pricing, demand response and other energy management strategies that help meet the on-going needs of the transmission and distribution system."<sup>58</sup>

Ulupono points out that the HECO Companies' "integrated grid planning approach represents a welcome improvement in the overall planning process that would eliminate some dysfunctional challenges . . . experienced in the past."<sup>59</sup>

Advanced Energy Economy Institute ("AEEI") states that integrated grid planning will "redefine the regulatory framework . . . creating new opportunities for third-party providers and customers to contribute to the operation of the electricity system."<sup>60</sup>

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<sup>57</sup>NREL Comments at 1.

<sup>58</sup>Comments of Environmental Defense Fund, Packet #10 page 3, filed on September 13, 2017 ("EDF Comments") at 3.

<sup>59</sup>Ulupono Comments at 6.

<sup>60</sup>Comments of Advanced Energy Economy Institute, Packet #7 page 1, filed on September 13, 2017 ("AEEI Comments"), at 6.

Stakeholder Engagement

Several commenters highlight the importance of customer-facing technology and engagement of customers and other stakeholders. NREL states that the Strategy's focus on "third-generation smart metering and standardizing communication" "will allow much more transparent information flow to customers for greater adoption of DERs and customers facing services such as demand response."<sup>61</sup>

EDF states that customers' "active participation in developing a comprehensive portfolio of energy management strategies could enhance the state's ability to meet its energy goals in a cost-effective manner."<sup>62</sup>

Cisco credits the HECO Companies for articulating a "commitment to adapt" in the Strategy and a vision of "interdependency with new grid participants."<sup>63</sup>

NRDC commends the Strategy as "an inspirational model for the entire electricity sector," including for its

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<sup>61</sup>NREL Comments at 1

<sup>62</sup>EDF Comments at 2

<sup>63</sup>Cisco Comments at 1-2

"[r]obust customer engagement" as a tool on the path to decarbonize the electricity sector.<sup>64</sup>

4.

Data Sharing and Access

Several commenters emphasize the need for data sharing and data access. AEEI states that "stakeholders should be involved in discussions regarding system and customer data, modeling assumptions, and modeling scenarios" and further points out that data may need to be provided in different formats to different users, such as utilities, customers, and third parties.<sup>65</sup>

EDF "commends the Companies' exploration into energy data access options for 'enabling customer choice and control,' including the Green Button standard."<sup>66</sup> EDF further notes that "providing customers with access to their energy consumption data not only empowers them to lower their utility bills, but is also integral to realizing a more efficient and cleaner electricity system that can smoothly integrate new DERs, including EVs and rooftop solar."<sup>67</sup> NRDC specifically advocates for enhanced

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<sup>64</sup>NRDC Comments at 1

<sup>65</sup>AEEI Comments at 4.

<sup>66</sup>EDF Comments at 5-6.

<sup>67</sup>EDF Comments at 5-6.

"[a]ccess to data and transparency" as the Strategy is implemented.<sup>68</sup>

5.

#### Adaptive Implementation

Several stakeholders stress the importance of flexibility, modularity, and an adaptive approach during the design and implementation of grid modernization investments.

Ulupono endorses the Strategy's approach "as a more cost-effective and practical approach to enabling DER" including "targeted deployment of smart meters, SCADA upgrades, and other elements."<sup>69</sup> Cisco states that the Strategy "targets technology resources where they are wanted, needed and utilized," expecting that "things will change . . . [and HECO's] electric service portfolio will continue to evolve".<sup>70</sup> AEEI supports the Strategy's characterization of walk, jog, run stages of development, "agreeing with the premise that the strategy must take into account dynamic changes."<sup>71</sup>

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<sup>68</sup>NRDC Comments at 1.

<sup>69</sup>Ulupono Comments at 6.

<sup>70</sup>Cisco Comments at 3.

<sup>71</sup>AEEI Comments at 3.

The commission reiterates its appreciation for the significant time and effort that went into stakeholders' helpful comments. The commission also acknowledges the Companies' efforts to improve the Strategy in response to stakeholder comments. Robust and early stakeholder engagement has markedly improved the Strategy. The commission expects the Companies to continue this best practice as they develop their application(s) to implement the Strategy.

#### IV.

#### DISCUSSION

##### A.

###### Commission Expectations for the Strategy

In Order No. 34281, the commission stated:

a modernized grid is the "backbone" necessary to advance the State's RPS goals, support integration of additional levels of renewables, encourage competition, empower consumers to make their own choices concerning the level and types of electric service they desire, and leverage customer-sited resources to assist in grid operation.<sup>72</sup>

The commission stated this high-level expectation for the Grid Modernization Strategy to provide a "comprehensive and holistic vision and context to inform subsequent review of

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<sup>72</sup>Order No. 34281 at 2.

discrete grid modernization project applications submitted by the Companies."<sup>73</sup> The commission also expected the Grid Modernization Strategy to be "flexible and able to accommodate changes over time, as the underlying elements, such as technology, customer expectations, and value proposition, continue to evolve."<sup>74</sup>

At a greater level of detail, the commission sought "an overall strategy and grid modernization investment budget that reflects a modular, flexible approach, consistent with the latest industry best practices" that identifies "the discrete grid modernization components that make up the larger strategy" and articulates "the proposed priority, implementation timing, and expected costs and benefits of each."<sup>75</sup>

B.

#### Guiding Principles

In Order No. 34281, the commission provided guiding principles for the Companies as they design and implement a

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<sup>73</sup>Order No. 34281 at 66.

<sup>74</sup>Order No. 34281 at 66.

<sup>75</sup>Order No. 34281 at 66-67.

comprehensive grid modernization strategy. First, the commission observed that the Legislature stated:

In advancing the public interest, the commission shall balance technical, economic, environmental, and cultural considerations associated with modernization of the electric grid, based on principles that include but are not limited to:

1. Enabling a diverse portfolio of renewable energy resources;
2. Expanding options for customers to manage their energy use;
3. Maximizing interconnection of distributed generation to the State's electric grids on a cost-effective basis at non-discriminatory terms and at just and reasonable rates, while maintaining the reliability of the State's electric grids, and allowing such access and rates through applicable rules, orders, and tariffs as reviewed and approved by the commission;
4. Determining fair compensation for electric grid services and other benefits provided to customers and for electric grid services and other benefits provided by distributed generation customers and other non-utility service providers; and
5. Maintaining or enhancing grid reliability and safety through modernization of the State's electric grids.<sup>76</sup>

The commission added to these guiding principles, stating that the grid modernization strategy should:

- Move toward the creation of efficient, cost-effective, accessible grid platforms

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<sup>76</sup>Order No. 34281 at 51 (citing HRS § 269-145.5(b)).

for new products, new services, and opportunities for adoption of new distributed technologies;

- Ensure optimized utilization of electricity grid assets and resources to minimize total system costs;
- Enable greater customer engagement, empowerment, and options for consuming and providing energy services;
- Maintain and enhance the safety, security, reliability, and resilience of the electricity grid, at fair and reasonable costs, consistent with the State's energy policy goals; [and]
- Facilitate comprehensive, coordinated, transparent, and integrated distribution system planning.<sup>77</sup>

The commission supports the Companies' proposed guiding principles, which largely mirror the principles articulated in Order No. 34281.<sup>78</sup> The commission expects the Companies to heed these principles as they implement the Strategy, and move towards a grid platform that increases opportunities for distributed technologies, optimizes grid assets to minimize costs, enables customer participation in consumption and energy services, and enhances grid safety, security, reliability, and resilience. In addition to these guiding principles, the commission

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<sup>77</sup>Order No. 34281 at 51-52.

<sup>78</sup>See "Hawaiian Electric Companies' Guiding Principles to Inform Grid Modernization," Strategy at 2.

re-emphasizes the importance of grid architecture, open standards, and interoperability.<sup>79</sup>

C.

Grid Architecture and Network Evolution

The Strategy presents a holistic view of how Hawaii's electric grid can evolve. Section 3 of the Strategy envisions the Grid as a platform that integrates customer owned DER as a system resource, but also acknowledges the necessity to replace aging infrastructure in a targeted and proportional way.<sup>80</sup>

The Strategy presents a grid architecture that will coordinate grid resources across three layers: customers, distribution systems, and transmission.<sup>81</sup> This system will rely on DER of different ages and sizes, including merchant DER, aggregators, and individual customers, utility DER and DR programs, and autonomous operating DER that use advanced inverter functions.<sup>82</sup> The Strategy also outlines near- and long-term

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<sup>79</sup>See Order No. 34281 at 6, 54-57. See also GridWise Architectural Council Policy Team (April 2007), Introduction to Interoperability and Decision-Maker's Interoperability Checklist, [http://www.gridwiseac.org/pdfs/gwac\\_decisionmakerchecklist.pdf](http://www.gridwiseac.org/pdfs/gwac_decisionmakerchecklist.pdf).

<sup>80</sup>Strategy at 25, 27.

<sup>81</sup>Strategy at 20.

<sup>82</sup>Strategy at 21.

strategies to control and use DER in abnormal system conditions.<sup>83</sup>

The Strategy includes a plan to integrate traditional planning elements (generation, transmission, and distribution) into a single planning process that incorporates DER.<sup>84</sup>

In addition, the Strategy depicts a grid that can accommodate changes over time. The Companies propose to evolve the grid, "consistent with meeting customer needs and deriving customer value" while remaining "flexible to adopting emerging technologies."<sup>85</sup>

The Companies' goal is for the grid to "evolve into a conduit for coordinated import and export of energy and related services."<sup>86</sup> The Companies envision an integrated grid platform that will "leverage energy storage, advanced grid technologies, and cyber-physical infrastructure upgrades that can incrementally evolve over time."<sup>87</sup> If the Companies can implement the grid described in the Strategy, they will be able to achieve 100 percent renewable generation by 2045, "with grid-scale and distributed resources" that are both "intermittent and highly

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<sup>83</sup>Strategy at 22-24.

<sup>84</sup>Strategy, Section 4.

<sup>85</sup>See Strategy at 17.

<sup>86</sup>See Strategy at 18.

<sup>87</sup>See Strategy at 18.

variable" and will enable "the convergence of multiple systems that would create strong economic benefits for communities, businesses, and customers as well as the infrastructure owners."<sup>88</sup>

The commission generally supports the Companies' approach to grid architecture and deploying grid and network investments proportionally to meet customer needs. But this proportional approach should not limit cost-effective deployment of distribution automation, advanced meters, or other grid investments. Tying such investments exclusively to customer DER adoption may unnecessarily limit their value. Therefore, the Companies should comprehensively evaluate grid needs to determine optimal timing, location, and sequencing of new investments.

As they begin deploying communications infrastructure, the Companies should closely track efforts underway in California and elsewhere to standardize protocols and ensure interoperability (e.g., use of IEEE 2030.5). Adopting open standards is essential to enabling the cost-effective, valuable grid of the future.

Finally, although the Companies emphasize grid modernization investments that allow them to control DER, such control is not necessary in all cases. DER should support autonomous operation and be responsive to communications,

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<sup>88</sup>See Strategy at 18.

but advanced DER capabilities can be obtained using less restrictive and costly methods, such as programmatic rules, contracts, and price signals.

D.

#### Stakeholder Engagement

The commission is encouraged that the Companies made extensive efforts to reach out to stakeholders, and solicit their input, as they developed the Strategy.<sup>89</sup> The dialogue generated by this process informed, and will continue to inform, the Companies as they implement grid modernization projects for each island system.<sup>90</sup> As the Companies implement the Strategy, they must leverage existing stakeholder relationships into lasting collaborations, to maximize the value of new and existing grid resources, including customer-sited DER.

E.

#### Integrated Grid Planning

The Companies intend to file a proposal for an integrated grid planning process by March 1, 2018.<sup>91</sup> This process has already

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<sup>89</sup>See Strategy, Section 2.

<sup>90</sup>See Order No. 34436 at 5.

<sup>91</sup>Strategy at 114.

begun, including the recent Integrated Grid Planning Symposium, held November 14-15, 2017.<sup>92</sup> As the Companies develop the integrated planning process, they should focus on the distribution system planning. The distribution system is particularly significant because that is where many grid modernization investments will be deployed, and where DER-related challenges and opportunities exist. Moreover, distribution planning has not traditionally been an open and transparent process that engages stakeholders. Accordingly, the integrated grid planning process must enhance the visibility and understanding around distribution planning. The commission strongly encourages the Companies to use best practices for distribution planning identified in other jurisdictions (e.g., California and New York). Furthermore, the commission expects the Companies to integrate the Grid Modernization Strategy into the integrated grid planning process, as it develops. In sum, the commission expects the Companies to include the Strategy's components into their ongoing planning, procurement, and budgeting process.

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<sup>92</sup>Integrated Grid-Planning Symposium on November 15, 2017 through November 16, 2017,  
<https://www.hawaiianelectric.com/about-us/our-commitment/investing-in-the-future/integrated-grid-planning/integrated-grid-planning-symposium> (last visited January 10, 2018).

Consistent with past commission guidance, the Companies should utilize a Value of Service ("VoS") approach developed in the DR Portfolio when analyzing grid needs.<sup>93</sup> Stated simply, VoS is a way to assess diverse resources and investment options relative to one another. VoS focuses on services and not on technologies or particular types of resources. Where possible, VoS is performed independent of technology selection to minimize biases that favor any technology. VoS allows a clear understanding, in economic terms, of the relative values that discrete services provide to the grid over time. VoS can reduce market inefficiencies, promote consistent resource assessment across the Companies' relevant business units, and facilitate an efficient and cost-effective resource selection process. Therefore, the commission directs the Companies to continue to use VoS as a foundational component of their future planning and procurement efforts.

F.

#### Data Sharing and Access

The Companies state that they are prepared, at the commission's direction, "to engage stakeholders in a technical

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<sup>93</sup>See In re Hawaiian Elec. Co., Inc. Hawaii Elec. Light Co., Inc., Maui Elec. Co., Ltd., Docket No. 2015-0412, Decision and Order No. 35238, at 96.

working group on data sharing beginning in Q1 2018."<sup>94</sup> The Companies describe this effort as "facilitated stakeholder discussions on data sharing for planning and operations . . . based on relevant experience in California and New York" that are "expected to result in achieving common understanding on many key issues and identification of any residual issues to support related activity in multiple regulatory proceedings."<sup>95</sup>

The commission supports the Companies' proposal to begin engaging stakeholders on data sharing. But because data sharing extends beyond grid modernization, the Companies' efforts may be more appropriately developed in the broader context of their proposed integrated grid planning process.<sup>96</sup> The Companies must also strive to build systems and collaborations that are extensible and useful to future anticipated data sharing efforts. The Companies should ensure that their grid modernization efforts enable customer access to data. In general, the Companies should follow industry standards and best practices for data access and sharing (e.g., the Green Button initiative).

Moreover, the commission recognizes that conversations around data sharing can raise sensitive, and potentially

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<sup>94</sup>Strategy at 113.

<sup>95</sup>Strategy at 39-40.

<sup>96</sup>Strategy at 114.

contentious issues. The commission supports the Companies' proposal to use an independent facilitator to lead these stakeholder discussions. This follows the best practices for successful stakeholder processes in Hawaii, such as the Reliability Standards Working Group.<sup>97</sup> It also follows best practices from similar proceedings elsewhere.<sup>98</sup> The facilitator must be a knowledgeable and credible third-party, that is able to assist stakeholders in productively discussing data access and sharing issues.

Consistent with the guidance outlined above, the commission directs the Companies to provide a more detailed explanation of their proposed data access and sharing efforts as part of their March 1, 2018 integrated grid planning filing.

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<sup>97</sup>See Strategy at 113. See also, Docket No. 2008-0273 March 28, 2011 Order.

<sup>98</sup>See Sky Stanfield, Stephanie Safdi, Optimizing the Grid, Interstate Renewable Energy Council, (December 2017) [http://www.irecusa.org/wp-content/uploads/2017/12/Optimizing-the-Grid\\_121517\\_FINAL.pdf](http://www.irecusa.org/wp-content/uploads/2017/12/Optimizing-the-Grid_121517_FINAL.pdf) ("Optimizing the Grid"), at 25-27.

G.

### Implementing the Strategy

The Strategy has meaningfully addressed many of the commission's concerns articulated in Order No. 34281. As the commission has stated, the modernized grid is the

"backbone" necessary to advance the State's RPS goals, support integration of additional levels of renewables, encourage competition, empower consumers to make choices concerning the level and types of electric service they desire, and leverage customer-sited resources to assist in grid operation.<sup>99</sup>

It is time to move beyond high-level strategies to build that backbone. The Companies must now demonstrate, in their forthcoming application(s), the details of how they will implement the principles articulated in the Strategy.

The Companies state that their next step is to "prepare an application(s) to execute the near-term roadmap[,]'" which they intend to file in the first quarter of 2018.<sup>100</sup>

The Companies divided their Strategy by technology into fourteen discrete components.<sup>101</sup> The Companies state that these component parts can layer on top of existing programs, including distribution substation automation, wide area networks,

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<sup>99</sup>Order No. 34281 at 2.

<sup>100</sup>Strategy at 113.

<sup>101</sup>See Strategy at 107.

and physical infrastructure replacement.<sup>102</sup> The Companies focus on the interoperability of these component parts, although they do not expect to achieve full interoperability within the first six years of the Strategy.<sup>103</sup> The Companies also divide the Strategy into six conceptual components, and provide a timeline and budget to implement each.<sup>104</sup>

After reviewing the Strategy and the public comments, the commission has remaining questions about the proposed priority, implementation timing, and expected costs of each component. The commission expects that the Companies will answer these questions when the Companies file their application(s) to implement the Strategy. In general, the commission expects the Companies to remain nimble, and adjust their planning process and grid modernization investments accordingly as programmatic solutions and technical advances emerge from other related proceedings, such as the Market Track of the DER investigation and the DR docket.<sup>105</sup>

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<sup>102</sup>See Strategy at 108.

<sup>103</sup>See Strategy at 108-109.

<sup>104</sup>The six components are: (1) customer facing technology, (2) sensing and measurement; (3) operational communications; (4) advanced operational systems; (5) distribution automation; and (6) volt-var management. See Strategy at 110.

<sup>105</sup>See Docket Nos. 2014-0192 and 2015-0412.

The commission believes that implementing the Strategy in a single application will make transparent the connections between the Strategy and the application, allowing all parties to more easily understand it, and provide useful feedback on the implementation. But the decision to implement the Strategy in one application, or in multiple applications, rests with the Companies.

If the Companies decide to divide implementation into multiple applications, they must provide, concurrent with the first application, a workplan that explains how the Strategy will be divided across multiple applications, the expected outcomes of each application, the interdependencies between each application, and the expected date the Companies intend to file each subsequent application. This workplan should be no more than 10 pages. The Companies should file updates to the workplan with each subsequent application. The commission will use the workplan to understand: (1) which element(s) of the Strategy the application fulfills; (2) how each element fulfills a component of the Strategy; (3) what elements of the application depend on elements already approved, or elements to be filed in a future application; and (4) the components of the Strategy that will be addressed by a future application(s).

The commission expects the Companies to provide more details about implementation in the forthcoming application(s).<sup>106</sup> At a minimum, the Companies should explain how each proposed grid modernization project will enable all customers to benefit, will promote customer engagement, and will appropriately and timely integrate technologies and practices.

Moreover, the application(s) must clearly describe and demonstrate: (1) customer value and benefits; (2) efforts to minimize risk of stranded costs; (3) greater renewable and DER integration; (4) data access, IT security and privacy measures; (5) support for other commission and Company priorities (e.g., DR, DER, community based renewable energy, etc.); (6) interoperability with existing non-legacy resources, including customer-owned, Company-owned, and third-party-owned, to the greatest extent possible; (7) that resources for the Strategy purchased in the next six years will be compatible with resources purchased beyond six years, to the greatest extent possible; and (8) describe any necessary expenditures beyond 2023.

As the Companies begin implementing the Strategy, the commission reminds the Companies to clearly identify bill impacts and customer benefits, and to the greatest extent possible, minimize the former and maximize the latter. As the commission

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<sup>106</sup>See Order No. 34281 at 44-52.

has already cautioned with respect to the SGF Project, the Companies must remain vigilant to avoid the risks of redundancy and obsolescence.<sup>107</sup>

H.

#### Conclusion

The Companies propose, among other things, to (1) refocus their current grid modernization efforts to align with the Strategy; (2) file an application(s) in the first quarter of 2018 to execute the near-term roadmap; (3) at the commission's direction, engage stakeholders in a technical working group on data sharing starting in the first quarter of 2018; and (4) file a proposed integrated grid-planning process by March 1, 2018, consistent with the commission's Order No. 34696, filed in Docket No. 2014-0183.<sup>108</sup> Because the Strategy reasonably complies with the commission's directives, set forth in Order Nos. 34281 and 34436, the commission directs the Companies to implement the Strategy, subject to the directives, conditions, and guidance in this Order.

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<sup>107</sup>See Order No. 34281 at 3, 5, 37, 41.

V.

ORDERS

THE COMMISSION ORDERS:

1. The Companies shall implement the Strategy, subject to the directives, conditions, and guidance contained in this Order.

2. Unless the commission orders otherwise, this docket is closed.

DONE at Honolulu, Hawaii FEB - 7 2018.

PUBLIC UTILITIES COMMISSION  
OF THE STATE OF HAWAII

By   
Randall Y. Iwase, Chair

By   
Lorraine H. Akiba, Commissioner

By   
James P. Griffin, Commissioner

APPROVED AS TO FORM:

  
Mike S. Wallerstein  
Commission Counsel

2017-0226.ljk

CERTIFICATE OF SERVICE

The foregoing order was served on the date of filing by mail,  
postage prepaid, and properly addressed to the following parties:

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