Hawaiian Electric
Maui Electric
Hawai'i Electric Light

Planning Hawai'i's Grid for Future Generations

Integrated Grid Planning Report

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Executive Summary

Powering a safe, secure, reliable, and resilient grid with Hawai'i's natural resources, whether on a small scale with individual customers, or through merchant renewable energy providers, will require thoughtful and coordinated energy system planning in partnership with local communities and stakeholders alike. Additionally, the electric grid of tomorrow will look dramatically different than the electric grid of the past, as it will need to efficiently handle complex tasks not originally imagined.

With a renewed focus on comprehensive energy planning, as discussed in this report, we believe customers will benefit from a process that will identify the best options to affordably move Hawai'i toward a reliable, resilient clean energy future with minimal risk. In addition, we believe the State will benefit from expanded market opportunities for resource, grid services, and non-wires alternatives for transmission and distribution ("T&D"), which can foster innovative solutions for a new energy economy.

The Hawaiian Electric Companies (the "Companies") began the process of developing an integrated grid planning ("IGP") approach based on enhancing the methods and tools of the prior power supply improvement plan ("PSIP"). This direction followed a path that other states are on – that is, incremental improvements to more traditional planning. However, as we reflected on the considerable stakeholder input received over the past year, it became clear that this initial approach would not accomplish the objectives we share with stakeholders – to achieve 100 percent renewables and utilize distributed resources to create value for customers.

Fundamentally, planning based on modeling theoretical values will no longer work at the scale of resource diversity and complexity in Hawai'i. It is essential to integrate market-based solutions and related integration considerations into the planning analysis to evaluate the best resource and grid options for customers.[1]

We then went back to the drawing board to redesign the approach. The result: The Hawaiian Electric Companies now propose to leap ahead to an innovative systems approach to energy planning. This fully integrated planning process intends to yield the most cost-effective renewable energy pathways that are rooted in customer and stakeholder input.

[1] Significant expansion on the concept in Decision and Order 33027, Integrated Demand Response Portfolio Plan issued in Docket No 2015-0412 on July 28, 2014 ("IDRPP Decision and Order"), page 45.

We made a significant change over traditional energy planning practices through streamlining traditionally disparate and serial tasks related to planning and procurement into a unified process. For instance, our proposed process, as illustrated in Figure ES–1, aims to establish a market for grid solutions that is tightly integrated into the optimization and decision-making process, thus increasing the number of market opportunities for unbundled grid services. This is an implementation of the Commission's value of services framework within a larger holistic planning process.

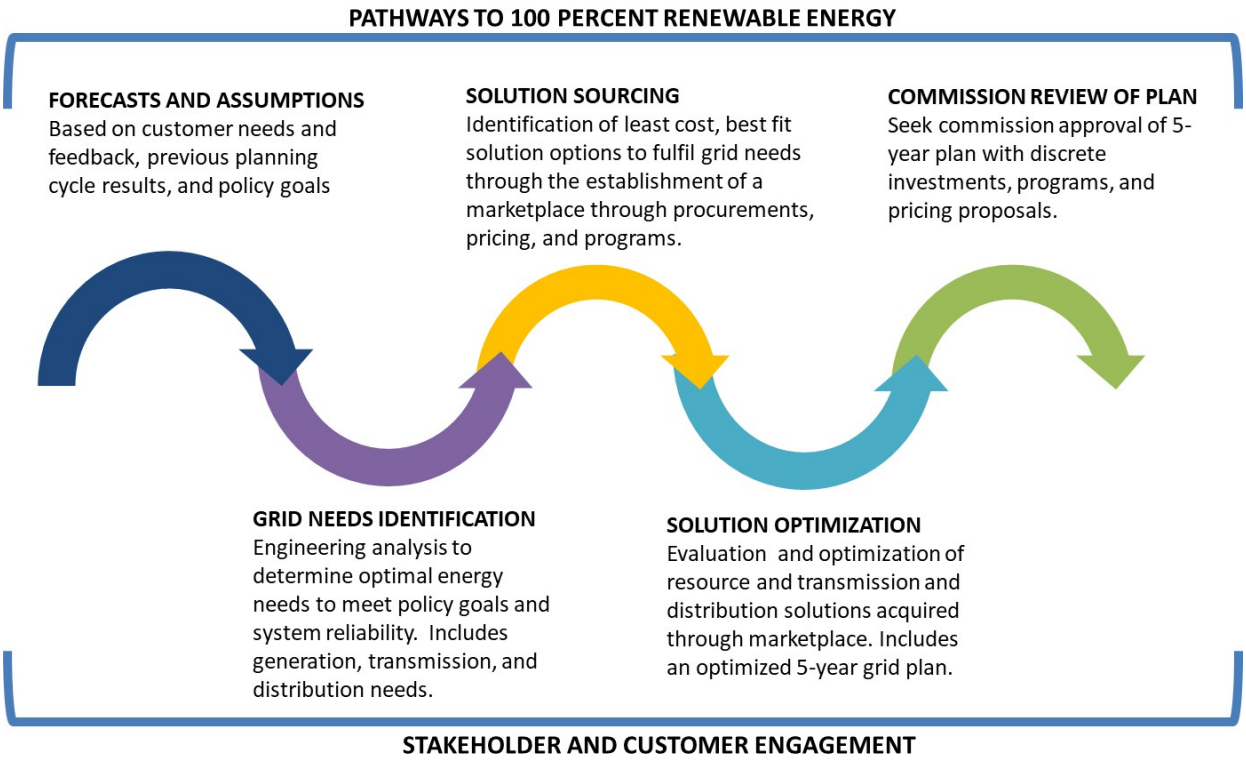

Figure ES-1: Integrated Grid Planning Process

Other highlights of this planning process include:

- Establishing customer-centric planning that yields customer value from market-driven alternatives that address resource, transmission, and distribution needs
- Creating greater market opportunities for distributed energy resource and demand response providers and grid-scale developers
- Enabling the development of an optimal portfolio of solutions to address resource, transmission and distribution needs
- Maintaining transparency through active multi-level stakeholder engagement and an independent technical advisory panel
- Implementing a streamlined 18-month planning process that culminates in a 5-year integrated plan with discrete proposals submitted to the Commission for review

This process was borne from the extensive discussions with both internal and external stakeholders and industry experts. Over the past six months, the Hawaiian Electric Companies have directly engaged stakeholders by holding a national integrated grid planning symposium, participating in the Pathways to an Open Grid initiative, and meeting with various local stakeholders. Collectively, the Hawaiian Electric Companies have engaged more than 100 experts globally, including researchers; modeling tool technology firms; utilities across the U.S., Japan, and Korea; and market operators in the U.S. and Australia.

The Hawaiian Electric Companies are excited to move forward to implement this innovative process as we plan Hawai`i's grid for future generations.

1 Customer & Stakeholder Input

The Companies have engaged and will continue to engage with customers and stakeholders to seek input and feedback on the plans to achieve 100 percent renewable energy and modernize the grid. This dialogue is an evolving conversation about customer needs and what it will take to affordably build a reliable grid in pursuit of Hawai`i's energy goals. Meeting these goals involves building a common understanding of the challenges, opportunities, and tradeoffs involved with enhancing the electric grid to meet customer service expectations and achieve the State's renewable goals. That understanding starts with listening to customers and stakeholders.

1.1 CUSTOMER INPUT

The Companies hired an independent consumer research firm, Ward Research, to conduct a series of customer interviews and focus group meetings from a cross-section of commercial and residential customers and community organizations throughout Hawai`i as part of the development of the Grid Modernization Strategy ("GMS"). These engagements were intended to gain better insight into consumer preferences, priorities, and expectations related to grid modernization, and they have implications for integrated grid planning as well. One-on-one interviews and focus groups meetings were held on Hawai`i Island, Maui, and O`ahu during April and May 2017. Ward Research's full report was included in Appendix B of the GMS.[2]

Many customers cited Hawai`i's goal of reaching 100% renewable energy by 2045. They expressed a social responsibility to assist in the goal of having renewable energy in Hawai'i. Customers offered various ideas about reaching this goal but said that they were not wedded to any specific plans; they just want to achieve cleaner energy as quickly and as cheaply as possible. Customers hoped that the Companies can help

> *"HECO should take a leadership role and help streamline the process for the entire state."*
> *~ Utility customer*

[2] Hawaiian Electric Companies, Grid Modernization Strategy, August 29, 2017. Available at https://www.hawaiianelectric.com/Documents/about_us/investing_in_the_future/final_august_2017_grid_modernization_strategy.pdf

streamline the plan to achieve the State's goals to make it easier for others to assist. One customer suggested that "HECO should take a leadership role and help streamline the process for the entire state."

A few customers expanded on the attributes of planning and information sharing they would like to see, stating that the Companies "need more integrated resource planning" and that "we don't have the information to point to a source to see what the capabilities of the current grid are or what updates need to be done to get it to where we want it to be." Also, industry experts and a few commercial customers suggested that the Companies should look for partners in technology, energy generation, and distribution, suggesting that they should, for example, "be able to use the innovation that exists and implement new technology as it becomes available." The survey, as highlighted in these sentiments, reflects a need for a holistic planning analysis and proactive market engagement for solutions as part of the planning process.

Clearly, it is important to understand how our customers' needs and expectations may change over time. As one customer emphasized, "HECO needs to continue to take community input and inform the community of future plans." Thus, a first step in integrated grid planning will be to engage with our customers through direct conversations and surveys to ensure that the planning process addresses their needs and expectations.

1.2 STAKEHOLDER INPUT

In its PSIP Decision and Order[3], along with stakeholder feedback, the Commission recognized that the PSIP was a significant advancement over prior planning efforts. In sum, the Companies were encouraged to build upon the successful components of the PSIP to develop the IGP process.

Following the Commission's PSIP Decision and Order, we met directly with several stakeholders in the development of the IGP process, including the following: Commission staff; the Consumer Advocate; Department of Business, Economic Development & Tourism (DBEDT); Hawai'i Natural Energy Institute (HNEI); Ulupono Initiative; the County of Maui; the County of Hawai'i; and the County of Hawai`i's consultant, Arizona State University. Several common themes emerged from the discussions that have guided the development of this IGP process.

Planning process must be diverse and customer-centric

The planning process must be customer-centric and engage stakeholders broadly to represent a range of interests of Hawai`i's various communities. This includes enabling transparent

[3] Decision and Order No. 34696 Instituting a Proceeding to Review the Power Supply Improvement Plans for Hawaiian Electric Company, Inc., Hawai'i Electric Light Company, Inc., and Maui Electric Company, Limited, issued in Docket No. 2014-0183 July 14, 2017 ("PSIP Decision and Order").

stakeholder engagement that balances inclusiveness with efficiency while remaining focused on value for customers, a theme emphasized by both Commission staff and the Consumer Advocate. The County of Maui emphasized the importance of affordability to all customers, in particular to those who cannot afford to invest in their own resources. Similarly, the County of Hawai'i emphasized the importance of affordability and reliability.

This also means actively engaging customers and communities throughout this process to ensure balanced representation. This will require additional education and understanding of a planning process that is often technical in nature. We recognize the benefits of input and feedback of all stakeholders and propose a comprehensive approach, which is described in Section 2.3 below.

Need to address uncertainty

The planning process must also address the uncertainty of the various input assumptions that drive forecasts and sensitivities. This includes, as suggested by Ulupono Initiative, factoring the corresponding risks into the analysis. Additionally, the Consumer Advocate, DBEDT, HNEI, and Ulupono Initiative each shared that the process should be holistic and have a near-term (up to 5 years) focus along with a view to the longer-term issues and considerations that will need to be addressed in the near term to enable subsequent action plans.

Additionally, given the current rate of technological advancement, long-term analyses and projections more than 10 years out have a high degree of uncertainty. HNEI suggested supporting longer-term analysis by using Hawai'i's 2030 intermediate goals as a reference point toward 2045.[4]

The planning process should include resiliency criteria

DBEDT, Ulupono Initiative, and HNEI recognized that the integrated planning process affords an opportunity to incorporate resiliency criteria as part of the overall planning criteria.

A successful IGP will require continuous improvement

Stakeholders recognized that the proposed integrated grid planning process is a first for the industry and that an evolutionary approach is appropriate given the complexity. This evolution will rely upon continuous improvement in the methods, analysis tools, data availability, and knowledge gained from conducting the process. This feedback is consistent with the Commission's direction in their PSIP Decision and Order.[5]

IGP must understand the interrelationships with regulatory activity and State and local planning

[4] Hawai'i State Energy Office, Grid Modernization, Renewable Portfolio Standard (RPS) targets: Available at http://energy.hawaii.gov/renewable-energy/grid-modernization.

[5] PSIP Decision and Order, pages 48-49.

In developing this planning process, stakeholders emphasized the importance of understanding the relationships between interrelated activities such as rate cases and various distributed energy resource ("DER")–related dockets. Additionally, IGP should coordinate and consider State and local planning for transportation, resiliency, and land use that go beyond the traditional boundaries of utility planning.

A technical advisory panel will provide expert advice on technical issues

Based on initial stakeholder meetings, the Companies recommend the formation of a technical advisory panel to provide input and feedback on methods and tools and serve as an expert-sounding board on technical issues. The group would be comprised of experts from across the world who have direct experience in related research and implementation of advanced planning issues and techniques. The County of Maui recommended that Arizona Public Service be the utility representative on the Technical Advisory Panel, based on the stakeholder suggestion of having a utility with relevant experience participate.

Incorporate grid services in planning process

Stakeholders, along with the Commission in its recently issued Demand Response ("DR") Decision and Order[6] and GMS Decision and Order,[7] pointed to a need to link the identification of IGP near-term needs to the identification and assessment of holistic, optimized solutions. This step would include procurements for resource adequacy, grid services, and potential non-wires alternatives. Additionally, the incremental deployment of grid modernization technology should be clearly identified with the appropriate linkage to the architecture identified in the Companies' GMS.

The Commission's collective guidance for IGP from the PSIP, DR, and the GMS decision and orders are summarized and cross-referenced to the respective sections in this report in Appendix C.

[6] Decision and Order No. 35238 For Approval of Demand Response Program Portfolio Tariff Structure Reporting Schedule, And Cost Recovery of Program Costs through the Demand-Side Management Surcharge, issued in Docket No 2015-0412 on January 25, 2018. ("DR Decision and Order"), pages 94–96.

[7] Decision and Order No. 35268, Instituting a Proceeding Related to the Hawaiian Electric Companies' Grid Modernization Strategy, issued in Docket No. 2017-0226 on February 7, 2018 ("GMS Decision and Order"), pages 29–30.

2 Integrated Grid Planning

2.1 VISION

The mission of the Hawaiian Electric Companies is to provide innovative energy leadership for Hawai'i and to empower our customers and communities with affordable, reliable clean energy. Our goal is to identify and enable the optimal mix of distributed energy resources (such as customer-generated rooftop solar PV), DR, and grid-scale resources through a flexible modern grid platform that enables the convergence of energy, technology, and customer value. The December 2016 PSIP represented a major step forward toward achieving that goal.

Although Hawai'i is already a leader in DER integration, the Companies envision achieving much higher levels, increasing the importance of the distribution system to transport energy and grid services that are both *provided by* and *consumed by* our customers.

We went back to the drawing board to redesign our process, which now leaps ahead to an innovative systems approach to energy planning.

As such, the Companies and others recognize the opportunity to create customer value by harmonizing resource, transmission, and distribution planning processes by collectively evaluating the identified needs and coordinating solutions that provide the best value on a consolidated basis. This approach evaluates the gross needs of the system, considers all alternatives, both traditional and non-traditional, and then selects the most cost-effective solution(s) to produce an optimized portfolio of incremental resources and transmission and distribution assets to reliably and affordably operate the grid.

The growth of distributed generation in, for example, a location where a transmission or distribution upgrade is necessary to accommodate growing loads could both offset the need for large-scale generation and defer or eliminate the need for grid upgrades. In this case, one solution addresses two needs, thus directly benefiting customers. Similarly, customer adoption of solar-plus-storage systems may offset the need to increase hosting capacity through traditional distribution upgrades if these systems are operated to benefit the circuit.

It is more complex in practice to develop a robust planning process that will address all of these dimensions. The initial IGP process identified in the development of the GMS was initially thought to be able to achieve the objectives through incremental enhancements to the PSIP

planning process, including coordination of resource, transmission, and distribution planning. After considerable stakeholder and industry expert discussions over the past six months following the GMS, it became clear the initial process was not going to achieve what we set out to do: maximize value to our customers with minimal risk. We came to the realization that the process was serial, with procurement initiating after completion of the planning analysis. This meant that the process was time-consuming – increasing the risk that assumptions could change by the time solutions were sourced. There was also the risk that the resulting resource, transmission, and distribution solutions would not be optimally coordinated, despite integrating the preceding planning work. So, we went back to the drawing board to redesign an IGP process that incorporated a market-based sourcing process into the core of the process.

We believe this innovative systems approach addresses Commission guidance over the past few years and highlighted in its PSIP Decision and Order that the purpose of integrated system planning is to determine a reasonable plan that can serve as a strategic basis and provide context to inform resource acquisition, incremental grid investments, alternatives, and system operation decisions.[8] The Commission further stated that "well-vetted, credible, comprehensive system analysis is essential to the Companies fulfilling their role to provide a platform to meet the diverse service requirements of their customers by integrating a variety of generation sources and customer-sited resources in an economically and operationally efficient manner."[9] Additionally, the Commission introduced a multi-step approach (now referred to as Value of Service ["VoS"]) to identify grid needs, define related services in a technology neutral manner, and source market-based grid services in its 2014 IDRPP Decision and Order and subsequent discussions. The Companies agree with the Commission to incorporate these aspects into a holistic approach, and the proposed IGP process is designed around this approach.

We are pursuing this comprehensive customer-centric IGP and sourcing process. This integrated planning process also engages stakeholders in a collegial process, incorporates procurements into the planning process to create new market opportunities, and considers customer affordability, reliability, and choice as we move toward 100 percent renewable energy. Consistent with the guiding principles accepted by the Commission in our GMS[10] and those used in the PSIP[11], our goal is for the process to produce:

Near-term actions that more fully coordinate and optimize customer resources and grid-scale resources while simultaneously improving the reliability and resiliency of the grid in a manner that benefits all customers.

[8] PSIP Decision and Order, pages 24-25.

[9] PSIP Decision and Order, page 24.

[10] GMS Decision and Order, page 26.

[11] PSIP Update Report, December 2016, page ES-2.

2.2 SYSTEM PLANNING & SOURCING PROCESS REDESIGN

The starting point for redesigning the planning process is the prior PSIP and current sourcing process, as conceptually illustrated in Figure 1 below. The Companies took a major step forward in their PSIP in the process, methods, and tools used to conduct the analysis. But we realize that it is necessary to advance planning much further to create a fully integrated planning process. For example, the PSIP did not fully integrate the distribution planning analysis with the resource-transmission assessment, which is essential given the importance of distributed resources in Hawai`i. The Commission recently noted this gap, stating that "achieving this goal will depend on the Companies' ability to work towards a more complete integration of the distribution planning and a refinement of the resource and transmission planning process."[12]

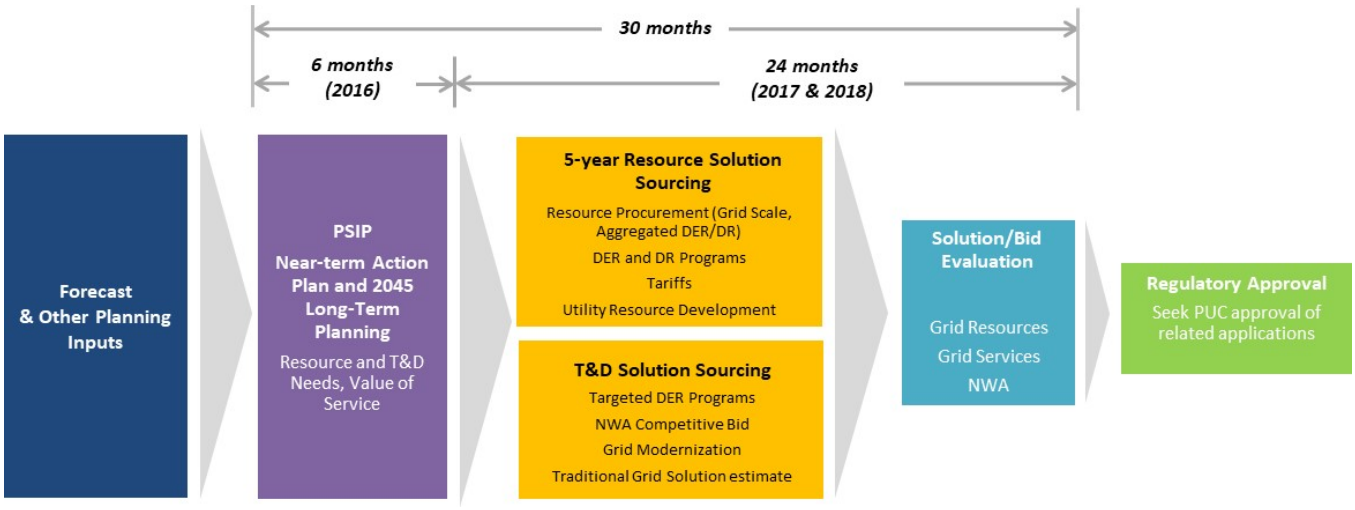

Figure 1: Existing System Planning & Solution Sourcing Processes

The entire current process of planning, solution sourcing, and evaluation extends 2½ years from forecasting through final evaluation. The resulting solutions are not fully optimized in the evaluation process, and the solution sourcing for resources and T&D solutions do not converge. This is partially due to these processes running independent of each other after the PSIP in relation to the multiple proceedings, each with its unique timetable, as illustrated in Figure 2.[13]

[12] GMS Decision and Order, page 31.

[13] See, Commissioner Akiba's presentation at the Integrated Grid Planning Symposium on November 17, 2018. Available at https://www.hawaiianelectric.com/Documents/clean_energy_hawaii/grid_modernization/igp_symposium/lunch_lorraine_akiba.pdf

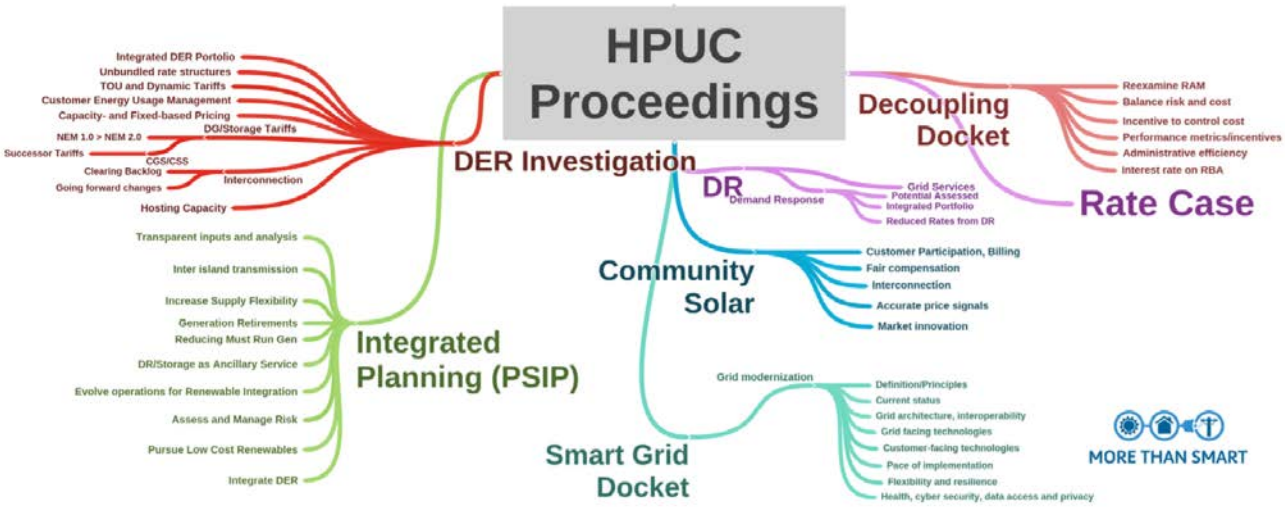

Figure 2: Hawai'i PUC Proceedings

The Companies and stakeholders all acknowledge the need to de-bottleneck this set of activities by shortening the overall timeline and integrating to a unified framework that can scale to achieve 100 percent renewables and active provision of grid services from a variety of sources. The Companies concluded that instead of pursuing a process as conceptually described in the GMS, a more radical redesign of the planning and sourcing process was needed. This drove the need to pivot from the conceptual integrated distribution planning–based approach in the GMS to pursue an IGP and sourcing process.

The challenge did not lie solely with the need to integrate distribution planning. A complete integration also requires incorporating market-based solutions into the heart of the planning process to develop more optimal outcomes for customers, rather than including market engagement as the last step in a long chain of serial activities based on assumptions and modeling estimates. While more complex to initially implement, this approach enables Hawai`i to reach its goals with a more complete planning analysis and consideration of market-based solutions. This process also affords greater opportunities for solution providers to participate and innovate, with the potential to spur economic development for the State. In this regard, we believe this approach moves ahead of the integrated distribution planning initiatives underway in several states.[14]

IGP integrates the resource, grid services, and solution sourcing for non-wires alternatives into the heart of the planning process.

In comparison, the integrated distribution planning approaches being developed in other states do not fully integrate planning analysis because they typically conduct resource, transmission, and

[14] L. Schwartz, Planning for the Evolving Grid: State Distribution Planning Practices presentation for National Conference of State Legislatures, Sept. 14, 2017, http://www.ncsl.org/Portals/1/Documents/energy/webinar_LSchwartz_9_2017_31633.pdf.

distribution planning separately. For example, the California and New York methodologies stack the results of separate planning analyses.[15] A comparatively simple stacking of results may miss benefits or impacts that span across multiple parts of an electric system. Furthermore, these approaches follow more traditional processes, where identification and sourcing of options is the last step or occurs after planning is completed. As such, they do not reflect an optimization or the true incremental "net need" or net value. Therefore, these approaches are unable to identify solutions that address multiple resource, transmission, and distribution needs collectively.

This gap was highlighted by a stakeholder in the January 2018 Pathway to an Open Grid workshop.[16] It was noted that without an integrated process that is "endogenous rather than exogenous" (i.e., internally consistent and integrated rather than inconsistent and separately developed), it is impossible to reconcile results from the different planning and sourcing processes to assure that optimized needs will lead to cost-effective outcomes for customers. Significant structural issues in other states make full integrated planning difficult, given that different entities may conduct the resource, transmission, and distribution planning on different planning cycles. In this context, the current integrated distribution planning and locational value approaches are an improvement over past practices. However, we have the opportunity to leapfrog these hybrid planning approaches to achieve fully integrated planning that efficiently benefits customers.

This need was also identified in the Commission's recent DR Decision and Order:[17]

> *"The absence of such unified valuation has the real potential to create market inefficiencies and inconsistent assessment of resource selection."*

The Companies agree that integrated planning and coordinated evaluation of market-based alternatives are essential to sustainably achieve value for all customers. The proposed IGP process is a major move forward for Hawai'i and for the electric industry. This will require substantive change for all stakeholders. But we believe that this path will lead to greater benefits and choices for customers through the flexibility we have built into the process, which will enable all customers to take advantage of economic and technological advancements transforming the electric industry.

Customers will benefit from the Companies' Integrated Grid Planning process that will streamline currently disparate processes

IGP will combine customer-centric resource, transmission, and distribution planning to holistically assess the physical, operational, technological, and behavioral changes to the electric grid necessary to enable safe, reliable, and affordable service that satisfies customers'

[15] California PUC Proceeding R.14-08-013, Distribution Resources Plan - Locational Net Benefits Analysis and New York DSP Case 14-M-0101, Reforming the Energy Vision – Benefit-Cost Analysis Framework.

[16] Pathways to an Open Grid, available at: https://www.pathways-opengrid.com/location-net-benefit-analysis/.

[17] DR Decision and Order, page 96.

evolving service expectations and use of distributed resources. This new IGP process will consider a full range of options and more effectively evaluate the final set of short-term solutions to meet Hawai'i's resource, transmission, and distribution needs defined in technology-neutral terms. This approach avoids the need to conduct transmission and distribution analysis outside of the resource planning process, as is the case with most locational benefits methods currently being employed in other states. IGP will need to learn from and inform other ongoing activities and relevant proceedings, including programs such as DER, DR, Community Based Renewable Energy ("CBRE"), Electrification of Transportation ("EoT"), and ongoing grid modernization projects.

Solution assessment will be based on market input for both resource needs and T&D non-wires alternatives referenced against the analytically derived value of a grid service using a "VoS methodology" model.[18] The IGP process will identify incremental resource, transmission, and distribution net system needs. These incremental needs (defined in a technology-neutral manner) will then become the basis for identifying potential resource and grid alternatives through a fair and transparent evaluation of alternatives, which will result in cost-effective solutions for customers in the near-term action plan.

The success of this process will depend on establishing an efficient and competitive marketplace that addresses resource and grid needs to create customer value.

IGP will also consider resiliency policy objectives, how energy planning can spur economic development of smarter cities and communities through the electrification of other sectors (e.g., transportation), optimal land use, and job creation. Finally, this process is a closed loop that uses the results of the prior plan (in this case, the PSIP action plan results and DR programs) as well as any identified major transmission and distribution capital upgrades as inputs. The IGP and sourcing process[19] is illustrated in Figure 3 below.

[18] DR Decision and Order, page 97.

[19] Consistent with Value of Service concept in IDRPP Decision and Order and subsequent Commission orders.

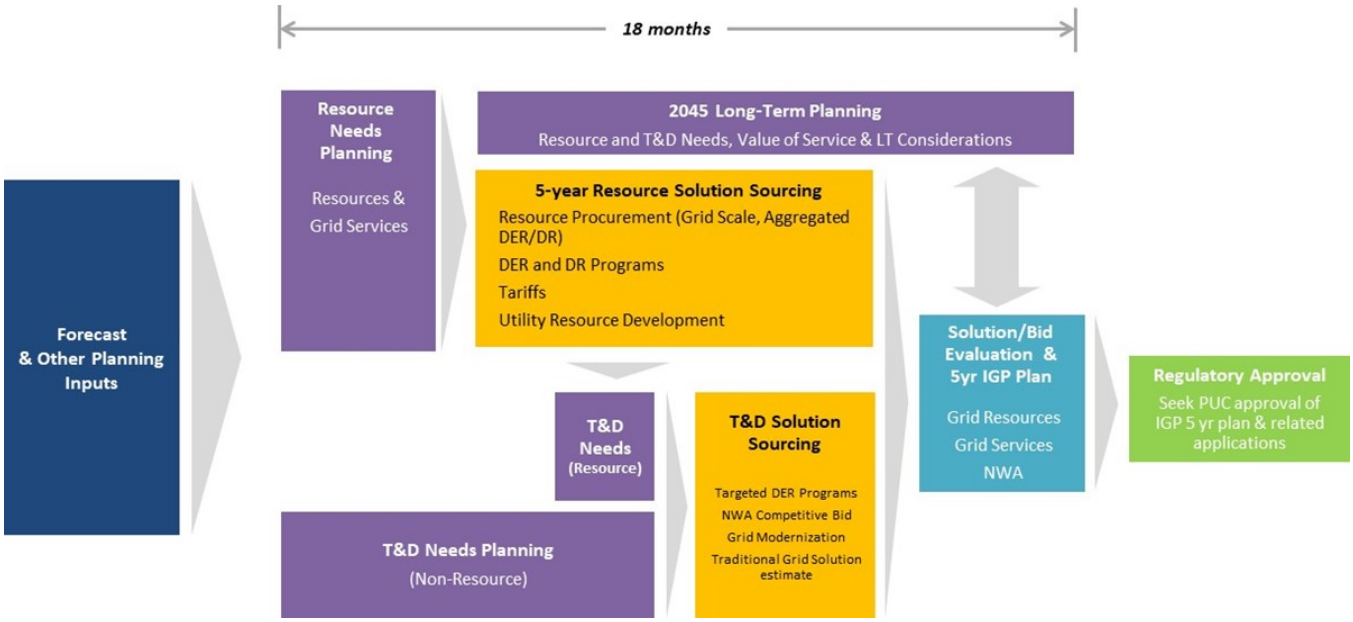

Figure 3: Integrated Grid Planning & Solution Sourcing Process

The IGP process will develop input assumptions and then identify resource needs (grid resources and grid services) using E3's RESOLVE capacity expansion model, the PLEXOS production simulation model, and PSS/E transmission planning software. The output of this first step is to quantify resource needs in technology-neutral terms with standard definitions.

The IGP process would then initiate market-based solution sourcing/procurement for the resource needs identified in the first step. Solutions include grid-scale resources and aggregated DER/DR as well as DER and DR programs, tariffs, and resource development by the Companies. Sourcing will involve two parts, starting with a request for information ("RFI") along with initiating program/tariff options. The second part will involve incorporating the T&D needs into a request for proposals ("RFP") and the resulting competitive solutions.

Information received from the solution sourcing/procurement RFI is used to identify T&D needs to integrate these resources. Additionally, T&D needs that are identified from ongoing non-resource planning work will be aggregated with resource-related T&D needs. The aggregated T&D needs will inform market participants to improve resource and grid services proposals in the subsequent resource/grid services RFP.

This also includes a T&D solution sourcing/procurement. Targeted DER programs, non-wires alternatives that are competitively sourced, grid modernization investment, and traditional grid solution estimates will be considered. The results from the T&D solution sourcing and resource solution source processes will provide the complete cost of actionable solutions to address the resource and T&D needs.

The final task is to evaluate the alternatives and develop the five-year action plan. The resource, grid services, and T&D solutions received from the solution sourcing/procurement

will be evaluated to create an effective portfolio and related action plan that addresses policy goals and customer needs. Also, the long-term planning to 2045 will be completed and informed by the near-term action plan. The long-term plan will be published and include key considerations for further discussion on important factors, such as land use, to identify pathways to Hawai`i's goals. The five-year action plan will be submitted to the Commission along with related applications for approval.

Appendix B describes the detailed process elements, key methods, and enhancements that will be utilized in the first IGP cycle, which begins this year.

With this approach, the Companies affirmatively acknowledge the Commission's requirements for evaluating resource and non-wires alternatives as described in the PSIP Decision and Order:

1. Conduct fair and transparent evaluation of alternatives, including consideration of alternatives that could result in lower cost and/or lower risk for customers
2. Consider all appropriate technologies, including combinations of technologies, to address system, capacity, and energy needs, rather than specifying a single resource option
3. Sufficiently justify how each resource is the best choice in conjunction with the near-term action plans identified in [an IGP]
4. Include performance measures to evaluate implementation of the proposed action

The success of this reengineered planning and sourcing process will depend on the establishment of an efficient and competitive marketplace that addresses resource and grid needs that create customer value.

This integrated grid planning process is anticipated to be conducted every two years for maximum flexibility and adaptability, with transparency and stakeholder engagement throughout. We propose to begin stakeholder engagement in 2018 and other activities to support commencing the initial planning cycle in 2019, incorporating both market-based resource and non-wires solution solicitations as part of the planning process that leads to an integrated grid plan by the end of 2020. A near-term, five-year action plan will be accompanied by a longer-term planning analysis considering the period from year six (2026) to 2045. We expect that implementing this process will identify opportunities for further refinement and will also need to adapt to changing conditions, new objectives, and uncertainties.

2.3 CUSTOMER & STAKEHOLDER ENGAGEMENT

The Companies designed this IGP process around an active customer and stakeholder engagement model similar to that which we adopted in developing the 2016 PSIP and the 2017 GMS. Based on the experience in these two previous efforts, the Companies believe that active engagement helps ensure alignment with customer and stakeholder interests and facilitates the development of broadly supported action plans.

In developing our IGP Stakeholder Engagement approach, we attempted to build on lessons learned from successful stakeholder engagement models used in Hawai'i (e.g., Honolulu Board of Water Supply) and by adapting successful elements from models that other jurisdictions[20] have used for similar programs. As a result the overall IGP stakeholder engagement model, as shown in Figure 4, provides a robust framework that enables us to engage with stakeholders and customers to gather their input and feedback throughout the IGP process.

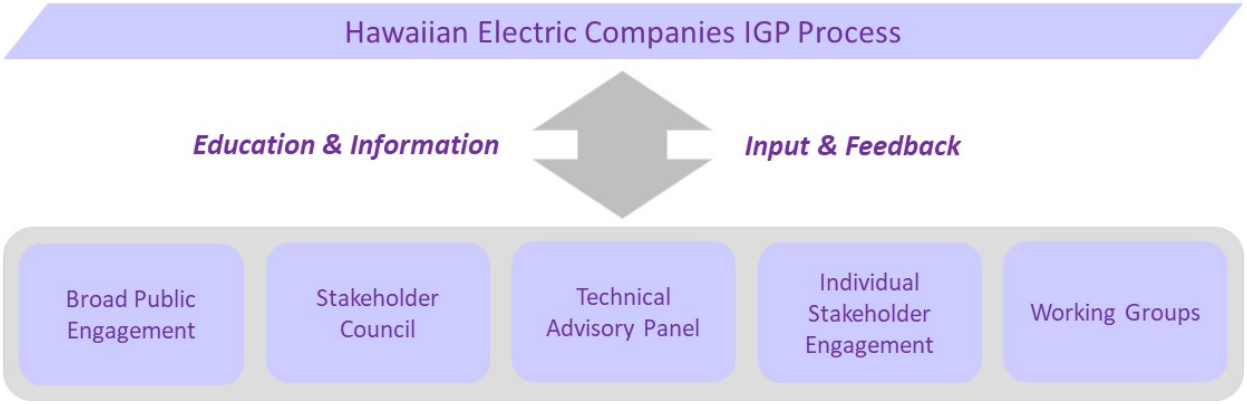

Figure 4: Stakeholder Engagement Model

The Companies believe that given the technical nature of the IGP development process, it will also be important to utilize the stakeholder engagement process as a means to provide education and information to customers and stakeholders on relevant IGP topics. Through a continuing investment of time in customer and stakeholder education, we believe that a common vocabulary and a common understanding of IGP principles, methods, and technologies will result, increasing the effectiveness of the stakeholder engagement process and the quality of stakeholder input.

This stakeholder engagement framework provides a number of elements, both ongoing and ad hoc, formal and informal, each of which will be utilized as appropriate during the IGP process. Each of these elements is described in greater detail in Appendix A.

Stakeholder Council

A standing IGP Stakeholder Council ("Council") is a key element of the overall IGP stakeholder engagement process. We intend the Council to be a standing group to provide strategic input and feedback on IGP process development, activities and results, and aspects for improvement. In addition, we propose holding Council meetings between active IGPs as well. Based on the feedback received from stakeholders noted earlier, it is important that this Council represent customers and the broad stakeholder interests in Hawai'i. Council members are expected to be ambassadors for their respective stakeholder communities—that is, they

[20] Joint Utilities of NY Stakeholder Engagement process, information available online at http://jointutilitiesofny.org/home/.

are expected to represent the interests of their communities by providing input and disseminating information.

Technical Advisory Panel

The development of an Integrated Grid Plan will rely heavily on the use of advanced methods and evolving specialized tools that are unique to the IGP process. This creates two needs that would benefit from a group of experts comprising a Technical Advisory Panel ("TAP") to provide:

- A sounding board on technical issues, new methods, advanced tools, and best practices
- Technical peer review to provide independent assessment of the process, methods, tools, and corresponding results

The TAP will be a standing group led by a chairperson on a two-year rotating term (to correspond with the expected IGP planning cycle). The inaugural TAP will be chaired by Rick Rocheleau, executive director of HNEI, and will consist of representatives from organizations with globally and nationally recognized competence in IGP technologies and methodologies and a senior representative of the Companies.

Working Groups

The Companies anticipate that some of the key aspects of the IGP development process will be facilitated through the work of subject matter expert–based working groups. Working groups will be formed on an as-needed basis to address specific topics where stakeholder input is needed and where specific subject matter expertise is required. Working groups will be stood down upon completion of the work task related to their input and contributions involving their subject-matter expertise. In an effort to create an efficient and positive group dynamic, participation in a working group ("WG") will ideally be comprised of subject matter experts or knowledgeable members in the topic area. Equally important is membership with the capacity to dedicate sufficient time to support the timely completion of the WG's scope of work. We anticipate forming several working groups in 2018:

- A forecast assumptions WG to support development of forecast assumptions and sensitivities as part of the pre-IGP planning cycle activity
- A market WG to identify proposed changes to the Commission's Framework for Competitive Bidding.[21] This includes streamlining and standardizing the process to reduce barriers to market participation and enable integration with the IGP.
- As described in this report, the IGP process will create and provide stakeholders the system data elements that the market desires as part of the integral market opportunities. There is an opportunity in 2018 to refine the scope of issues that need to be addressed. We will engage stakeholders as part of our IGP engagement efforts to

[21] Decision and Order No. 23121 issued on December 9, 2006, in Docket No. 03-0372.

discuss the data that will be available in the new IGP process and identify the scope of issues that may require a WG or other venue for addressing.

- A customer data access WG will be addressed as part of the ongoing GMS implementation effort. Customer data access and sharing issues and related technology (e.g., Green Button) are distinctly different than system data and are closely aligned with advanced meter deployment and the customer-facing solutions that are part of the GMS.[22]

Customer & Public Engagement

The Companies and stakeholders agree that incorporating customer input into a planning process at the outset is an essential step. This proved to be very effective for development of the GMS and this IGP process. As part of the initial steps of the IGP process, we intend to seek customer input through a variety of potential methods that may include surveys, focus groups, and one-on-one interviews. We will also continue to periodically engage with individual stakeholders as needed to solicit input and feedback to support the IGP process and its expected evolutionary development.

Additionally, the Companies intend to further stakeholder education and IGP transparency through public forums via in-person workshops or webinars. Through these engagements, we will educate and inform stakeholders about the IGP process, progress updates, and/or results.

[22] GMS, page 66

3 Requests & Next Steps

The Companies intend to begin the necessary prerequisite steps in 2018 in order to be able to start the IGP process in 2019. In order to proceed expeditiously, the Companies respectfully request the following actions by the Commission.

Grant a Waiver from the Framework for Competitive Bidding

Competitive sourcing of resource, grid services, and non-wires alternatives will play a prominent role in this new process. It is essential that the Companies be granted a waiver from the Framework for Competitive Bidding through the IGP process, for at least this initial cycle, for supply-side resource procurements. We envision that streamlining the RFP process will help to ensure competitive procurement of resources. It is essential to integrate market-based solutions and related integration considerations into the planning analysis to evaluate the best resource and grid options for customers. We expect that the formation of a market working group will address the needed structural changes to streamline the RFP procurement processes, including definition of unbundled grid services and standardization of contracting methods and agreements. The working group can benefit from the ongoing RFPs and DR Grid Services Purchase Agreement work that has been completed to date. The work product of this group could inform this first IGP planning cycle as well as significant refinements for the subsequent second IGP cycle.

Continue Current Resource Procurements & DR/DER Programs

Current efforts to execute on existing resource plans and related procurements and DR/DER programs should continue to ensure that needs identified in the PSIP are met. The Companies recognize that these ongoing efforts will overlap with the initial IGP planning cycle and need to be coordinated. We recommend that ongoing resource and DER-related programs and efforts, and alignment of the final outcomes from related proceedings, be integrated into the second IGP planning cycle, which begins around 2021. Additionally, upcoming expected issues in the DER Market track could be addressed by the IGP resource and T&D solution sourcing process as the IGP process creates new market opportunities for DER providers.

IGP as a Utility-Driven Routine Planning Process

We request consideration be given by the Commission that the IGP process be permitted to proceed outside of a formal docketed proceeding in order to facilitate open communication

and more collaboration among stakeholders during the planning process. As we collectively look to evolve planning and sourcing in Hawai'i, it is essential that the community be engaged in a range of open, productive discussions to address the changes needed. This engagement includes the need to resolve technical issues and/or create solutions to complex issues. The robust stakeholder engagement process incorporated into the IGP should serve the interests of transparency and opportunity for input/feedback. This worked well for the GMS and the development of this IGP process.

This is a significant advancement over previous planning processes to create a scalable process to address the needs of Hawai`i. As such, we request that the first cycle of the IGP process be given an opportunity to succeed by limiting the scope of the process to what is proposed. It is also necessary that the related market activities identified (e.g., defining grid services and standardization) be started as soon as possible to support this effort. We respectfully request that the Commission and stakeholders recognize that this is just the beginning; we will all learn in this first IGP cycle and have the opportunity to improve going forward.

Ulupono Initiative recognized this challenge in their Grid Modernization Strategy comments[23] when they stated:

> "The integrated grid planning approach represents a welcome improvement in the overall planning process that would eliminate some of the dysfunctional challenges that we have experienced in the past. It is particularly beneficial to integrate grid and power supply planning and increase customer engagement. We support the approach of expenditure categories and concur with using the total resource test as the economic approach to determining whether an asset or program is in the public interest. We have two caveats on this proposed approach. **First, given the data needs, we believe that a two-year cycle is ambitious, and anticipate that the first round will** [need] **an extra year to do the underlying data gathering and analysis in a transparent way that includes stakeholders.**"

Longer term, the Companies expect that the IGP process will become the new business as usual and as such, will become a routine process that has outputs that link to various regulatory proceedings. In this context, we expect to conduct the IGP process with the Commission's oversight and effective engagement with the Consumer Advocate.

Next Steps

Over the next ten months, we will launch the formal stakeholder engagement and continue our customer education and engagement to seek input. This includes standing-up the following stakeholder engagement groups in 2018:

- Stakeholder Council

[23] See Ulupono Initiative LLC's comments on Grid Modernization Strategy filed on September 13, 2017 in Docket No 2017-0226, page 6 (emphasis added).

- Technical Advisory Panel
- Forecast Working Group
- Market Working Group

We anticipate a coordinated set of ongoing engagements with customers and stakeholders in support of the first IGP cycle, as illustrated in the draft schedule in Figure 5. Note that this is a draft schedule that will be refined with each group as part of their formation. It also only covers the first sixteen months, and subsequent schedules will be developed.

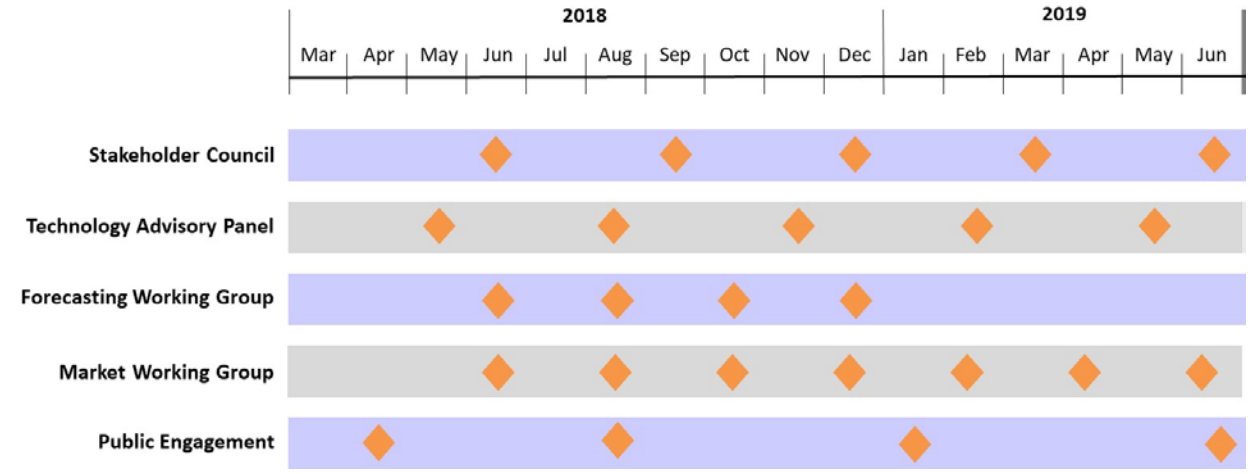

Figure 5: Stakeholder Engagement Draft Schedule

Appendix A: Stakeholder Engagement

Stakeholder engagement framework elements are described in detail below. For each group formed, a formal organizational charter will be developed. The charter will include a definition of the group's goals and objectives as well as the ground rules governing its activities, including a code of conduct and the approach to providing public information on discussions (e.g., meeting summaries and posting presentations). Ground rules will include the Chatham House rule, which allows that members be free to use the information received during a meeting, but that neither the identity nor the affiliation of the providers of that information may be revealed external to the meeting. The use of the Chatham House rule allows for meeting participants to engage with each other in a more open and collaborative manner.

A.1. Stakeholder Council

A key element of the overall IGP stakeholder engagement process will be the Stakeholder Council. The Companies intend for the Council to be a standing group to provide strategic input and feedback on IGP process development, activities and results, and aspects for improvement and to represent customers as well as the broad stakeholder interests in Hawai'i. We have considered several organizational approaches in the formation of this council. The Council blends the organizational models employed by the Honolulu Board of Water Supply (BWS) and the Joint Utilities of New York (JUNY), which address similar issues. Additionally, the size of the Council is an important factor in its formation. Research and best practices in community-based advisory groups suggest that it is important to have membership representative of the diversity of needs and interests[24] and that research from a national study of community boards[25] suggest an average of 16 members be employed. The BWS has 26 members and the JUNY has 15 stakeholder members. We believe that around 20 members representing the diversity of needs and interests will be an effective size.

[24] Community Advisory Board (CAB) requirements in the Communications Act, Section (A) iii, available at https://www.cpb.org/stations/certification/cert3.

[25] BoardSource Non-Profit Board Governance Index 2010, available at http://www.performingartsconvention.org/file/BoardSource%20Nonprofit%20Governance%20Index%202010.pdf.

The Council will consist of one member from the following representative stakeholder interests (in alphabetical order):

- City/County representative (one from each county)
- Community representative (one from each island)
- Consumer Advocate
- Demand Response
- Electric vehicles
- Energy efficiency
- Energy storage
- Hawai'i Public Utilities Commission
- Independent Power Producers
- Large commercial and industrial customers
- Small solar developers
- State of Hawai'i Department of Business, Economic Development, & Tourism (DBEDT)
- Local sustainability advocate
- National sustainability advocate
- U.S. Department of Defense (DOD)

Council members are expected to be ambassadors for their respective stakeholder community. That is representing the interests of their community of interest in providing input and disseminating information. Additionally, members must be willing to commit to participation on the Council for a full IGP planning cycle. Ideally, council members should have general knowledge of electric system planning and operations. If not, the Companies will provide education to help enable effective participation. We will extend invitations to the respective organizations or trade associations to identify qualified members.

The Council is expected to meet four to six times per year, depending on the level of IGP activity, to provide a forum for stakeholder input and feedback on key aspects of the IGP process. Also, the Council will discuss priority issues that may benefit from a subject matter expert–based working group to address tactical and technical issues.

The Council will be chaired by a senior representative of the Companies and facilitated by a knowledgeable, experienced facilitator. The members will be expected to be ambassadors for their respective stakeholder group interests. That is, the council member will be expected to share the views not only of their organization but also their colleagues and conversely share their observations from the Council discussion with their colleagues. For example, the member representing electric vehicles would be the ambassador representing their interests and those of their colleagues involved in electric vehicle development.

A.2. Technical Advisory Panel

The development of an Integrated Grid Plan will rely heavily on the use of advanced methods and evolving specialized tools that are unique to the integrated grid planning process. This creates two needs that would benefit from a group of experts comprising a Technical Advisory Panel (TAP) to provide:

- Sounding board on technical issues, new methods, advanced tools and best practices, and

- Technical peer review to provide independent assessment of the process, methods, tools and corresponding results.

IGP is the first of its kind to be employed in practice in the electric industry. As such, the Companies recognize the value of having a standing group of experts drawn from research, market operators and utilities with relevant global insights and experience to discuss technical planning related issues and seek guidance on possible resolutions and emerging best practices. It is anticipated that these experts will also benefit from participation as they are also working to address similar needs elsewhere.

Additionally, due to the highly technical and complex nature of the engineering-economic analysis and modeling tools, the IGP process can become somewhat of a "black box" to customers and stakeholders. While we plan to provide education on the methods and tools similar to the IGP Symposium held in November 2017, we recognize that the TAP can provide an independent peer assessment of the IGP development process, methodologies, tools, and results.

The TAP will be a standing group led by a chairperson on a two-year rotating term (to correspond with the expected IGP planning cycle). The inaugural TAP will be chaired by Rick Rocheleau, executive director of HNEI, and consist of representatives from organizations with nationally recognized competence in IGP technologies and methodologies and a senior representative of the Companies. The inaugural independent TAP members were identified based on recommendations and feedback from stakeholders. The confirmed members are listed in the table below:

Name	Title	Organization
Rick Rocheleau	Executive Director	Hawai'i Natural Energy Institute
Jeff Smith	Program Manager, Distribution Planning, Operations & Studies	Electric Power Research Institute
TBD	TBD	Australia Energy Market Operator
Julia Matevosjana	Lead Planning Engineer	ERCOT
Anderson Hoke	Senior Electrical Engineer	National Renewable Energy Laboratory
Jeff Burke	Director, Resource Planning	Arizona Public Service

A.3. Working Groups

The Companies anticipate that some of the key aspects of the IGP development process will be facilitated through the work of subject matter expert–based working groups (WG). Working groups will be formed on an as-needed basis to address specific topics where stakeholder input is needed and where specific subject matter expertise is required. Working groups would remain active until their defined scope of work as defined in a charter is completed.

In an effort to create an efficient and positive group dynamic, participation in a working group will ideally be comprised of subject experts or knowledgeable members in the topic area and with the capacity to dedicate sufficient time to support the timely completion of the WG's scope of work. It is also desired that working groups have a limited number of people, participating in-person to enable effective group dynamics[26] to successfully address topics. However, these working groups would include conference call and webinar availability for other interested stakeholders to participate remotely. This hybrid approach has been used successfully in New York on similar issues over the past two years. Meeting summaries and/or presentations will be accessible online. It is intended that these working groups provide broad stakeholder representation and a wide range of stakeholder perspectives.

As with the Council, WG would be expected to define a formal charter, including the definition of goals and objectives and ground rules. In general, WG will be charged with the overall goals of identifying common ground among WG members and reducing the number of outstanding issues. To enable these outcomes, the Companies will provide a knowledgeable, experienced facilitator for each WG. In addition to facilitating the WG's activities, the facilitator will be responsible for providing a base level of education for the WG.

We anticipate forming working groups in 2018 as follows:

- A forecast assumptions working group to support development of forecast assumptions and sensitivities as part of the pre-IGP planning cycle activity. This group would be tasked with providing specific input on forecast assumptions and related sensitivities in support of our interest in using primarily market-based factors in forecasts.

- A market working group to address changes needed in the competitive procurement process to streamline and standardize the process to reduce barriers to market participation and enable integration with the IGP process. This working group would also work on the process to obtain the non-wires T&D grid services, including the definition of T&D non-wires services.

[26] M. Blenko, P. Rogers and M. Mankins, Decide and Deliver: Five Steps to Breakthrough Performance in Your Organization, Bain & Company, 2010

- The IGP process will create and provide stakeholders the system data elements that the market desires as part of the integral market opportunities. There is an opportunity in 2018 to refine the scope of issues that need addressing. We will engage stakeholders as part of our IGP engagement efforts to discuss the data that will be available in the new IGP process and identify the scope of issues that may require a working group or other venue for addressing.

- Customer data access and sharing working group will be addressed as part of the GMS implementation effort. Customer data access and sharing issues and related technology (e.g., Green Button) are distinctly different than system data and closely aligned with advanced meter deployment and customer facing solutions that are part of GMS.[27]

A.4. Customer & Public Engagement

The Companies and stakeholders agree that incorporating customer input into a planning process at the outset is an essential step. This proved to be very effective in the development of the GMS and for this IGP process. As part of the initial steps of the IGP process, we intend to seek customer input from a variety of potential methods that may include surveys, focus groups, and one-on-one interviews. This outreach will solicit input directly from residential and commercial customers, with the objective of increasing our understanding of customer preferences, priorities, and expectations in order to inform the planning assumptions and objectives.

Additionally, the Companies intend to further stakeholder education and IGP transparency through public forums via in-person workshops or webinars. Through these engagements, we will educate stakeholders on the IGP process, progress updates, and/or results. We intend to hold the first webinar of 2018 this spring to provide an overview of the IGP process and this report, followed by a second webinar in the summer of 2018 to educate stakeholders on transmission and distribution planning.

We also value stakeholder input and feedback received individually. This has proven very beneficial in developing the PSIP, the GMS, and this IGP process. We anticipate continuing to periodically engage with individual stakeholders as needed to solicit input and feedback to support the IGP process and its expected evolutionary development.

[27] GMS, page 66

Appendix B: Integrated Grid Planning Process & Methods

INTEGRATED PLANNING PROCESS

This appendix is organized around the four major steps in the integrated grid planning process as detailed in Figure 6 below. The major steps are:

1) Forecasts and Planning Inputs
2) Resource Needs & Sourcing
3) Transmission & Distribution Needs & Alternatives
4) Near-term Action Plan & Long-term Pathway

The following subsections describe the process elements in more detail highlighting how existing analysis will be linked to new analysis and combined with sourcing of alternatives in the heart of the process consistent with the Value of Service concept.[28] The colors in Figure 6 align with those used in the earlier diagrams; blue are inputs, purple are planning, yellow are sourcing, turquoise is portfolio evaluation, and green is regulatory process. The light shaded boxes are existing or enhanced steps and the darker shaded boxes indicate new detailed steps.

[28] Value of Service concept introduced in the IDRPP Decision and Order and subsequent orders.

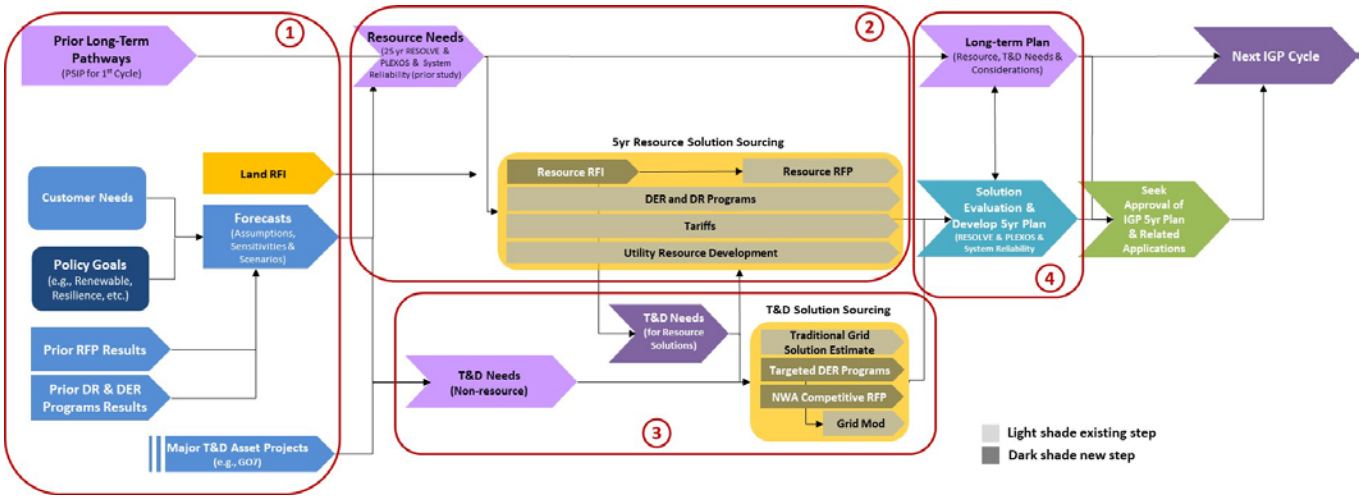

Figure 6: IGP Process Major Steps

B.1. FORECASTS AND PLANNING INPUTS

The resource planning analyses will be based on broad groups of input assumptions for the modeling process. The IGP will transparently provide the assumptions data used in the analyses similar to what was done in the 2016 PSIP.[29]

Planning Requirements. Fixed parameters of RPS mandates, regulatory and environmental compliance, and overall planning criteria (such as system reliability, adequacy of supply, system hosting capacity, circuit hosting capacity, service quality, and other factors).

Input Assumptions. Metrics driven by market conditions, modeling inputs, or other factors beyond our control. These include fuel price forecasts, resource cost assumptions, resource potential and performance, power purchase agreements, energy efficiency forecast, and others.

Fixed Assumptions. Metrics that we can control such as DER, DR, CBRE, and EoT forecasts (based on existing programs) or projects that have been approved or seeking approval, transmission line limitations and upgrade potential, resource retirements, PPA renewals, and generation modernization scope and cost.

Customer Needs and Policy Goals. The IGP will consider resiliency policy objectives, how energy planning can spur economic development of smarter cities and communities through the electrification of other sectors (i.e., transportation), DER targets, optimal land use, and job

[29] Appendix J of the PSIP Update Report: December 2016.

creation with Stakeholder Council input. Understanding that all planning assumptions have inherent uncertainty and risk, a reasonable scope of scenarios and sensitivities to be analyzed in the IGP will be discussed through stakeholder engagement prior to the start of the analyses.

B.2. RESOURCE NEEDS & SOURCING

B.2.1 Resource & Grid Services Needs

This step involves identifying the incremental needs regarding resource adequacy in terms of energy and related capacity as well as the incremental amount of grid services (i.e., those related to ancillary services)[30] required to meet system operational reliability criteria. This step is expected to take about 2 months. A prerequisite for this step is the further development of ancillary services as part of a broader definition of unbundled grid services, as described by the Commission.[31] Clear definition of these services enables the determination of the quantity and other performance attributes in a technology neutral manner. To support this first IGP planning cycle, it is necessary to begin to identify and define the additional grid services in technology agnostic terms building on the work developed for the DR. The effort to define these grid services should begin in 2018 to support the activity in the initial IGP in 2019.

The method to identify resource and ancillary services needs involves building upon the methods used in the 2016 PSIP Energy and Environmental Economics' (E3) RESOLVE capacity expansion modeling tool to develop theoretical least cost resource plans employing the forecasts and assumptions described above. RESOLVE will utilize the input assumptions to process a predefined set of core cases based on feedback through the stakeholder engagement framework. The result is a theoretical optimal resource portfolio from 2021 to 2045 that meet the RPS and other policy objectives while minimizing costs. This analytical approach is consistent with the resource optimization model suggested previously by the stakeholders and orders from the Commission.

RESOLVE by itself, however, is not able to complete the analysis required to fully develop near term action plans because it lacks the granularity needed to completely evaluate the variability of intermittent renewable resources and does not provide an hourly dispatch, which is necessary to understand the systems' ability to serve load and for subsequent analysis (in PSS/E) to identify system reliability resource needs for frequency, voltage, and rotor angle stability and to estimate customer rates and bills. RESOLVE relies on a sample of hourly net loads to determine hourly dispatch as opposed to use of annual hourly or 15-minute net loads used by PLEXOS and other models. Accordingly, RESOLVE is useful for developing longer

[30] Federal Energy Regulatory Commission (FERC) defines ancillary services as: "those services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system."

[31] DR Decision and Order, page 96 and IDRPP Decision and Order, pages 33-34.

term expansion plans over a wide range of input scenarios and assumptions but the RESOLVE least cost plans must be validated to ensure that they are indeed lowest cost, robust under a range of future uncertainties, and maintain reliability at the sub-hourly level.

In order to refine the RESOLVE results, we will use PLEXOS to provide the hourly dispatch for subsequent system reliability analyses in PSS/E and identify additional grid services needs (beyond the RESOLVE portfolios) to ensure reliable system operation. The attributes of the needed grid services will be based on the power system impacts of the theoretical resource needs derived from RESOLVE for each island.

The resource and grid services needs will be described by the respective, specific attributes in a technology neutral manner unless specific technology needs and attributes are evaluated to be required or desirable. These needs, in turn become the input into the Value of Services analysis and the 5-year Resource and Grid Services Solution Sourcing.

Grid Services Value Modeling

In the IGP, the Companies will primarily use market-based pricing input through the resource and grid services sourcing to determine the price of a service. A VoS methodology for modeling the value of grid services was developed as part of the DR portfolio and tariff framework as described in the Commission's recent DR Decision and Order.[32] The consultant's proprietary model produced results that essentially represented an estimated value that was used to determine a reasonable "price cap" for a grid service. We believe a refined, more transparent version of this analysis can continue to provide a reasonableness test against market pricing. We also believe it will inform longer-term planning.

B.2.2 Resource & Grid Services Solution Sourcing

Once incremental resource and grid services needs have been identified, the Companies will initiate sourcing of solutions that meet these needs. Possible solutions include grid-scale resources and aggregated DER/DR as well as DER and DR programs, tariffs, and resource development by the Companies. The objective of sourcing solutions at this point is to identify actionable solutions, which will in turn, enable us to (1) assess transmission and distribution improvements or upgrades to integrate each solution and (2) use pricing from market-based proposals to determine the optimal portfolio of solutions to address resource, transmission, and distribution needs. This represents a significant improvement over current planning methods that use cost assumptions and are unable to account for project size, location, and transmission and/or distribution needs and corresponding costs to integrate to the system. Moreover, current planning methods do not fully capture technology innovation and the full breadth of solutions that could be provided by market participants. Market participants are unlikely to disclose innovative solutions outside of a procurement process for competitive

[32] DR Decision and Order, page 96-97.

reasons. Our proposed IGP process affords an opportunity for market participants to propose these innovative solutions as an integral part of developing the IGP 5-year plan.

Resource RFI and RFP

The Companies envision seeking proposals for the identified resource and grid services needs through a streamlined procurement process. The procurement process would be initiated with a Request for Information (RFI) to seek preliminary proposals from market participants, followed by a Request for Proposals (RFP) to seek binding proposals.

After resources and grid services have been determined, the Companies would initiate a two-step procurement process using standard, technology-neutral terms and agreements, as defined by the Companies with input from the Market Working Group. The first step is to open RFIs seeking grid resources such as renewable energy and capacity and grid services such as flexible load, fast-frequency response, regulating reserve, ramping capacity, and replacement capacity. Results screened from the RFIs would then be used to assess and identify transmission and distribution needs to integrate the proposed projects to the system. The transmission and distribution needs would be available for use by market participants to improve their projects or redefine it should the transmission and/or distribution needs be very extensive. In the second step, the Companies would then open an RFP, where market participants are able to provide firm, binding proposals that will be evaluated against all proposals.

Prior to initiating the RFI, the Companies would work to identify land resources that are available for development of grid scale renewable energy projects, similar to the Land RFI process that we completed in 2017. Information from this RFI would then become available to developers. Alternatively, information from the land RFI could be used by the Companies to identify and lease or purchase properties that could then be subsequently developed as a renewable energy project. This could greatly simplify and enhance the overall competitiveness of the procurement process.

Additionally, to ensure effective participation by DER and DR aggregators, we envision a process building upon, and incorporating lessons learned, the process used to develop the current Demand Response programs and select aggregators that can supply the needed services. The options may include development of new programs, or expansion of existing programs.

Tariffs

In addition to any existing DER programs such as CSS, CGS, CGS+, and Smart Export, the Companies envision developing new DER tariffs to provide continued and expanded customer opportunities and choices not available under the existing suite of programs and tariffs. The options may include development of new tariffs, and extension and expansion of existing tariffs. For example, we may propose successor tariffs to replace the current CGS+ and Smart

Export tariffs, incorporating improvements and lessons learned after these programs reach their MW program caps. New tariffs could be developed to include, for example, annual MW program targets to better align the growth of DER to the pace of implementation of system reliability improvements and grid modernization projects. Additionally, location specific tariffs could be developed to target obtaining specific locational benefits and deferring other investments and mitigating grid impacts. The energy cost of these new tariffs would be evaluated against other options to identify the lowest reasonable cost solution that meets policy objectives.

Utility Resource Development

This category of resources options includes development of utility self-build options to meet resource needs. It also includes identification of critical resources identified to meet unique resource needs or provide critical services that can be justifiably best provided by the utility. Examples of this include the Schofield Generating Station constructed to provide backup service to the Army to meet its national security mission and critical reliability (or system security) services like the Fast Frequency Reserve (FFR) battery that supplements DR provided FFR used to stabilize the grid after a disturbance.

B.3 TRANSMISSION & DISTRIBUTION NEEDS & ALTERNATIVES

B.3.1a Transmission Needs (non-resource)

Focusing on customers, the Companies oversee transmission planning for the islands of Hawai`i, Maui, and O`ahu. Transmission planning also conducts studies for the islands of Lana'i and Moloka'i.[33] The transmission system forms the backbone of the electric grid and is designed to be both reliable and resilient while efficiently transmitting bulk power to distributed load centers. Transmission planning criteria in conjunction with TPL-001 establishes the design parameters and analysis requirements necessary to plan, operate, and maintain the transmission system.

Transmission planning studies are based on simulations using detailed system models. Steady-state and/or dynamic simulations are performed for each island system to ensure system parameters such as voltage and current are maintained at acceptable levels to ensure public safety, protect customer and utility equipment, and ensure reliable service. Transmission planning studies are performed to support the following activities:

a. Provide transmission infrastructure to enable load growth.

[33] The islands of Lana'i and Moloka'i are radial distribution systems and are not governed by the Companies' transmission criteria or TPL-001. Studies are performed to ensure these systems can withstand disruptions from a sudden disturbance or contingency and maintain operating equilibrium.

b. Ensure the transmission system can maintain operating equilibrium for a set of predefined contingency events.
c. Interconnect new generation resources including customer and community adoption of DER.
d. Evaluate system performance to contingency events.
e. Addition and/or modifications to large generating resources, energy storage systems, and transmission system components.

These studies analyze changes to the island's transmission system from multiple generation interconnect requests, changes in island load and DER growth, and the reduction of fundamental grid services and determine technology-neutral requirements to maintain system reliability. The studies evaluate the ability of the system to withstand disturbances or contingencies from a loss of generation or an electrical fault, causing sudden changes to frequency, voltage, and current. Operating equilibrium following these disturbances must be restored to ensure public safety and to prevent damage to customer and utility equipment.

Studies are also performed to determine transmission system losses to ensure bulk energy transfer is efficient and cost-effective. Transmission circuits that exhibit high losses can ultimately lead to transmission constraints and reliability issues that are unique to each island system. If the need for a new transmission line is identified, a robust non-transmission alternative study is performed to ensure the most cost-effective solution is implemented.

We currently use industry-standard transmission system analysis tools to perform these studies, such as PSS/E and PSCAD. Transformation of our electrical systems will require new software tools to fully analyze DER impacts to the bulk transmission system and to analyze weak electrical systems, typically characterized by low inertia and low short-circuit current.

B.3.1b Distribution Needs (non-resource)

Distribution planning currently performs two primary functions: (1) plan the orderly expansion of the distribution system to serve new electrical load (i.e., ensuring sufficient capacity exists to fulfill our obligation to supply power to customers) and (2) safely interconnect distributed generation while maintaining power quality and reliability for all customers (i.e., diesel generators, rooftop solar systems, among others). As part of the planning process distribution planning may justify new transmission or distribution substations, expansion of existing substations, new circuits, upgrades or re-configuration of existing circuits either due to new load or generation.

On an annual basis, distribution planning[34] conducts Substation Load and Capacity Analysis (SLACA) of the distribution system. This entails analysis of the previous year's substation

[34] The process describe here applies primarily to O'ahu. The process on the other islands does not include on a routine basis these steps but the Companies are moving towards standardizing the distribution planning processes for all islands as part of its One Company initiative.

transformer (and circuit) loading data from our SCADA system, if available, to identify the highest peak load demand observed at the substation transformer. This information is updated in the SLACA tool which provides a 10 year load projection; however "useful" distribution forecasts rarely exceed 5 years. Other inputs into SLACA include: new customer service requests (i.e., new housing developments), information from marketing or the media related to developments, and historical load growth rates, which are geographically dependent.

Upon completion of SLACA, area or system reviews are performed of the distribution system (including the subtransmission system) to ensure that the updated circuit and substation loading do not violate distribution planning criteria in the current year or in future years. This is performed for both normal and emergency conditions. For example, during an emergency condition an unexpected outage may occur, a substation transformer shall have the capacity to not only accommodate the highest peak demand and any forecasted load growth, but also accommodate the additional transferred load from the loss of a neighboring substation transformer (sometimes referred to as N-1 reliability). This analysis is necessary to ensure that equipment is not damaged during normal or emergency conditions, which could lead to long, extended service interruptions to customers. If the planning criteria cannot be met, then traditional distribution projects are initiated to resolve any issues resulting from an area review. Solutions include, among others, re-configuration of a feeder, construction of a new circuit, conductor upgrades, or construction of a new substation.

Area reviews of the distribution system are not only performed subsequent to the completion of SLACA, but also based upon operational needs and service requests submitted by customers throughout the year. Based on these system or area reviews, distribution planning may recommend initiating a project to meet a customer need, or perform a long range area study.

Long range plans are generated for areas that have an abnormally high amount of load growth. For example, a developer may submit plans for a large community many years in advance. Although the project may not begin within the normal 5-year planning window, distribution planning will study the overall development and produce rough electrical loading conditions to provide developers prospective infrastructure requirements. Although the project is many years away, the customer can start planning to allocate the land and right of ways necessary to accommodate such infrastructure requirements.

In recent years, distribution planning, by necessity, subsumed the role of planning the system to accommodate distributed energy resources. To plan distributed energy resources effectively, the Companies have taken steps to integrate the "traditional" distribution planning process with the distributed generation interconnection process. A few of the ways DER has been integrated into the traditional process include: (1) modification of the planning criteria and practices to account for generation, (2) significant expansion of the scope of planning studies to include the evaluation of DER specific impacts, (3) analyzing other times of the day such as minimum loading during the solar peak, and (4) daily incorporation of new advanced computer modeling tools for routine work.

One of the more significant ways that distribution planning has adapted to distributed generation is through circuit hosting capacity analysis.[35] PV hosting capacity is the amount of PV that can be accommodated (regardless of location) on a circuit without violating power quality or reliability and without requiring mitigation measures like upgrades to infrastructure. The analysis that distribution planning performs evaluates (1) voltage power quality, (2) equipment and wire capacity, and (3) operational flexibility. There are many more potential impacts that can affect the safety, reliability, and power quality of electric service to our customers, but these three issues are of the utmost immediate near-term concerns. Operational flexibility (sometimes referred to as operational circuit limit) is determined by the reverse power threshold at the substation to maintain the operational flexibility of the circuit—whether the distributed generation power can be accommodated on the transformer due to the loss of a neighboring substation transformer (this is the same process described above for area reviews which are used to determine whether N-1 reliability can be achieved but this time considering distributed generation power and not just loads).

Distribution planning uses the circuit hosting capacity analysis in three ways: applying it as a tool to (1) streamline the interconnection process for customers, (2) inform customers and DER developers where saturated circuits are located, and (3) inform the planning process and identify circuit constraints to be solved to expand DER growth. These use cases are consistent with industry best practices[36] as presented at the Companies' Integrated Grid Planning Symposium held on November 15-16, 2017.[37]

Distribution planning reviews distributed generation interconnection proposals on the subtransmission, distribution, and secondary voltage systems. Safe interconnection of renewable energy is in part determined by Tariff Rule Nos. 2 (power quality) and 14 (interconnection process). In streamlining the interconnection process, the hosting capacity analysis informs screens that evaluate primary distribution system steady-state voltage, loading, and operational flexibility. In lieu of more conservative, and time consuming manual calculations, the hosting capacity modeling analysis can provide answers to screens that are used to determine whether a distributed generator can be safely interconnected. Distribution planners now have the capability to run hosting capacity computer simulations for complex cases.

The hosting capacity analysis is a useful tool for customers in setting expectations by informing customers whether the circuit they reside on is saturated or not. Customers can look up their home address on the Companies' website (see, https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/locational-value-maps)

[35] Additional details regarding the hosting capacity analysis are in the document titled, Rooftop PV Interconnections: A Methodology of Determining PV Circuit Hosting Capacity filed in Docket No. 2014-0192, on December 11, 2015.

[36] Available at, https://www.hawaiianelectric.com/Documents/clean_energy_hawaii/grid_modernization/igp_symposium/2_1_samir_succar.pdf (Page 3)

[37] Available at, https://www.hawaiianelectric.com/about-us/our-commitment/investing-in-the-future/integrated-grid-planning/integrated-grid-planning-symposium

map-(lvm)) to determine if a faster interconnection process with respect to primary distribution circuit impacts should be expected. Solar developers and installers likewise can use the tool to educate customers as well as target locations on the island where interconnection delays are less likely to occur.

Finally, the hosting capacity analysis helps distribution planners to identify congested circuits and find solutions to integrate high forecasted levels of DER. Once current and near-term circuit constraints are identified, planners identify potential solutions for solving those constraints – whether the solution is a low-cost utility-side adjustment, a customer solution (i.e., advanced inverter), or a traditional circuit upgrade.

The Companies recognize the importance of integrating a diverse portfolio of distributed resources, while ensuring the safety, reliability, and resiliency of the grid. As technology and system constraints evolve, resources and technology like advanced inverter functions and battery energy storage will become a ubiquitous part of the distribution system.

As discussed earlier, planners traditionally planned the distribution system based on the peak demand of a circuit, which typically occurs in the evening. However, with the introduction of PV, distribution system planning now accounts for minimum load, high generation periods when performing the circuit hosting capacity analysis. While sufficient, the analysis is largely static in nature, and does not appropriately recognize other technologies like battery energy storage systems, electric vehicles and infrastructure, among others.

Distribution Planning Process Improvements

Distribution planning recently started the process of improving the current hosting capacity analysis from one that is largely static in nature that looks at the worst-case condition that occurs during the solar peak hours to one that is more dynamic, probabilistic, and incorporates resources other than solar. The added capabilities that are actively being developed include, but are not limited to, (1) improved methods of distribution level spatial forecasting of load demand and DER based on historical substation data, advanced meter data, customer billing data, distribution transformer monitoring data, geospatial data, and economic variables to the extent they are available and applicable, (2) granular (i.e., 8760 hourly) load and DER profiles that can be incorporated into the hosting capacity analysis to better evaluate other types of distributed resources, and (3) flexible models that can appropriately evaluate the impacts and benefits of other DER programs and resources such as, customer self-supply, smart export, electric vehicles, and time-of-use rates.

These improvements will be accomplished through advanced software tools. We use SynerGI Electric to model the distribution system's hosting capacity. To accomplish the hosting capacity improvements discusses above, distribution planning will integrate a new tool, LoadSEER, with the hosting capacity models, which will require enhancements to SynerGI Electric. LoadSEER is currently, and will continue to, play a key role in our integrated grid planning efforts. For example, the Companies recently worked with Integral Analytics (the makers of LoadSEER) to develop a macro level EV adoption forecast across multiple sectors.

Additionally, the LoadSEER software was used to create an agent-based, bottoms-up distribution system level forecast and EV charging profile to determine the localized impacts that various levels of EV adoption would have on the distribution system. This type of granular analysis will help us to develop cost-effective ways to mitigate the future impacts of EV and other types of DER adoption to our system.

At the Companies' Integrated Grid Symposium, representatives from Pacific Gas & Electric, Electric Power Research Institute, Integral Analytics, and DNV GL, discussed the latest hosting capacity methodologies and the advanced tools available today to enable those methodologies. The improvements discussed here are consistent with those of the industry and represents best practices for an integrated planning process.

B.3.2a Transmission Planning for Resources

Transmission planning analysis for the IGP will continue to build upon the results and methodologies used from the previous PSIP. Specifically, the reduction of must-run generation requires analysis of each resource plan to ensure frequency stability, voltage stability, and rotor angle stability is maintained from an overall system perspective considering all the resources operating on the system. Optimized resource plans are analyzed to determine if system security is maintained, concentrating on the near-term action plan period of five years. General assessments can be made on the impact of specific resources to the reliability of the system as they are proposed based on the results and observations from previous studies.

Frequency Stability: Dynamic simulations of the largest loss of generation contingency are performed to determine frequency stability of a resource plan. The analysis determines system requirements for frequency response reserves; fast frequency response one and two (FFR1 and FFR2), and primary frequency response (PFR). Currently, system inertia is determined by the unit commitment and dispatch schedule from the production simulation data but future resource plans may require technologies like flywheels to maintain a minimum rate-of-change of frequency.

To evaluate resource plans, a PSS/E screening tool is used analyze hourly production simulation data from PLEXOS. The screening tool is a condensed single-bus network model that facilitates an automated process to perform dynamic loss of generation simulations for every hour in selected years. The screening tool calculates the frequency nadir for the largest generator trip and each hour is placed in a frequency nadir bin for further analysis. Two informative hours (a boundary hour and typical hour) are selected for further detailed analysis on the full transmission system model to determine frequency response reserve requirements. The loss of generation contingency in the boundary hour is a dispatch that results in the lowest frequency nadir with a lower probability of occurrence. The dispatch for the typical hour represents a contingency event with a higher nadir and a higher probability of occurrence.

Besides calculating the frequency nadir, the screening tool performs the following production simulation data analysis:

- Calculates FFR1 requirement for each hour in the study year
- Calculates total MVA (megavolt-ampere) of online synchronous generation to meet minimum fault current requirements for relay protection
- Calculates PFR from spinning reserves

Resource plans must meet reliability standards specified in TPL-001. For the island of O'ahu, the largest loss of generation contingency shall result in no load shedding while the criterion for Maui and Hawai'i Island is 15% of system load.

An area of concern and study for a system with high penetrations of DG-PV is its limited under voltage ride-through capability. An electrical fault can cause large capacities of DG-PV into momentary cessation operation or under voltage trip. Either case could represent a very large loss of generation contingency.

Voltage Stability: To determine steady state voltage stability, QV analysis is performed to determine reactive power requirements under applicable N-1 or N-2 transmission line contingencies. The QV analysis ensures bus voltages remain within specified limits for different unit commitment and dispatch schedules, typically under high load conditions.

The system's reactive power requirements can be met with capacitor banks, static VAR compensators, Dynamic VAR compensators, and synchronous machines. Of these alternatives, only synchronous machines can provide short circuit current for proper relay operation and transient voltage stability so only synchronous condensers are analyzed to meet reactive power requirements to prevent potential stranded investments of the other alternatives.

Besides steady state stability, transient voltage stability analysis is required. The Companies are in the process of developing PSCAD models to perform transient voltage stability analysis to determine weighted short circuit ratio[38] (WSCR) requirements. The WSCR is defined as:

$$WSCR = \frac{\sum_i^N SCMVA_i * P_{RMW_i}}{\left(\sum_i^N P_{RMW_i}\right)^2}$$

In this formula, SCMVAi is the short circuit capacity at bus *i* from synchronous generators; P_{RMWi} is the MW output of nonsynchronous generation at bus *i*; and N is the number of wind plants interacting with each other and *i* is the wind plant index. Based on this formula, more synchronous condensers will be required as RPS requirements increase. This is why reactive power requirements are being addressed with synchronous condensers as opposed to capacitor banks, static VAR compensators, and/or dynamic VAR compensators.

[38] Y. Zhang. S.H.F. Huang, J. Schmall, J. Conto, J. Billo and E. Rehman, "Evaluating system strength for large scale wind plant integration," 2014 IEEE PES General Meeting, National Harbor, MD, 2014, pp. 1-5.

Rotor Angle Stability: Rotor angle stability and transient voltage stability are very closely linked. A system with transient voltage stability issues will typically have rotor angle stability issues too since these are inherent to weak electrical systems. The most severe disturbance is an electrical fault at a generating station bus. If a close-in fault is not cleared within the critical clearing time of a generator, loss of synchronism can occur. Analysis performed for rotor angle stability include breaker failure analysis for O'ahu and delayed clearing faults for Maui and Hawai'i Island. Breaker failure analysis will be performed for all islands in the future.

B.3.2b Distribution Planning for Resources

Historically, the distribution planning process did not need to integrate with resource and transmission planning when considering resource plans. Resource and transmission planners ensured that an adequate supply of generation and transmission capacity was available to serve load growth on the distribution system. However, with the distribution system envisioned to function similar to a generation tie to the bulk system and a path for ancillary services, while maintaining its status as the grid's load center, distribution planning will need to become an integral part of resource and transmission planning in development of resource plans.

The new distribution planning process will incorporate new tasks as part of the integrated planning process, in addition to the current annual reviews of distribution system capacity, DER circuit hosting capacity. As described in this Appendix, distribution planning will need to identify the distribution needs to accommodate technologies and resources that are brought by the market. One of the challenges distribution planning will face is the identification of needs for a resource choice like aggregated DER because of the locational impacts of DER. Efficient execution of this portion of the process will require sound technical policies and requirements to avoid lengthy interconnection delays that may impact acquiring capacity by certain dates. The distribution planning process improvements discussed earlier in this Appendix will be a key component to the integration of distribution planning with the IGP process. Not only does this represent industry best practice in terms of planning, transparency, and DER and DR integration, it represents the next evolution of the current integrated distribution planning processes ongoing in New York, California, and Minnesota.

B.3.3 T&D Solution Sourcing

The output from the planning process is an identification of resource and grid needs that may be met by more traditional utility "wires" or a "non-wires" solution, such as an aggregated DER provided service or targeted DR program. Currently, the Companies have proposed DR programs for DER services to meet bulk power system needs and anticipate there may be opportunities for distribution services.[39] However, as noted in California,[40] for DER to

[39] California's Competitive Solicitations Framework Working Group work products available at: https://drpwg.org/sample-page/ider/.

[40] Ibid.

successfully provide grid services, they must meet the same technical and operating standards as the rest of the system such that when DERs are interconnected, they do not impact the safety and reliability of the grid. In addition, DER that provide services must also operate in a manner that aligns with the local transmission and distribution area's electrical loading attributes to ensure safe and reliable distribution service.

It will be necessary for Hawai'i to define the distribution grid services before the T&D Solution Sourcing will begin in this first IGP planning cycle. As a starting point, Hawai'i can leverage the thorough work products from California's working group.[41] This group of California utilities and stakeholders defined in detail a set of distribution services and related templates to facilitate competitive procurement and DER/DR program design. These were based upon a common set of four principles for articulation of grid services that the Companies propose to use. The four principles are as follows:[42]

- Location of where distribution service is provided
- Timing of when distribution service is provided
- Level of DER service provided
- DER availability and assurance of ability to provide

The Companies propose that a market working group address this need beginning in 2018.

B.4 INTEGRATED GRID PLAN

B.4.1 Solution Evaluation and 5-Year Action Plan

After the pricing proposals for the various resource solutions are combined with the T&D solutions, the total integrated costs of the various solutions will be evaluated in the RESOLVE and PLEXOS models to develop the portfolio of solutions to address resource, transmission, and distribution needs optimized around costs and objectives. The total integrated costs based on market and other solutions will replace the resource costs assumptions used in the first analysis identifying the resource needs in the five year period. Although the procurement of resources covers the first five years of the planning horizon, it is likely that proposals (e.g., grid-scale resources) will extend beyond the 5 years; therefore, the evaluation of the proposals may need to cover a period longer than the initial 5 years. The resulting optimized portfolio of solutions that provides the lowest cost and meets the system needs identified in the 5 Year Action Plan should ensure customer value. This enhancement to prior resource planning efforts includes fully integrated project and solution costs in the 5 Year Action Plan in lieu of

[41] Ibid.

proxy costs. The 5-Year Action Plan and related project applications will be submitted to the Commission for approval.

B.4.2 Long-Term Pathway

The portfolio of solutions in the 5-Year Action Plan will then be integrated into the long-term resource, transmission, and distribution needs to provide a pathway to 100 percent renewable energy. The long-term pathway provides a vision of the safe, secure, reliable, and resilient grid coalesced with Hawai'i's natural resources. As noted by the Commission in its PSIP Decision and Order, the purpose of integrated system planning is to determine a reasonable plan that can serve as a strategic basis and provide context to inform resource acquisition, incremental grid investments, alternatives, and system operation decisions.[43] The Commission further stated that "well-vetted, credible, comprehensive system analysis is essential to the HECO Companies fulfilling their role to provide a platform to meet the diverse service requirements of their customers by integrating a variety of generation sources and customer-sited resources in an economically and operationally efficient manner."[44] The IGP is designed to do exactly that.

The long-term pathway will provide the strategic context to guide discussions in the continuous IGP cycles as the Companies transform to the 100 percent renewable energy future. It is expected that as the vision becomes reality that discussions in the IGP will continue to evolve and tackle challenging topics on resiliency policy objectives, how energy planning can spur economic development of smarter cities and communities through the electrification of other sectors (e.g., transportation), optimal land use, and job creation. We believe that the IGP is the best mechanism to building a common understanding of the challenges, opportunities, and tradeoffs involved with enhancing the electric grid to meet customer service expectations and achieve the state's renewable goals.

B.5 INTEGRATED STAKEHOLDER ENGAGEMENT

Figure 7 describes the overall process for integrated grid plan development, including examples of several key times for stakeholder engagement in the process.

[43] PSIP Decision and Order, page 24.

[44] Ibid.

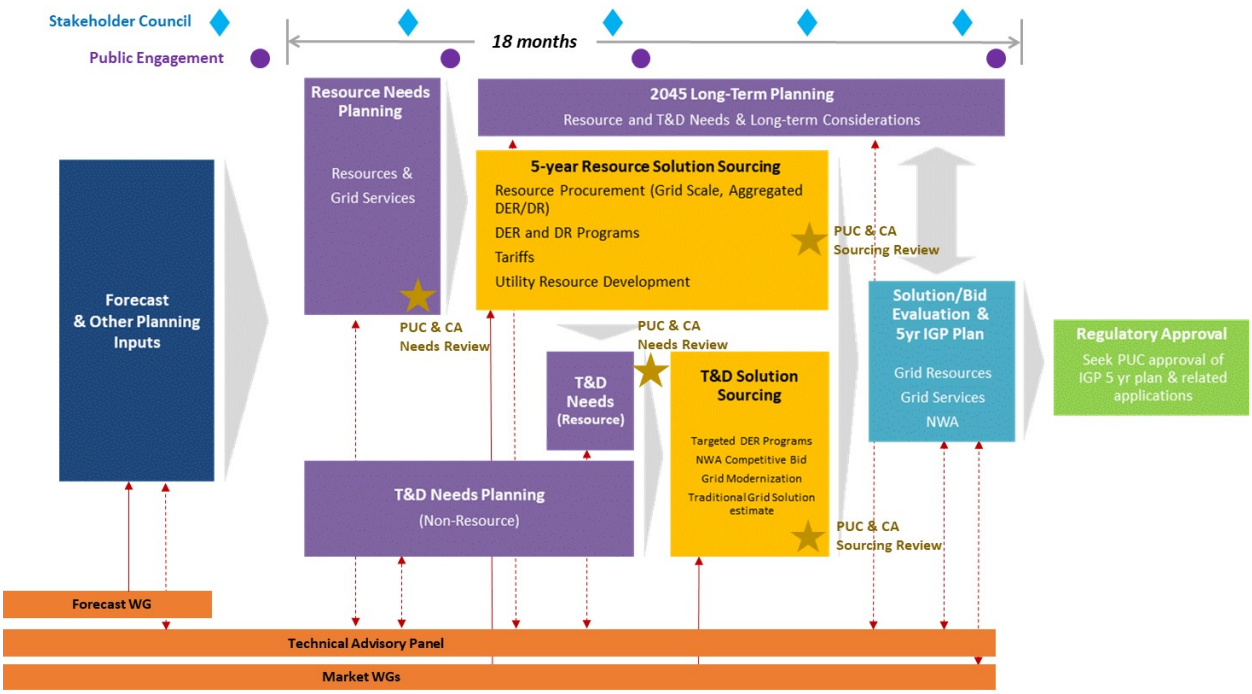

Figure 7: Stakeholder Engagement in IGP Process

First, stakeholder engagement will be utilized in the development of forecast assumptions and scenarios critical to the overall IGP process. We understand that the buy-in of stakeholders to the forecast assumptions and scenarios is essential to the acceptance of the planning results.

Stakeholders will be engaged again as part of the core IGP development process in review and input of the analytical tools and methodologies to be utilized. The Technical Advisory Panel is expected to play an important stakeholder role at this juncture, providing a peer-level review of the technologies and methodologies being deployed.

The results of the IGP analysis, that will identify incremental resource and grid needs, will also be reviewed with stakeholders. These resource and grid needs discussions are key process points and the Companies anticipate discussing with Commission staff and the Consumer Advocate before results are released for stakeholder discussion. As part of these discussions, the opportunity to understand the impact of policy decisions, for example, and adjust as needed is seen as a critical aspect of this type of integrated grid planning process to address affordability and other goals.

Finally, when grid needs are identified, there needs to be a simple, transparent process to conduct a comparative evaluation of wires and non-wires alternatives or traditional versus technology-driven alternatives. The evaluation of alternatives will involve proprietary and confidential information to ensure commercially competitive solutions are proposed. Therefore, a select group of non-market participants should be convened. For example, in California, a group comprised of regulatory staff, consumer advocate, and a few independent

advocates that have signed non-disclosure agreements review the results of RPS procurements.

Appendix C: Commission Order Cross-Reference

Commission Order 34696 Guidance	IGP Cross Reference
Discussion	
PSIPs "should place particular emphasis on identifying and supporting the near-term actions, applications, and decisions necessary to effectively meet identified challenges, policy goals, and planning objectives."	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
The Companies have provided only limited responses to the commission's instruction to analyze customer and implementation risks. The Companies do not appear to have evaluated the capital investments, financial commitments, and the resulting increasing rates in the context of affordability to customers and the risk of stranded assets.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
It is the Companies' responsibility to diligently examine and fully consider the possibilities and risks that their plans pose to customers. The impacts of increasing customer rates and the prospect of uneconomic customer exits can be reasonably anticipated and could be forestalled or exacerbated by the Companies' investment, procurement, and operational decisions.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
Topics Requiring Further Analysis	
The commission expects future planning cycles will more fully address the capital costs, operating costs, and reliability concerns associated with long-term achievement of the RPS goals.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods

Commission Order 34696 Guidance	IGP Cross Reference
The commission expects that the Companies will continue building upon their efforts to date by diligently refining their system security analysis.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
Future Planning Activities	
[T]he Companies must work diligently to continuously improve their planning tools and methods, and timely revise their estimates and forecasts as part of an ongoing, cyclical planning process.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
The Companies' future planning efforts must coordinate with and learn from other ongoing activities and pertinent proceedings and activities, including programs such as DER, DR, CERE, and proposed grid modernization projects.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
Future planning efforts must also include and build upon the new set of tools used in the last round of PSIPs, particularly the use of advanced resource optimization models	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
Finally, future planning efforts must continue to actively engage stakeholders, and incorporate their constructive input.	Section 1 Customer & Stakeholder Input Section 2 Integrated Grid Planning Appendix A Stakeholder Engagement Appendix B Integrated Grid Planning Process & Methods

Commission Order 35238 Guidance	IGP Cross Reference
Discussion	
The commission agrees that, going forward, the VoS approach is a natural component or output of an iterative, integrated planning process. Accordingly, the commission directs the Companies to continue to embrace VoS as a foundational component of the Companies' future planning and procurement efforts.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods

Commission Order 35268 Guidance	IGP Cross Reference
Discussion	
As the Companies develop the integrated planning process, they should focus on the distribution system planning.	Section 2 Integrated Grid Planning
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).	Section 2 Integrated Grid Planning
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.	Section 3 Requests and Next Steps
Consistent with past commission guidance, the Companies should utilize a Value of Service ("VoS") approach developed in the DR Portfolio when analyzing grid needs….[T]he commission directs the Companies to continue to use VoS as a foundational component of their future planning and procurement efforts.	Section 2 Integrated Grid Planning Appendix B Integrated Grid Planning Process & Methods
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….The commission supports the Companies' proposal to use an independent facilitator to lead these stakeholder discussions….[T]he 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.	Section 2 Integrated Grid Planning Appendix A Stakeholder Engagement Appendix B Integrated Grid Planning Process & Methods