



HAWAII STATE  
**Energy Office**

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# **CLEAN ENERGY INNOVATION PLAN**

## **Key Findings, Strategies & Actions**

PREPARED BY  
Cascadia Consulting Group  
with Clean Edge and  
Responsible Markets



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## Acronyms

|              |   |
|--------------|---|
| <b>DBEDT</b> | Department of Business Economic Development & Tourism |
| <b>DERC</b>  | Distributed Energy Resources Council (of Hawaii)      |
| <b>DG</b>    | Distributed Generation                                |
| <b>DOD</b>   | Department of Defense                                 |
| <b>DOE</b>   | Department of Energy                                  |
| <b>EE</b>    | Elemental Exceleator                                  |
| <b>EMT</b>   | Executive Management Team                             |
| <b>ERC</b>   | Energy Resource Coordinator                           |
| <b>EV</b>    | Electric Vehicle                                      |
| <b>FTE</b>   | Full-Time Employee                                    |
| <b>GWH</b>   | Gigawatt Hours  |
| <b>HCEI</b>  | Hawaii Clean Energy Initiative                        |
| <b>HECO</b>  | Hawaiian Electric Company                             |
| <b>HEPF</b>  | Hawaii Energy Policy Forum                            |
| <b>HNEI</b>  | Hawaii Natural Energy Institute                       |
| <b>HSDC</b>  | Hawaii Strategic Development Corporation              |
| <b>HSEO</b>  | Hawaii State Energy Office                            |
| <b>HTDC</b>  | Hawaii Technology Development Corporation             |
| <b>HVCA</b>  | Hawaii Venture Capital Association                    |
| <b>LEED</b>  | Leadership in Energy & Environmental Design           |
| <b>NELHA</b> | Natural Energy Laboratory of Hawaii Authority         |

|              |   |
|--------------|---|
| <b>NGO</b>   | Non-Governmental Organization                   |
| <b>NREL</b>  | National Renewable Energy Laboratory            |
| <b>PCATT</b> | Pacific Center for Advanced Technology Training |
| <b>PUC</b>   | Public Utility Commission                       |
| <b>RPS</b>   | Renewable Portfolio Standard                    |
| <b>SBC</b>   | Sustainable Business Corporation                |
| <b>SBIR</b>  | Small Business Innovation Research              |
| <b>UH</b>    | University of Hawaii                            |

## Introduction

This Consultant's report summarizes findings and makes recommendations to the Hawaii State Energy Office (HSEO) regarding how the office can best support clean energy innovation in Hawaii, which is one part of HSEO's overall mission. As support staff for the Energy Resources Coordinator, HSEO is charged with informing policy, formulating plans, conducting and collecting analyses, developing programs, and supporting stakeholders towards the energy ecosystem's collective goals. Reaching the State's energy goals requires strategies for all ecosystem actors that leverage innovation.

## Innovation Defined

Innovation will be a key factor to enable a successful clean energy transition, and, more generally, is vital for economic growth and prosperity. In fact, some economists consider innovation as more important a contributor to gross domestic product than capital appreciation or growth in the labor market.<sup>1</sup> For the purposes of this plan, innovation can be understood as:

*"A new idea, or more effective device or process. Innovation can be viewed as...the application of better solutions that meet new requirements, unarticulated needs, or existing market conditions."<sup>2</sup>*

Innovation can take the form of a radical new product or technology—such as the invention of electricity, the internal combustion engine, or the first solar panel—as well as the many evolutions of a product or service to improve its usefulness, quality, or cost-effectiveness.<sup>3</sup> Promotion of evolutionary technology comes in the form of new offerings to existing users and existing offerings to new users.<sup>4</sup> This long-term attention toward developing technology is necessary for innovations to adapt to market needs. Innovations are often market-driven, resulting from investments in research and development, but can also be serendipitous. Such revolutionary technology is disruptive and requires validation and overall system integration to reduce risk. Whether evolutionary or radical, proper planning and support can often enable and accelerate success as innovations are introduced and become established in an ecosystem.

Innovation generally thrives in systems that are open and connected (rather than closed and

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<sup>1</sup> Solow, R. "Growth Theory and After," [https://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/1987/solow-lecture.html](https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1987/solow-lecture.html)

<sup>2</sup> Maryville, S. "Entrepreneurship in the Business Curriculum," *Journal of Education for Business*, Vol. 68 No. 1, pp. 27–31, 1992

<sup>3</sup> Verbong, G. and F. Geels. "The ongoing energy transition: Lessons from a socio-technical multi-level analysis of the Dutch electricity system (1960-2004)." *Energy Policy* 35 (2007). pp. 1025-1037.

<sup>4</sup> IDEO.org. [The Field Guide to Human-Centered Design](#). IDEO.org, 2017.

siloe d).<sup>5</sup> In such a system, individuals and entities engaged in research and development, testing, and deployment are networked and encouraged to build upon each other's ideas. Ecosystem actors are encouraged to work together toward advancing solutions through strategic partnerships that promote public-private cooperation among entrepreneurs.

Economic growth is limited in a closed system. Taking advantage of proximate resources to solve local problems can be an operationally efficient way to stimulate economic growth. Once solutions to local problems are tested, economic growth can occur by exporting the newly developed technologies and solutions. Exports typically stimulate job creation and incomes that in turn grow the local economy. This type of growth can emerge from "clusters":

*"A cluster is a geographic concentration of related companies, organizations, and institutions in a particular field that can be present in a region, state, or nation. Clusters arise because they raise a company's productivity, which is influenced by local assets and the presence of firms, institutions, and infrastructure that surround it."*<sup>6</sup>

### GOVERNMENT'S ROLE IN INNOVATION

Government, the private sector, and non-profit organizations all have essential roles to play in the dynamic innovation process. While governments do not usually directly create economic growth, they can enable increasingly sophisticated ways of competing by creating a favorable operating environment and supporting businesses that, in turn, create jobs and wealth.<sup>7</sup> Supporting open and connected systems increases productivity and operational efficiency, stimulates and enables innovation, and facilitates commercialization and new business formation.

In Hawaii, several entities are already working in the clean energy innovation space. Therefore, this report outlines the roles that HSEO can play in promoting clean energy innovations without duplicating parallel efforts by other ecosystem actors, including:

- 1) Providing support for the development of innovative technologies and businesses in an equitable manner while reducing risk from disruptive technologies.
- 2) Opening and connecting ecosystem actors, such as entrepreneurs, state agencies, research institutions, and county governments.

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<sup>5</sup> Chesbrough, Henry. (2006). *Open Innovation*. Boston, Massachusetts: Harvard Business Press.

<sup>6</sup> Porter, Michael. (2017, December 1). *What are clusters?* Retrieved from <https://www.isc.hbs.edu/competitiveness-economic-development/frameworks-and-key-concepts/Pages/clusters.aspx>

<sup>7</sup> Porter, Michael. (2017, December 1). *The Diamond Model*. Retrieved from <https://www.isc.hbs.edu/competitiveness-economic-development/frameworks-and-key-concepts/Pages/the-diamond-model.aspx>

- 3) Supporting innovations in clean energy that improve local operational efficiency and foster economic growth, including industry clusters.
- 4) Engaging the community in the development and success of innovative clean energy solutions.

## Methodology

This report was developed for HSEO to inform and recommend how the office can best support innovation toward the State's clean energy goals. The Consultant team ("Consultant") consisted of Cascadia Consulting Group as the project manager with expertise in climate and clean energy plans, Clean Edge as clean energy market trends and technology experts, and Responsible Markets as a Hawaii-based firm with policy and programmatic experience. The Consultant researched and developed this plan from October 2016 to August 2017. To formulate the recommended strategies, the Consultant undertook the following steps:

1. **Industry Research:** The Consultant researched Hawaii's historical performance and progress based on Clean Edge's state index to understand the State's key strengths and advantages in clean energy innovation and identify opportunities in the near to mid-term to improve Hawaii's competitive position in technology, policy, and attracting capital. The research included a review of successful innovation centers and structures in the continental United States to: 1) identify best practices; 2) better understand how innovation centers meet ecosystems needs elsewhere; and 3) identify attributes that maximize the likelihood of success. Finally, the team researched innovation theory to identify the key elements of an innovation-conducive ecosystem.
2. **Stakeholder Interviews:** Members of the Consultant team interviewed 48 stakeholders from 34 organizations across the public, private, and non-profit sectors. These interviews, conducted at the outset of the project in person and by phone, were used to identify key ecosystem needs, assess perceptions of HSEO's strengths and weaknesses, and understand Hawaii's cultural context.
3. **Assessment and Draft Strategies:** Findings from the industry research and stakeholder interviews were synthesized and used to inform development of a draft set of strategies for HSEO review. Criteria used to shortlist potential strategies included: 1) key ecosystem needs to advance innovation; 2) HSEO's suitability to fill these needs based on its statutory authority and identified strengths and weaknesses; and 3) capacity.
4. **Workshops:** During the second project trip, the Consultant presented draft strategies at four workshops and in one-on-one meetings with twenty attendees, gathering additional input, obtaining feedback, and further engaging key stakeholders in formulating the plan.



5. **Plan Development:** The Consultant integrated findings, draft strategies, and workshop input into a draft plan document for review by, and discussion with, HSEO. The final version incorporates HSEO's feedback and includes, as a separate executive summary, an infographic highlighting key findings and recommendations.

## Key Findings – Situation Analysis

Through market research and stakeholder input, and as the basis for developing recommended strategies, the Consultant assessed the clean energy lay of the land in Hawaii, captured ecosystem needs around clean energy innovation, and considered how HSEO can support the State's energy goals considering its statutory authority and capabilities. Key findings are presented below, organized into subsections as follows:

**Hawaii's Clean Energy Market:** Overview of clean energy needs/opportunities/progress, energy sector goals, and market dynamics. These *external conditions* are the context for HSEO's efforts. To optimize HSEO's role in advancing innovation, recommended strategies must be responsive to Hawaii's unique circumstances and address opportunities and challenges in the context of a rapidly changing industry with many different players developing, investing in, consuming, and regulating the marketplace.

**Hawaii Energy Players and Ecosystem Aspirations:** Summary of five key needs in the energy ecosystem to advance clean energy innovation, including a particular emphasis on data and analysis. These *ecosystem needs* were identified by energy sector actors through the stakeholder research. HSEO can strategically provide support directly to address some of these needs and through partnerships for others.

**Hawaii State Energy Office's Situation Analysis:** Summary of HSEO's statutorily defined role in helping the State meet its clean energy goals and facilitate the clean energy transition, including capacity, strengths, and limitations. These *internal conditions* need to be considered to determine how the Agency can best support clean energy innovation.

In addition to the key findings summarized herein, additional detail is provided in Appendices C, D, and E.

## Hawaii's Clean Energy Market

### NEEDS AND OPPORTUNITIES

Market conditions in Hawaii highlight the importance of and opportunity around clean energy development. As of 2015, Hawaii imported 90.8 percent of the primary energy it consumed, mostly in the form of petroleum. Data from 2016 shows that 82.3 percent of Hawaii's electricity was generated using fossil fuels (66.7 percent petroleum, 15.1 percent coal, and 0.5 percent

synthetic natural gas), with the remaining 17.7 percent generated from renewable sources.<sup>8</sup> Two-thirds of the State's overall energy usage is in the transportation sector.<sup>9</sup>

With Hawaii's heavy dependence on volatily priced fossil fuel imports, a transportation sector that consumes a large portion of total energy, and extreme vulnerability to climate change impacts, the state stands to benefit from leveraging innovation and the State's abundant renewable resources to significantly accelerate the transition to clean energy. This transition can lessen Hawaii's dependence on imported fossil fuels, develop indigenous resources, and reduce carbon emissions. Additionally, with clean energy creating jobs at twelve times the rate of the rest of the U.S. economy<sup>10</sup>, leading the way on this transition provides Hawaii with a once-in-a-generation opportunity to create sustainable economic prosperity—benefiting the State's communities, workers, businesses, and the public sector.

## PROGRESS TOWARDS GOALS

Hawaii's energy sector goals reflect the opportunities and benefits of a transition to clean energy. An initiative known as the Hawaii Clean Energy Initiative (HCEI) was launched in 2008 by a Memorandum of Understanding between the State of Hawaii and U.S. Department of Energy to collaborate on reducing Hawaii's dependence on fossil fuels. HCEI is a framework of statutes and regulations supported by stakeholders, including statutory goals to achieve 100 percent renewable energy in the electricity sector by 2045 (HRS 269-92) and a target to lower electricity consumption by 4,300 gigawatt-hours by 2030 (HRS 269-96). Additional goals, such as the Hawaii State Planning Act, mandate planning for the elimination of Hawaii's dependence on imported fuels for electrical generation and ground transportation (HRS 226-18). At the county level, all four mayors pledged to lead the way in clean ground transportation fuel sources by establishing a 100 percent renewable-powered City fleet by 2035.

When HCEI started in 2008, the RPS was 9.4 percent. As of 2017, the statewide RPS is 27.6 percent. Hawaiian Electric Companies achieved a consolidated 26.8 percent renewable portfolio standard. By island the breakdown is: Hawaii Island, 56.6 percent; Maui, 34.2 percent; and Oahu, 20.8 percent.<sup>11</sup> Kauai Island Utility Cooperative reports achieving a 44.36 percent renewable portfolio standard.<sup>12</sup>

<sup>8</sup> [http://files.hawaii.gov/dbedt/economic/data\\_reports/reports-studies/energy-data-trend-2018.pdf](http://files.hawaii.gov/dbedt/economic/data_reports/reports-studies/energy-data-trend-2018.pdf)

<sup>9</sup> DBEDT and Hawaii State Energy Office. "Transforming Power in Paradise: The Hawaii Clean Energy Initiative." [http://www.hawaiicleanenergyinitiative.org/wp-content/uploads/2015/02/HCEI\\_FactSheet\\_Feb2017.pdf](http://www.hawaiicleanenergyinitiative.org/wp-content/uploads/2015/02/HCEI_FactSheet_Feb2017.pdf)

<sup>10</sup> Environmental Defense Fund. "Now Hiring: The Growth of America's Clean Energy & Sustainability Jobs" 2017, [http://edfclimatecorps.org/sites/edfclimatecorps.org/files/the\\_growth\\_of\\_americas\\_clean\\_energy\\_and\\_sustainability\\_jobs.pdf](http://edfclimatecorps.org/sites/edfclimatecorps.org/files/the_growth_of_americas_clean_energy_and_sustainability_jobs.pdf)

<sup>11</sup> <https://puc.hawaii.gov/wp-content/uploads/2018/02/RPS-HECO-2017.pdf>

<sup>12</sup> <https://puc.hawaii.gov/wp-content/uploads/2018/04/RPS-KIUC-2017.pdf>

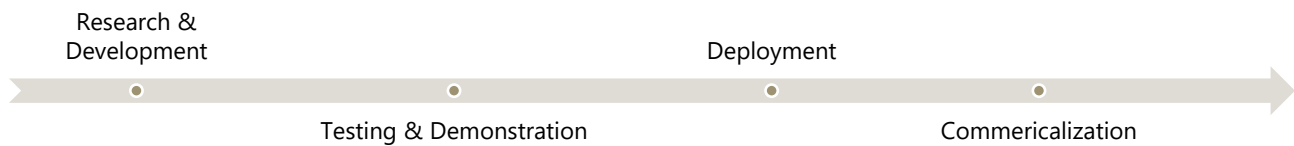
In addition to the current goals, Hawaii is well-positioned to play a vital role in the transition from fossil fuels to clean energy. Based on Clean Edge’s U.S. Clean Tech Leadership Index, the state ranks 10<sup>th</sup> in the nation in advancing clean energy.<sup>13</sup> After improving its ranking from 19<sup>th</sup> in 2010, the state has maintained its current position for the past three years behind industry leaders California, Massachusetts, and New York, along with smaller states such as Oregon and Vermont. Hawaii’s overall ranking is comprised of its performance in the following sub-areas:

| Ranking     | Sub Category | Reason  |
|-------------|--------------|---|
| <b>4th</b>  | Technology   | Both Hawaii’s solar generation share as a percent of total fuel mix and electric vehicle (EV) adoption per capita are second only to California. Hawaii also has a progressive green building industry. |
| <b>11th</b> | Policy       | Hawaii’s Renewable Portfolio Standard (RPS) leads the country, but policies and programs are needed to support this goal, execute on policy, and encourage adoption of clean energy technologies.       |
| <b>22nd</b> | Capital      | Hawaii falls lower in the rankings in this category, with less robust venture capital activity, research universities limited by funding, and lack of a federal research facility. <sup>14</sup>        |

## MARKET DYNAMICS

Hawaii’s favorable position in the dynamic, rapidly changing clean energy industry is bolstered by its competitive advantage within the innovation pipeline (shown below), which many stakeholders and the Consultant concluded lies in testing, demonstration, and deployment of leading edge technologies, business models, and policies.

### Innovation Pipeline



<sup>13</sup> U.S. Clean Tech Leadership Index, Clean Edge. Inc., 2016. Each year, Clean Edge produces an index of clean technology performance for all 50 states. The sixth edition covers more than 70 indicators in three main categories: Technology, Policy, and Capital. Data is included on such variables as clean-energy generation, energy storage installations, green building deployment, energy efficiency expenditures, VC investments, and clean-energy patents.

<sup>14</sup> This rating does not include government funding, which is a significant source of capital in Hawaii.

Key factors supporting Hawaii's position as a testing, demonstration, and deployment innovator include:

### Testing & Demonstration

- **The current high penetration of renewables on the grid** (23 percent, including distributed generation<sup>15</sup>) creating a pressing need to deploy innovative integration and load management technologies to provide grid stability.
- The imperative to **develop reliable and cost-effective solutions** to systematically advance to 100 percent renewables by 2045.
- The existing **active clean energy ecosystem**, with high project visibility, a diverse field of startups and established businesses, and strong supporting entities like the Hawaii Technology Development Corporation (HTDC), Hawaii Strategic Development Corporation (HSDC), Blue Planet, Ulupono, and Elemental Excelsior.
- Hawaii's **island economics and grids**—specifically the highest electricity prices in the country, which enhance product feasibility, and small-scale grids that enable product testing.

### Deployment<sup>16</sup>

- Hawaii's **abundant natural assets**, including geothermal, wind (onshore and offshore), solar, hydropower, biofuels, and ocean (ocean thermal energy conversion, tidal energy, and seawater air conditioning).
- Hawaii's connections with and **access to the Pacific Rim and Asian markets**, especially island economies with similar resources.
- The **U.S. military as an active partner and market** for microgrid, storage, and renewables generation technologies.

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<sup>15</sup> U.S. Energy Information Administration, "Hawaii State Profile and Energy Estimates," 2016, <https://www.eia.gov/state/analysis.php?sid=HI>

<sup>16</sup> Deployment is the standard term used in the clean energy sector to refer to the stage in the innovation pipeline between where a product or service has been tested and demonstrated to work as designed and commercialization, where that product or service is produced and sold at a scale that enables profitability. In the deployment stage, products or services are installed via pilots and in smaller markets, used by a variety of customers, and where scaling for higher production volumes and lower unit costs begins. Many of the stakeholders interviewed in Hawaii and who participated in the workshops, consider accelerating deployment and overcoming barriers at this stage crucial to advancing clean energy innovation in the state.

In addition to the elements mentioned under testing and demonstration and deployment, Hawaii's clean energy ecosystem is also influenced by broader market dynamics in Hawaii, including the following:

- **Electricity utilities and regulators play an important role in the electricity market.** Utilities and regulators influence, and sometimes control, which innovations are viable in the electricity market, particularly on the utility side of the meter. This influence spans both economic viability (e.g., rates and rate structures) as well as technical viability (e.g., permitting requirements and limitations around interconnection).
- **Hawaii is both geographically small and a small energy market.** There is limited land area to develop utility-scale renewables. Additionally, electricity loads in Hawaii (which are based, in part, on Hawaii's mild climate) limit the number of innovations that can be applied on the same grid and can reduce the incentives for businesses to pursue Hawaii as a market for their products.
- **Traffic is congested.** Traffic congestion, and associated idling, highlight the demand for diversified transportation options, including transit, remote work schedules, and other mobility choices.
- **Hawaii's electrical grid and other infrastructure are outdated.** Aging infrastructure can limit which innovations are safe and feasible to integrate with the existing grid.
- **One of Hawaii's largest economic sectors is tourism.** As a major economic driver in Hawaii, the needs of the tourism industry are particularly important to consider. There are opportunities associated with an increased focus on eco-tourism and efficiency as well as vulnerabilities associated with fluctuating fuel prices impacting airline pricing.

## HAWAII'S SOCIAL AND CULTURAL CONTEXT

Hawaii is a unique place to do business, creating both opportunities and challenges for innovation. Advancing clean energy technologies and solutions requires an understanding of and respect for Hawaii's culture, and a sincere commitment to serving the needs of the State's communities. To this end, stakeholders identified key considerations that are especially important to address in strategic planning efforts, several of which were mentioned by multiple interviewees and workshop attendees:

- **Understand Hawaii's culture and politics of change.** Hawaii's culture is forward-thinking, resourceful, and cosmopolitan. However, many stakeholders commented on a general resistance to change that may stem in part from a history of outside interests providing solutions that do not address the social, political, and cultural needs of the community. In addition, stakeholders mentioned an aversion to entrepreneurial risk taking and a lack of political will to overcome barriers and provide adequate resources for clean energy as key factors affecting Hawaii's innovation potential. Understanding

these dynamics—and finding ways to innovate from within the ecosystem to gain additional political and public support—will be important in the future.

- **Engage communities.** New facilities and projects need to deliver tangible benefits to communities, whose input must be included in a project's development. This can add time and cost to a project but ultimately ensures buy-in and long-term support.
- **Respect Hawaii's natural resources when developing new projects.** Stakeholders emphasized the importance of considering ecological impacts, local sensitivities, and current uses of land and water resources when developing new clean energy solutions. Projects must be strategically located and sensitively developed with the long-term health of Hawaii in mind.
- **Foster equity across islands and demographic groups.** Inter-island resource disparities and tensions must be recognized and addressed. Lower income residents, renters, and residents with limited energy procurement options must have a way to benefit from the deployment of new technologies.
- **Offer competitive wages for skill level and costs of living.** The high cost of living and relatively low wages in Hawaii can make it difficult to attract and retain talent and a skilled workforce. Stakeholders agree that there needs to be a clean energy career pipeline to match workforce skills with job opportunities and avoid "brain drain."

## Hawaii Energy Players & Ecosystem Aspirations

Hawaii has a small but active clean energy ecosystem, with a variety of players across the public, private, and non-profit sectors. Attachment 1 in Appendix C provides an overview of entities involved in this ecosystem. For the state to achieve its clean energy goals, this ecosystem must provide the capabilities, services, and roles necessary to accelerate innovation. Again, while HSEO cannot—and should not—address the breadth of ecosystem needs related to fostering increased innovation in Hawaii, HSEO can provide support directly and indirectly through partnerships.

Stakeholders across four energy ecosystem groups: entrepreneurs, government, county energy coordinators, and advocates/non-governmental organizations, were interviewed to capture the perspective of relevant actors related to needs and opportunities to advance clean energy innovation in Hawaii. These interviews also included a discussion of the possible role that HSEO could play in meeting broader ecosystem needs. Data and analysis emerged as the most widely identified type of need by interviewed stakeholders. These stakeholder requests include:

### Leadership

- Stronger alignment among state level leadership and stakeholders to overcome barriers and ecosystem constraints.
- Stronger leadership to support planning and implementation of strategies to reach the State's clean energy goals.

### Market Support

- Additional capacity within the utility sector, at the Public Utility Commission (PUC), and within government to test, approve, and deploy new technologies, regulations, and policy solutions.
- Innovative lower-cost demonstration and testing facilities with better access.
- Permitting efficiencies to streamline testing and deployment.
- Customized assistance to address specific market needs and issues faced by clean energy businesses.

### Data and Analysis

- Information and data is needed to enable analysis and inspire innovative energy product development that consider statewide benefits.
- Transparent analysis to facilitate effective decision-making, problem solving, and consensus building.
- Data sharing agreements to allow synergy and validation of analyses.
- Up-to-date and timely information on relevant clean energy legislation, including the status of the governor's priorities, during session.

### Policy and Business Model Innovation

- Policies and regulations that provide a favorable framework for clean energy innovation and specifically support achievement of RPS goals.
- Incentives to stimulate venture capital activity and successful business models to enable the clean energy transition.
- Development of business models that effectively address community interests and reward innovators for providing public benefits.<sup>17</sup>

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<sup>17</sup> HRS Chapter 420D encourages the establishment of Sustainable Business Corporations (SBCs). The "ingenuity section" of the SBC statute enables innovative enterprises to strengthen their patents as a direct result of the statutory requirement that the right to exclude be used in the service of specific public benefits.



## Capital

- Education and mentorship to develop talent, research capacity, entrepreneurs, and the clean energy workforce.
- Financial capital for scaling and commercialization. Adequate, stable, and sustainable funding for key entities, including HSEO.
- Additional support to foster a business culture that is increasingly prepared to take risks associated with innovation and entrepreneurship.

A more detailed presentation of stakeholder perspectives can be found in Appendix C.

## Hawaii State Energy Office's Situation Analysis

The Hawaii State Energy Office (HSEO)'s situation analysis is defined by the external opportunities and threats that organically occur within the statewide energy ecosystem, and HSEO's internal capabilities to address them as mandated by legislation and perceived by its stakeholders.

### GUIDING LEGAL MANDATES

HSEO's legislative mandates include several responsibilities related to the optimal development of Hawaii's energy resources and to facilitating the attainment of the State's 100 percent RPS goal, along with related objectives to reduce electricity consumption and transportation-related petroleum use. This includes coordinating programs with government agencies and the private sector while acting as the primary consultant to the governor through the formulation of plans.

Relevant HSEO statutory powers and duties are summarized in Appendix B and highlighted for each strategy in the Recommendations section.

### ENERGY STAKEHOLDERS' PERCEPTIONS OF HSEO'S CAPABILITIES

Stakeholder perceptions of HSEO's capability (summarized below) are important context for determining how HSEO can best advance the State's clean energy goals, pointing to a niche role for HSEO within the ecosystem as well as areas where HSEO actions may be most enthusiastically received by other ecosystem actors. See Appendix C for a detailed analysis of stakeholder input.

- **Embedded state agency.** HSEO is a division of the Department of Business Economic Development & Tourism (DBEDT). The director of this department is statutorily the Energy Resource Coordinator (ERC), who directly consults the governor on the State's energy plans. Through this relationship, HSEO's director and staff have influence on planning efforts and

access to other state agencies designed to create a business environment conducive to innovation and equitable resource abundance for the State's entire citizenry. Many stakeholders had only a limited understanding of HSEO's position in government and these responsibilities. Some stakeholders mentioned that HSEO's position as an embedded government agency—as well as limited staff resources—may contribute to HSEO being less visible (e.g., “deskbound”), slow moving, and risk averse.

- **Unique position within the energy ecosystem.** Stakeholders mentioned that HSEO's advantage as a government actor is that it is an impartial party and trusted resource, making HSEO well positioned to collect and distribute data and provide objective statewide analysis. HSEO is also naturally positioned to work with and convene a variety of stakeholders, coordinate people, and regularly assess ecosystem resource needs and respond accordingly. The agency also has the potential for advocacy and visioning.
- **Expertise in system level analysis.** HSEO is widely recognized by stakeholders as having expertise in renewable deployment, energy efficiency, systems planning, and data analysis.
- **Successful creation of proven products.** The agency is the author of various products that stakeholders recognize as effective in overcoming barriers (e.g., permitting wizard, the Developer and Investor Center, EnerGIS).
- **Limited funding.** Barrel tax revenues (only a fraction of which go toward HSEO) are HSEO's primary funding source and will diminish with Hawaii's transition from imported fossil fuels to cleaner energy resources. Additional budget constraints result from unfunded mandates and a lack of available resources for HSEO to convene stakeholders. The challenges surrounding funding should inspire HSEO to look for clean energy solutions through strategic partnerships in innovation, while ensuring adherence to HSEO's established ethical standards and procurement practices.

## Recommendations

The stakeholder feedback, ecosystem analysis, and HSEO's statutory duties provide the basis for the Consultant's recommendations on how HSEO can spur clean energy innovation. They include a suggested vision for clean energy innovation in Hawaii, HSEO's related purpose and role, outcomes related to the vision, strategies and actions, near-term implementation steps, milestones, and metrics to track progress.

Implementing these recommendations involves engaging all HSEO branches as applicable to different areas of expertise within the agency, with the Clean Energy Solutions Branch responsible for maintaining a core area of expertise in energy innovation and fostering cooperative partnerships within the ecosystem. Fulfilling these recommendations may require significant monetary and staff resources, (which is beyond the scope of this plan to address) and will involve partnering with other government entities, non-governmental organizations (NGOs), and the private sector to achieve desired outcomes.

## Vision, Purpose and Role, Outcomes

To serve as a compass to guide HSEO's innovation-related activities, including implementing the recommended strategies and actions and making mid-course corrections as needed, the Consultant defined a vision for the future of innovation in Hawaii's energy ecosystem, outlined HSEO's purpose and role related to innovation, and identified a set of outcomes that will help to achieve the vision.

**Vision for innovation in Hawaii's energy ecosystem:** Hawaii's communities and workforce benefit from clean energy through market-based innovations that create lasting jobs and prosperity while protecting the environment and reducing fossil fuel dependence.

**HSEO's innovation-focused purpose and role:** HSEO complements existing efforts by fostering partnerships, facilitating testing and demonstration projects, setting milestones, formulating policy solutions, and filling ecosystem gaps related to system-level and resource planning to advance innovation and accelerate Hawaii's transition to 100 percent clean energy.

**Outcomes to achieve the vision:** Achieving a future where Hawaii's communities and workforce benefit from innovations to achieve 100 percent clean energy will be enabled by achieving the following outcomes over time:

1. New rate structures, utility models, and financing mechanisms are deployed, attracting capital and enabling an efficient marketplace that rewards innovative clean energy solutions, energy efficiency, and informed consumer decision-making.
2. Significant regulatory barriers are overcome, enabling the accelerated testing and deployment of clean energy technologies.
3. State agencies and stakeholders align on and implement a cross-sectoral framework and incentives for clean transportation.
4. Hawaii fosters a globally oriented, innovation-friendly business climate/culture and provides the resources, institutional capacity, and regulatory framework that attracts and retains clean energy businesses and capital to the state, creating a thriving economic cluster and resulting in jobs and export opportunities.
5. Hawaii's diverse communities and workforce embrace and benefit from clean energy innovation.
6. Clean energy innovation becomes a top economic and environmental priority of the State, with adequate funding provided to the sector and legislation adopted that serves to accelerate the transition from fossil fuels to renewable energy.

Many different entities will need to be engaged to achieve these outcomes, with HSEO playing an important role—working alongside others—consistent with its statutory duties, capabilities, and available resources.

## Strategies and Actions

To advance innovation to accelerate the transition to a 100 percent clean energy future, HSEO should pursue three overarching strategies:

1. Maintain a core competency in innovation focused on the 100 percent Renewable Portfolio Standard, energy efficiency, and clean transportation.
  - 1.1. **Continuously monitor** ecosystem needs and innovation opportunities.
  - 1.2. **Prioritize innovation** to achieve 100 percent RPS that includes energy efficiency and clean transportation.

2. Provide needed services to accelerate innovation.
  - 2.1. Collect and distribute **data** and conduct **research** to guide, inform, and track progress. This information should be focused to enable the private sector to develop new energy innovations that help the State of Hawaii reach its energy goals.
  - 2.2. Deliver **innovative programmatic market support** to help businesses expeditiously meet Hawaii's business requirements, correctly complete applications, and efficiently develop and deploy new innovations that bring the State closer to its energy goals.
  - 2.3. Develop innovative **state-level policy solutions** to spur economic development, attract capital, and enable new business models that contribute to achieving the State's energy goals.
  - 2.4. **Coordinate and convene** agencies and stakeholders to align interests, activities, and initiatives and foster public-private partnerships that advance clean energy innovations.
  - 2.5. **Inform and engage the public** to build support for innovative clean energy deployment.
  
3. Foster Hawaii's leadership in innovative clean energy.
  - 3.1. Work towards **long-term partnerships and stakeholder networks** designed to continuously usher and incorporate innovative solutions into the energy sector and energy-related state-level planning.
  - 3.2 Market **Hawaii as a hub for innovative clean energy testing and deployment**, increasing opportunities for economic development that fulfill the State's clean energy goals.
  - 3.3 Align **Hawaii Clean Energy Initiative's** goals and missions with the innovation economy by opening and connecting the energy ecosystem while collectively focusing on the State's energy goals.

These strategies are designed to establish a viable policy and business framework that will enable Hawaii's communities and workforce to benefit from innovative clean energy solutions. In addition, these recommendations define HSEO's role in energy innovation over a five year planning horizon. Each strategy is supported by initiatives and actions, reflecting current needs, opportunities, and conditions. These strategies should be updated as conditions change and as actions are completed, enabling the plan to remain relevant over time. Recommended near-term actions, metrics, and milestones are included in the *Plan Implementation* section.

Each strategy and its associated initiatives and actions are described in detail below.

## 1. MAINTAIN A CORE COMPETENCY IN INNOVATION FOCUSED ON 100 PERCENT RPS, ENERGY EFFICIENCY, AND CLEAN TRANSPORTATION

This strategy provides the foundation for HSEO’s effectiveness and establishes priorities to focus HSEO’s clean energy innovation related activities. The strategy consists of two initiatives:

- 1.1 Continuously monitor ecosystem needs and innovation opportunities.
- 1.2 Prioritize innovation to achieve 100 percent RPS, energy efficiency, and clean transportation.

### 1.1 Continuously monitor ecosystem needs and innovation opportunities

*Statutory authority: Develop and maintain capabilities to evaluate, analyze, develop and coordinate energy planning efforts.*

- 196-1 | Energy Resources: Findings and declaration of necessity
- 196-4 | Energy Resources: Powers and duties

Building on the existing knowledge presented in this plan, HSEO should continue to develop a robust and contemporaneous understanding of ecosystem needs and innovation opportunities. This understanding is the foundation for the successful implementation of the other recommended strategies. Continuous knowledge of innovation needs and opportunities ensures that HSEO’s actions, such as policies and programs, are responsive to evolving market conditions and effectively contribute to achieving the State’s clean energy goals. This competency includes gaining knowledge of the interactions between policy, regulation, and innovation (e.g., changes in rate design, grid integration technologies) as well as staying current with the interests and capabilities of private and community innovators. It also involves recognizing that markets will change over time, sometimes quickly, suggesting the need for continuous engagement.

“It’s important to have repeated one-on-one conversations with actors in the ecosystem to understand their needs and [determine] how HSEO can provide value.”

-Entrepreneur

“It’s important for the Energy Office to provide leadership and be an honest broker, but they need to raise their visibility first.”

-Government employee

As HSEO works to address innovation in the clean energy sector, it will increase the agency's visibility and relevance while enhancing the ability to convene stakeholders and advance solutions. First, the agency can supplement annual reports to policymakers with more nuanced information regarding barriers and needs by stakeholder type, fostering equity across the ecosystem. Second, HSEO can shine a spotlight on unmet market needs as potential business opportunities for entrepreneurs and communities. Third, HSEO can continue to sponsor workshops and related forums for stakeholders who want to ensure that their perspectives are considered in state-level planning deliberation. Finally, based on the agency's energy sector awareness—gleaned through constant interaction with diverse stakeholders—and its unique position as an unbiased party, HSEO can recommend innovative policies and programs based on a holistic understanding of ecosystem-level needs, the system's innovation pipeline, stakeholder perspectives, and social inequities across the state.

"If progress is going to happen, HSEO needs to be more comfortable focusing resources on certain roadblocks rather than worrying about picking winners."

-Entrepreneur

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### Actions

Through the research undertaken for this project, HSEO has already demonstrated its commitment to developing its capabilities in facilitating innovative clean energy solutions. HSEO's understanding of ecosystem needs should be leveraged to:

- Assess stakeholder energy innovation and ecosystem-level needs and aspirations by **holding regular one-on-one meetings** with:
  - Private sector representatives
  - Government agencies
  - Military branches
  - NGOs
  - Energy customers
  - Academics
  - Community groups
- **Stay current with industry reports and white papers** to match ecosystem needs with emerging clean energy innovations. Partnering with aligned research institutions could lead to the advancement of both evolving and radical innovations.
- **Empower an informal advisory group of stakeholders**, possibly through HCEI, to provide input and feedback on ecosystem-level plans and the viability of innovations that address local needs.

- **Assist in marketing and attending events held by ecosystem actors** to be more available to stakeholders, reduce duplication of events, and honor the efforts of other ecosystem actors.
- **Host and co-host clean energy events** to engage partners and stakeholders in addressing emerging clean energy innovation issues and opportunities.
- **Attend or host conferences and other regional groups** to learn about and be inspired by innovations from governments and businesses across the globe, especially in other island markets.

By continuously and adaptively monitoring ecosystem-level needs, HSEO can work to provide relevant data and analysis (Strategy #2.1), market support (Strategy #2.2), and state-level policy solutions and leadership (Strategy #2.3), with a strong foundation in the aspirations and experiences of ecosystem actors.

“We can provide information around barriers and challenges that entrepreneurs and innovators are experiencing on-the-ground, and we would love to have powerful policy support to develop and take forward policy proposals and analyses to the legislature and regulators.”

-Entrepreneur

## 1.2 Prioritize innovation to achieve 100 percent RPS, energy efficiency, and clean transportation

*Statutory authority: The Department of Business, Economic Development, and Tourism shall, in partnership with federal agencies, provide “meaningful support” by offering research, development, and demonstration funding—provide technical assistance—to support Hawaii in its efforts to achieve its RPS.*

196-41 | State support for achieving renewable portfolio standards  
 196-42 | State support for achieving alternate fuels standards  
 269-92 | Public Utilities Commission: Renewable portfolio standards

Considering ecosystem needs, abundant potential opportunities, and resource constraints, HSEO should focus its innovation-related initiatives and activities on:

- 1) Achieving the 100 percent RPS goal – necessitating innovations in central and distributed renewables generation, storage, and grid management that address local needs.
- 2) Promoting building energy efficiency and consumer behaviors to achieve the 4,300 gigawatt hour (GWh) target reduction in electricity consumption.



- 3) Developing policies, incentives, and infrastructure for clean transportation, as a timely and high impact means to reduce petroleum consumption.

These innovation priorities leverage HSEO’s core competencies, honor the agency’s mandate, further HSEO goals, and are expected to achieve near-term progress in the clean energy sector. They must be pursued in a manner that enables adequate rewards for innovators and creates jobs that strengthen economic clusters, while avoiding an undue burden on ratepayers.<sup>18</sup>

### *Innovation to Achieve 100 percent RPS*

With progress towards achieving the 100 percent RPS goal slowing, policies and solutions that enable more rapid deployment of technologies and innovations in the test-bed stage are warranted. HSEO can play a valuable role here by:

- Using its central role in the energy ecosystem to gather and illuminate system needs
- Matching those needs with solutions in the innovation pipeline
- Advancing innovations that support a planned—yet adaptively managed—infrastructure
- Avoiding “picking winners” by fostering solutions that advance all viable renewable portfolio options

In addition, given HSEO’s past success creating tools for entrepreneurs (e.g., permitting wizard), the recently completed electric sector business model study, other system-wide studies, and HSEO’s role as a convener, HSEO is well positioned to spur innovation and help overcome barriers by advancing new business models, regulatory changes, policies, and rate incentives.

### *Innovation to Achieve Energy Efficiency*

Innovations in energy efficiency will be a key means to meet the requirement to reduce electricity consumption by 4,300 GWh from 2008 levels by 2030 as well as to achieve the 100 percent renewable energy portfolio for the entire state. Innovations are needed in such areas as financing and pay-for-performance mechanisms, solutions to the problem of split incentives, and advances to technologies and systems to design, build, and operate net zero buildings. In addition, Hawaii’s tropical climate and island economy creates the opportunity for locally designed (rather than imported) energy efficiency solutions, developed and implemented by Hawaii-based innovators and businesses.

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<sup>18</sup> These themes are also emphasized in the recently completed report on innovation commissioned and published by the Elemental Excelsator. This report concludes that the faster Hawaii transitions to clean energy, the more jobs and prosperity will be created. To access this report go to <https://transcendingoil.com/>.

## *Innovation to Achieve Clean Transportation*

Given the high cost of—and dependence on—imported petroleum and the relatively short driving distances, Hawaii is uniquely positioned to benefit from shifting to alternative sources of energy for transportation such as electricity powered by renewable resources, hydrogen, and biofuels. The opportunity for HSEO in clean transportation is to coordinate the activities of state agencies across sectors to address barriers and create policies and market signals that result in investments in new infrastructure and clean fuels. As staff of the Energy Resource Coordinator, HSEO can play a unique and leading role in this effort, convening and working with all parties involved and facilitating solutions.

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## *Actions*

HSEO should prioritize the agency’s innovation-focused resources on areas that address barriers to achieving the State’s 100 percent RPS, including increasing energy efficiency and advancing clean transportation. Specifically, HSEO should:

- Identify ecosystem needs to achieve 100 percent RPS (see Strategy #1.1).
- Monitor energy efficiency innovations and advance solutions that are suitable and effective for Hawaii.
- Facilitate cross-sectoral agency efforts related to clean transportation; propose policies and solutions to accelerate investment in and deployment of new technologies, infrastructure, and clean, renewable energy sources for the transportation sector.
- Address stakeholders needs across the diverse spectrum of clean energy transportation solutions and innovation pipeline such as Drive Electric Hawaii; maintain an understanding of all portfolio options and associated tradeoffs.

## **2. PROVIDE NEEDED SERVICES TO ACCELERATE INNOVATION**

This strategy consists of six initiatives:

- 2.1 Collect and distribute **data** and conduct **research** to guide, inform, and track progress. This information should be focused to enable the private sector to develop new energy innovations that help the State of Hawaii reach its energy goals.
- 2.2 Deliver **innovative programmatic market support** to help businesses expeditiously meet Hawaii’s business requirements, correctly complete applications, and efficiently develop and deploy new innovations that bring the State closer to its energy goals.

2.3 Develop innovative **state-level policy solutions** to spur economic development, attract capital, and enable new business models that contribute to achieving the State’s energy goals.

2.4 **Coordinate and convene** agencies and stakeholders to align interests, activities, and initiatives and foster public-private partnerships that advance clean energy innovations.

2.5 **Inform and engage the public** to build support for innovative clean energy deployment.

**2.1 Data and research**

*Statutory authority: Develop programs to encourage private and public exploration, research, and development of indigenous energy resources that will benefit the state.*

- 196-1 | Energy Resources: Findings and declaration of necessity
- 196-4 | Energy Resources: Powers and duties
- 226-18 | Objectives and policies for facility systems -- energy

Many stakeholders shared their appreciation for the energy market data and analyses currently provided by HSEO and expressed a desire for more information to serve as the basis for research, better decision-making, and the development of clean energy innovations that match the needs of the system. Specifically, data and studies are needed to serve key stakeholders in the following ways:

For **clean energy businesses**, more comprehensive and granular data and analyses will allow them to better identify market needs and innovative opportunities, develop new products and services, and make informed business decisions.

For **advocates and other NGOs**, the information and studies, as well as up-to-date bill information, provide the basis for understanding progress and shortcomings and engaging in regulatory and legislative proceedings.

“Making data available is the single most important thing the Energy Office does.”  
-Advocate

For **government decision-makers**—including the DBEDT Director/Energy Resource Coordinator, the HSEO director, the governor, and the legislature—accurate data and sound analyses of trends, needs, and market opportunities provide a foundation for effective policy and decision-making. Awareness of state-level infrastructure plans and solutions in the innovation pipeline can empower government leaders to enact informed, effective policies.

Additionally, data and research are essential for HSEO to understand the ecosystem and innovation opportunities, as recommended in Strategy #1. It is equally important for HSEO to monitor this data and research as it is for them to digest and disseminate it to promote adoption of state-level energy plans.

### Actions

HSEO currently publishes energy data, performs studies, conducts analysis, and produces

“We need an entity that can display data in a neutral way.”

-Government

reports. Going forward, these efforts should explicitly incorporate needs and issues related to innovation as it relates to future energy planning. A key part of this work will be to refine the methods used to disseminate the information to stakeholders and the public to maximize accessibility.

Accordingly, as a core service offering, HSEO, working in partnership with other entities, should consider implementing the following actions, which include providing information of use to stakeholders:

- **Address privacy concerns pertaining to customer usage data needed to develop smart grid and customer efficiency programs** (while not exposing customers to potential exploitation). These data include:
  - Energy demand and supply by time of day, week, and month.
  - Energy consumption by customer type.
  - Energy consumption for each customer (available to the customer and, potentially, with their permission, to non-utility service providers and NGOs).
  - On-grid and off-grid energy consumption.
- **Raise awareness of market needs by collecting and distributing data**, such as:
  - Clean energy sector employment (note: a survey will be needed to obtain this data as clean energy is not currently a sector tracked by the State).
  - Energy sector investment.
  - Number of devices and equipment installed.
  - Energy efficiency savings achieved, for incorporation in annual reports.
  - A map of infrastructure depicting:
    - Clean transportation (e.g. the location and quantity of electric vehicles)
    - Generation, distribution, transmission & storage
- **Open and connect the energy ecosystem by serving as an information clearinghouse** including facilitating access to:

- PUC dockets and other related processes.
- Models and assumptions used for utility resource planning and the development of fiscal notes.
- Energy-related bill information.
- **Continuously monitor and measure innovation policy and program effectiveness.** Periodically report on progress towards State goals, including energy efficiency and clean transportation achievements.
- **Report on the results** of innovation policies, initiatives, and pilots in the state and globally.
- **Commission or coordinate technology-level studies** from third-party organizations or academic partnerships (e.g., HNEI). Studies could include assessing the tradeoffs between different portfolios of innovative renewable energy and efficiency solutions.

## 2.2 Develop innovative programmatic market support

*Statutory authority: Develop programs to encourage private and public exploration, research, and development of indigenous energy resources that will benefit the state.*

196-1 | Energy Resources: Findings and declaration of necessity

196-4 | Energy Resources: Powers and duties

226-18 | Objectives and policies for facility systems -- energy

Providing market support in areas identified by clean energy businesses is a high-impact opportunity to encourage the exploration, research, and development of indigenous energy resources. While Hawaii attracts companies due to the visibility of pilot projects, high energy costs, and abundant renewable resources, barriers to operating in Hawaii have caused some companies to relocate to other markets. Providing programmatic support to both start-ups and established businesses could increase the likelihood of companies locating and remaining in Hawaii.

In the interviews and workshops, clean energy businesses and other stakeholders identified ways in which they could benefit from government assistance to overcome barriers and catalyze innovation. These include:

“Our project took two years to get built and another nine months to get the utility to take the load—we considered filing a PURPA complaint.”

-Clean Energy Business

- **A first point of contact** helping businesses learn about community needs and interests, as well as gain perspective on Hawaii’s energy players and marketplace, how decisions are made, and local business practices.
- **Support with permitting** to test and deploy new technologies, at both the county and state levels, including providing an orientation and technical assistance when complying with permitting requirements, providing checklists and FAQs for applicants, identifying common errors by applicants, and possibly simplifying those requirements (especially for pilot projects). Other needs include standardizing permitting processes for new technologies, providing more transparency into what businesses can expect regarding permitting, providing training for county authorities.
- **Access to testing facilities**, including easy and inexpensive access to sandbox and testing facilities for R&D, testing, and demonstration of viability to potential buyers (e.g., the utility). These facilities need to be able to accommodate many potential products and services, as entrepreneurs are developing a wide variety of technologies and solutions that could be deployed both on the grid and behind the meter.
- **Training and mentorship** of businesses and other stakeholders to “think globally,” developing the capacity to export ideas and products to external markets, as well as to increase local knowledge across industry clusters. This training should focus on developing sustainable businesses and industry clusters in order to create long-term value and jobs for Hawaii’s people.
- **Access to talent and a workforce** that matches the skills and training required for employment in clean energy businesses.
- Providing information about and promoting competitive compensation packages to **attract and retain a talented workforce**.
- **Support for promising pilot projects**, including referrals to potential sources of funding.
- **Access to office space**, including affordable, centrally located space for convening, trainings, networking, and a shared work environment. This space is expected to be of interest to Elemental Exclerator program graduates as well as to other clean energy entrepreneurs and service providers who have not participated in the program.

“It is difficult to predict what will be required for permitting and the UL code is constantly changing.”

-Entrepreneur

Serving in its coordinator role (see Strategy #2.5), HSEO is well positioned to lead and coordinate activities that meet market needs through innovation. By serving as businesses’ first point of contact, HSEO can provide immediate value to new businesses by sharing information on state-level energy plans and infrastructure and by connecting organizations to existing and potential resources. HSEO can help meet these ecosystem needs through partnerships, including collaborations with:

- HTDC, HNEI, NELHA, and the military to help meet testing facility needs.
- The Department of Land and Natural Resources to understand their priorities and ensure complete and accurate application submissions to help expedite permitting and development.
- Groups such as the HVCA, HI Growth Initiative, Hawaii Angels, Blue Startups, PCATT, HNEI, Elemental Excelerator, other incubators, and educational institutions to provide training and mentorship as well as access to capital.
- Educational institutions (K-graduate school) to create aspirational employment pathways for local students and align programs and degrees with workforce needs.
- Potential funders—including the military, foundations, and government agencies—to support pilot projects.
- HTDC and co-working providers (e.g., Impact Hub, BoxJelly, Real Office Centers) to provide access to office space, including co-working space and test-bed facilities (see Strategy #3.1).

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### *Actions*

Recommended HSEO market support services:

- **Serve as the first point of contact for businesses**, which will involve:
  - Assigning a staff person charged with understanding the needs and dynamics of the market and serving as a one-stop shopping “energy innovation facilitator” resource to connect businesses to available resources.<sup>19</sup>
  - Maintaining a web portal with relevant information for entrepreneurs.

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<sup>19</sup> HSEO has a statutory position for a Renewable Energy Facilitator (see Appendix B) and filled this position for a year several years ago. HSEO, entrepreneurs, permitting agencies, etc. all learned from this pilot effort, including 1) that it is difficult to not prioritize helping one person or entity over another (conflicting with HSEO’s commitment to providing equitable resources) and 2) entrepreneurs frequently lost touch with HSEO because they realized ideas were not viable or they needed basic guidance that could be addressed with FAQs or checklists. If HSEO moves forward with this support service, it is recommended that the organization carefully review prior experience and apply lessons learned to the design and implementation of this new role, including how to provide support services on an equitable basis. Stakeholders strongly supported the idea of having such a position, so it is included here as a recommendation. The Consultant believes that the service, if properly provided, can add significant value to advancing clean energy innovation.

- **Provide permitting support**, by:
  - Collaborating with county energy offices to facilitate permitting, troubleshooting issues, and developing new procedures and approaches.
  - Providing permitting trainings for businesses and regulators.
  - Providing information about what businesses and residents can expect when undergoing permitting reviews.
  - Considering and potentially recommending alternative models for permitting, such as temporary or provisional permitting following the military's Joint Technology Demonstration model.
- **Facilitate access to testing facilities**, by:
  - Identifying available resources and connecting interested clean energy businesses to existing facilities.
  - Assessing the need for and viability of new facilities, and, if viable, seeking partners and funding to implement.
- **Find partners to conduct training and provide mentoring** to innovative clean energy businesses, government officials, and other stakeholders that address market needs, including:
  - Trainings in permitting processes for counties, agents, and developers.
  - Mentoring of global companies new to Hawaii in customer demographics, community interests, infrastructure, and ecosystem needs.
  - Mentoring businesses in customer development, global engagement, and the value of exporting products and services.
  - Information provided via websites, tools, and materials such as checklists and FAQs.
- **Help align workforce needs and employment opportunities**, by:
  - Developing and maintaining an understanding of workforce development needs for governments, NGOs, and clean energy businesses.
  - Making the case to relevant agencies, businesses, colleges, and universities to provide necessary training and apprenticeships.
  - Locating and coordinating potential existing resources, such as partnering with University of Hawaii departments, other academic institutions, and/or national labs to provide engineering and marketing capacity to startups.



- **Find and attract financial capital**, especially to support pilot projects, by:
  - Working in partnership with organizations and businesses to seek grants while addressing procurement and ethics concerns.
  - Hosting investor forums.
  - Strengthening connections with the military to increase access to clean energy innovation grants and pilot projects.
  - Equitably connect ecosystem partnerships and promote natural economic clusters.
- **Advocate for additional space** to meet ecosystem needs, by:
  - Relaying information about space needs to Department of Defense (DOD) facilities and co-working companies such as BoxJelly, Impact Hub, Regus, and Real Office Centers (ROC) and vice versa.
- **Coordinate with county energy coordinators, the military, EPA, and other state agencies** to address and resolve the specific needs and issues of individual businesses that are seeking to develop and deploy innovations that bring the state closer to its energy goals.

## 2.3 Develop innovative state-level policy solutions

*Statutory authority: Consult on energy-related matters to the governor, public agencies, and private industry; recommend market-based policies to develop energy resources, systems, and markets; and review proposed state actions*

196-3 | Energy Resources: Energy Resources Coordinator

196-4 | Energy Resources: Powers and duties

Stakeholder input and market research documented the pressing need for state-level leadership and policy solutions to address barriers and opportunities related to clean energy innovation. Indeed, a principal finding of this strategic plan is that strong leadership, from the governor on down, is needed to overcome ecosystem constraints and inertia in the system, implement policies that facilitate testing and deployment, and attract the capital needed for commercialization of clean energy technologies and market solutions that scale.

“Technology has outpaced policy innovation.”

-Academic Partner

HSEO can play a vital role in enabling this policy leadership, serving as an honest broker to enable ecosystem stakeholders to understand and resolve issues and barriers, and advancing policies that open markets to innovative technologies. Consistent with its statutory authority and the agency's strengths, HSEO is uniquely suited to support key decision-makers and stakeholders by recommending policies and plans, convening stakeholders, and engaging in proceedings. HSEO can be effective in this endeavor by using its expertise and credibility to inform decisions that support piloting potential solutions, analyze and track their progress, and refine strategies moving forward.

"We would love to see strong policy packages that break open markets for new technologies. We...would love to have powerful policy support to develop and take forward policy proposals and analysis to the legislature and regulators."

-Entrepreneur

## Actions

Recommended HSEO activities are outlined below.

- **Articulate and advance an adaptable clean energy vision and coordinated innovation strategy** for Hawaii. Specifically, HSEO should:
  - Use this plan as a starting point to convene stakeholders and key decision-makers to formulate and communicate a coordinated strategy, defining roles, and activities for all key players as well as priority initiatives.
- **Conduct policy analyses to develop and advance policy proposals**, in partnership with others, to take forward to the governor, legislature, and regulators. Several high-priority policy needs were identified by stakeholders, which address specific barriers to innovation. To avoid "picking winners" these should be vetted by HSEO prior to policy formulation to ensure that they are consistent with state-level policies and priorities related to achieving 100 percent RPS:
  - Electric utility rate reforms that send accurate market signals and enable demand response, distributed energy, storage, and microgrids.
  - On-site solar access and choice.
  - Incentives for alternative transportation solutions, including electrification, including increasing financing for new charging stations and electric vehicle purchasing.

"HSEO has been helpful in stopping bad legislation from passing, but we need the State to advance good policy ideas, not just stop the bad."

-Entrepreneur

- Data transparency and privacy, including policies to balance the competing needs of energy consumers and clean energy businesses for access to real-time and historical energy usage data.
- Solutions that accelerate grid modernization and enable increased energy efficiencies.
- Advanced metering & controls—including policies or regulations to accelerate the deployment of advanced metering & controls technologies—to allow customers to provide and be compensated for load management and grid services.
- **Conduct “big-picture” statewide studies** and develop longer-range plans and systems-level solutions that signal what innovations are necessary in order to inform near-term incremental policies, and decision-making, including:
  - Complete the ongoing utility and regulatory model study. Based on the results of the study, develop recommendations for new utility models, policies, and incentives that enable financial viability, attract financial resources, and accelerate the safe and reliable transition to 100 percent renewable energy.
  - Undertake a deep decarbonization study to develop and recommend alternative pathways to achieve the State’s 100 percent renewable electricity goal, maximize clean energy in the transportation sector, and minimize fossil fuel consumption through energy efficiency and the consideration of alternative sources of clean fuels.
  - Analyze the state and county system for permitting clean energy pilot projects and new types of energy solutions such as battery storage, solar, and other forms of distributed energy resources. If justified, develop alternative permitting systems and solutions to accelerate testing, deployment, and commercialization.
- **Engage in PUC proceedings**, not as an intervener, but as a problem solver, facilitator, and information provider, by:
  - Maximizing HSEO’s influence on PUC dockets by providing information and analyses for dockets and working in a facilitator role to help parties potentially reach settlements.

## 2.4 Coordinate and convene agencies and stakeholders to align innovation interests, activities, and initiatives

*Statutory authority: Coordinate efforts of statewide industry and government energy interests. Coordinate State energy programs with other governmental programs, including those of the federal government, other state governments, governments of nations with interest in common energy resources, and political subdivisions of Hawaii.*

196-4 | Energy Resources: Powers and duties

226-18 | Objectives and policies for facility systems – energy

196-10.5 | Hawaii clean energy initiative program

Virtually all stakeholders agreed that—in addition to being a power and duty of HSEO—an essential role and function of the agency is to convene and coordinate players within the ecosystem. Innovation requires open and connected systems where stakeholders can collaborate, experiment, evolve, and have access to regulators, investors, and technical expertise.

“The State Energy Office wields power as a state agency—people see value in working and collaborating with them.”

-Entrepreneur

Therefore, this strategy involves HSEO building on its role as a coordinator and convener to become the *go-to* resource for collaborating and creating synergies on clean energy issues—where HSEO both acts as the honest broker and provides the high level, statewide perspective in the room. This strategy leverages the individual meetings recommended in Strategy #1 to identify areas where convening and coordination may help overcome barriers and meet ecosystem needs. Based on

the Consultant’s stakeholder research, HSEO is the entity best positioned to convene and coordinate stakeholders across sectors, as is necessary for developing the clean transportation sector and innovative alternatives to petroleum.

### Actions

- **Convene and align government agencies** across sectors—including agriculture, energy, and transportation—to develop strategies and address barriers to clean transportation and the development of petroleum alternatives.
- **Coordinate city, county, and state agencies** to address and develop solutions for permitting roadblocks, facilitate pilot projects, and accelerate deployment.
- **Regularly convene and facilitate ad hoc working groups of stakeholders** to address issues as they arise and problem solve solutions associated with the clean energy transition.

- **Coordinate agency funding requests** and facilitate matching of available resources across ecosystem actors, such as with public and private financing.
- Assemble participants in PUC docket processes to **facilitate consensus agreements**.

## 2.5 Inform and engage the public to build support for deploying innovative clean energy solutions

*Statutory authority: Develop programs to encourage private and public exploration, research, and development of indigenous energy resources that will benefit the State.*

196-4 | Energy Resources: Powers and duties

226-18 | Objectives and policies for facility systems -- energy

Ultimately, success in accelerating innovation and achieving the State’s clean energy goals will require the full support of the public, including ratepayers, residential and business consumers, and Hawaii’s diverse communities. Innovation can directly impact communities, and the process can, at times, be unpredictable, time consuming, and costly. Alternatively, communities can be the innovators, finding new solutions to problems and creating new opportunities. As one stakeholder put it, “all deployment is local.” While the long-term benefits of a clean energy future may be compelling, the immediate disruptions and uncertainty—and the impacts of

“My top priority for HSEO is to have them engender and maintain local support for clean energy development.”

-Entrepreneur

technology deployment on the landscape—can be significant and antagonizing. Accordingly, care must be taken to involve communities, ensure that those communities ultimately benefit from new technologies and projects, and foster durable public support for clean energy.

The government has a key role to play in this endeavor, including engaging and educating the public, facilitating processes to gain buy-in from key stakeholder groups and community leaders, and establishing ground rules for the testing and deployment of both pilot and full-scale projects.

### Actions

Many different state agencies and the private sector have a role to play in this endeavor, with HSEO playing a supportive rather than leading role. Activities for HSEO to undertake include:

- **Informing and engaging the public about clean energy innovation and projects** via web, social media, brochures, hosting forums, and showcasing technologies and solutions around the island.
- Providing **data and information** to the public in an easy to understand, compelling, and media-friendly way.
- **Educating entrepreneurs, clean energy businesses, and project developers** new to Hawaii on the energy ecosystem’s needs and how best to involve affected communities and gain their support.
- **Addressing the equity dimensions of the clean energy transition** by working to make sure that the benefits and costs of projects and policies are equitably distributed.
- **Engaging in renewables project siting processes** to better understand community needs and issues.
- **Exploring partnerships** with educational institutions and/or the private sector to provide public education and engage communities, including developing initiatives to inspire clean energy career paths from kindergarten through graduate school.

“With innovation, you can be too organized. A lot of it happens organically.”

-Government Partner

### 3. FOSTER HAWAII’S LEADERSHIP IN CLEAN ENERGY INNOVATION

As documented through stakeholder and market research, Hawaii is considered a leader in clean energy due to its 100 percent RPS goals, energy efficiency initiatives, current high percentage of renewables deployed, and status as a magnet for entrepreneurs eager to test and deploy innovative technologies. Hawaii can sustain this leadership by: 1) continuing to pioneer technology, policy, and system solutions to achieve 100 percent RPS and reduce electricity and petroleum consumption; 2) developing local human and intellectual capital as well as a workforce to implement solutions; and 3) exporting clean energy innovations to other states, island economies, and regions.

Importantly, success will flow from innovations and new technologies that benefit from and are strongly supported by local communities through the creation of lasting jobs, wealth, and social well-being. This type of success can be difficult to achieve—innovations and new energy projects are sometimes disruptive, can lead to job displacement, are often opposed by nearby residents, and/or primarily benefit a select few at the top of the economic pyramid. Hawaii, thus, can also demonstrate leadership by creating new models and approaches that effectively engage local stakeholders in project development and provide tangible and lasting community, workforce, and local wealth creation benefits.

HSEO’s efforts should be focused on creating this preferred clean energy future, where the State’s pursuit of the 100 percent RPS goal, energy efficiency, and clean transportation: 1) fosters “innovations from within” that address local needs as well as create export opportunities,

and 2) continues to attract entrepreneurs, established businesses, and communities to test, deploy, and commercialize innovative solutions, resulting in investments in the state and the continued development of Hawaii’s human capital.

Initiatives that serve to foster this type of clean energy leadership include:

- 3.1 Work toward **long-term partnerships and stakeholder networks** designed to continuously usher and incorporate innovative solutions into state-level planning and on-the-ground implementation.
- 3.2 Market Hawaii as a **hub for clean energy testing and application** to increase opportunities for economic development through innovations that fulfill Hawaii’s clean energy goals.
- 3.3 Align **Hawaii Clean Energy Initiative’s** goals and missions with the innovation economy by opening and connecting the energy ecosystem while collectively focusing on the State’s energy goals.

**3.1 Work toward long-term partnerships and stakeholder networks designed to continuously usher and incorporate innovative solutions into state-level planning and on-the-ground implementation.**

*Statutory authority: Coordinate efforts of statewide industry and government energy interests as well as conduct public education programs about the current state of the energy landscape and any government actions.*

- 196-4 | Energy Resources: Powers and duties
- 196-10.5 | Hawaii clean energy initiative program
- 226-18 | Objectives and policies for facility systems – energy

At the workshops, many stakeholders supported the creation of a physical center that would serve as a hub for clean energy innovation, provide opportunities to foster partnerships, and enhance the development of a clean energy cluster in Hawaii. Stakeholders were particularly attracted to attributes of the center that would support convening, collaboration, co-working, and market support services, including facilities for:

- Design and testing
- Holding in-person meetings and videoconferences
- Hosting workshops and trainings
- Engaging the public on a regular basis
- Showcasing clean energy technologies

Some stakeholders, however, expressed concern about the possible opportunity cost of this concept, suggesting that the capital and operating funds could be better deployed to directly address ecosystem needs. Stakeholders emphasized that the facility should be designed to complement, rather than duplicate, existing efforts and be implemented as a component of a broader clean energy innovation strategy.

In this context, functions of a clean energy innovation center that would support actions recommended in this plan include:

- Hosting workshops and events that engage and bring together stakeholders around key issues and opportunities (Strategy #1.1)
- Serving as the first point of contact for businesses (Strategy #2.2)
- Supporting training and mentoring and providing mentoring to clean energy businesses, government officials, and other stakeholders (Strategy #2.2)
- Finding and attracting capital (Strategy #2.2)
- Advocating for additional space to meet ecosystem needs (Strategy #2.2)
- Convening and aligning government agencies across sectors (Strategy #2.3)
- Convening and coordinating city, county, and state agencies to address and develop solutions for permitting roadblocks (Strategy #2.2 and #2.3)
- Convening and facilitating ad hoc working groups of stakeholders (Strategy #2.3)
- Informing and engaging the public about clean energy innovation and projects (Strategy #2.5)
- Providing data and information to the public in an easy to understand, compelling way (Strategy #2.1 and #2.5)
- Educating entrepreneurs and other clean energy businesses and project developers new to Hawaii and that could benefit from increased understanding of the State's energy ecosystem plans (Strategy #2.2)

Given recent developments including a change in the plans of potential partners and funding limitations, as well as the uncertain benefit of the center relative to the opportunity cost, the Consultant is not recommending the development of a physical center at this time. However, the Consultant does recommend that HSEO continue its efforts to provide the services listed above that are related to a center and be open to partnerships that could offer convening, testing, and showcasing space at low cost to advance clean energy innovation in the state.

Appendix A provides a more comprehensive discussion of the center, including services to provide and potential partnerships.



### 3.2 Market Hawaii as a hub for clean energy testing and deployment.

*Statutory authority: Promote Hawaii's clean and renewable resources to potential partners and investors.*

- 196-1 | Energy Resources: Findings and declaration of necessity
- 196-4 | Energy Resources: Powers and duties
- 196-10.5 | Hawaii clean energy initiative program

Even as Hawaii currently attracts businesses wanting to test and deploy their technologies, the State's energy market is quite small and constrained by scale. This limits the potential for clean energy innovation serving Hawaii's markets alone to become a major driver of economic development and job growth. To achieve these broader economic and workforce benefits, Hawaii should strive to position itself as a global hub for clean energy testing, evaluation, and deployment by:

- Attracting companies to the state to develop technologies that can address local energy issues as well as those that have broader applications (such as to other island economies).
- Designing and implementing innovative clean energy policy, capital, and business model solutions.
- Exporting proven technologies, systems, and policy solutions to Pacific Rim, island, and continental U.S. economies.

"We have to develop global markets to succeed. Our companies have to be global."

-Government Partner

The opportunity is to create a cluster of startups, local businesses, established energy companies, expert consultants, and investors all focused on developing and deploying innovative clean energy technologies and processes to achieve the State's 100 percent goal with consideration for export. An added benefit of this approach could be for local consumers to become familiar with new technologies and energy systems, potentially increasing customer and community acceptance of their deployment in Hawaii once proven.

To realize this vision, several stakeholders advocated for establishing a large facility for testing and experimentation that has the following characteristics:

- Is separate from the electric grid
- Does not directly affect local communities
- Has alternative permitting processes
- Provides an innovation-friendly regulatory regime

- Facilitates connections between large and small businesses and investors

Several stakeholders suggested Kalaeloa as the location for a large sandbox testing facility.

HSEO can play an important role in this effort by: 1) identifying the technologies and types of solutions that Hawaii needs to move forward to achieving 100 percent and providing that information to the marketplace; 2) providing the market support services to companies as identified in Strategy #2.2, especially those services that facilitate innovations as they incubate; 3) convening stakeholders and coordinating efforts to address and resolve barriers; and 4) developing and promoting approaches that effectively engage communities and develop Hawaii's intellectual and human capital.

One option is to promote the deployment of Hawaii's unique sustainable business model legislation (HRS Chapter 420D) in the clean energy sector, which strengthens patent protections for businesses that incorporate under the law and deliver public benefits including job creation. Successfully applying this approach could simultaneously serve the public interest, increase intellectual capacity, and attract capital to the state from parties interested in investing in sustainable business ventures and infrastructure improvements. This type of approach can increase the stake that communities have in the success of clean energy innovation, stimulating indigenous innovation and paving the way for both increased local deployment and exports.

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### *Actions*

HSEO's role would be to initiate, but not lead this effort. Specific actions for HSEO include:

- **Convening potential partners**, identifying a lead entity, and participating in discussions and processes to further develop the concept of a potential testing facility and other means to establish Hawaii as a "hub." Potential partners include the DOD, HSDC, HTDC, Oahu Economic Development Board, Hawaii Business Roundtable, HECO, and Elemental Excelsior, among others.
- **Coordinating funding** for further studies that look at feasibility analysis assessing Hawaii's competitive position, market demand, investment requirements, financial viability, and tradeoffs between renewable portfolio solutions.
- **Monitoring progress** on the initiative.
- **Marketing the location and services globally**, including to potential clean energy markets in the Asia-Pacific region and other island economies.

### 3.3 Align Hawaii Clean Energy Initiative’s plan of action with the innovation economy

*Statutory authority: The Department of Business, Economic Development, and Tourism is mandated to manage Hawaii’s Clean Energy Initiative (HCEI) program.*

196-10.5 | Hawaii clean energy initiative program

With HCEI marking its ten-year anniversary in 2018, it is timely to review and refresh the mandate and activities of this program. In the interviews and workshops, stakeholders expressed both appreciation for, and concern about, the effectiveness of HCEI in advancing clean energy innovation in Hawaii. Interviewees respected past accomplishments, including the Advisory Board’s high-level access and strong influence in shaping Hawaii’s energy policy. More recently, however, many stakeholders believe that the Advisory Board has become less relevant and somewhat parochial and is no longer providing the leadership or strategic direction originally intended. Strong leadership is needed to develop an innovation ecosystem that effectively integrates invention and ingenuity into the electricity and transportation markets, adequately rewards innovators, and benefits communities, consumers, and the workforce over the long run.

Accordingly, it is appropriate at this juncture to consider evolving the HCEI program to improve its effectiveness at guiding policy to achieve the 100 percent RPS goal, maximize energy efficiency, and advance clean energy in the transportation sector.

The Consultant therefore recommends that HSEO refresh and recommit HCEI’s plan of action by examining the HCEI charter, composition of the Advisory Board, reporting relationships, and responsibilities pertaining to clean energy innovation. This refresh should be undertaken with the support of—and in close coordination with—the HCEI Executive Management Team. Recommendations should then be advanced through the HSEO Energy Program Administrator and the DBEDT Director/Energy Resources Coordinator to the rest of the HCEI Executive Management Team for decision-making and announcement to the Advisory Board and other Hawaii energy ecosystem stakeholders.

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#### Actions

- Obtain support from the DBEDT Director/Energy Resources Coordinator, HSEO Administrator, and HCEI Executive Management Team to undertake the review.
- Organize and facilitate the refresh of the HCEI program, to include but not limited to, focusing on how HCEI can both promote innovation and strengthen existing economic clusters. Engage appropriate stakeholders in the process.
- Present findings and recommendations to the DBEDT Director.

## Plan Implementation: Near-Term Action Steps, Metrics, and Milestones

Taken together, the recommended strategies and actions presented above form a comprehensive approach to advancing innovative clean energy solutions in Hawaii. This section of the Plan provides additional detail on near-term actions, metrics, and milestones that will serve to guide initial HSEO implementation activities and track progress along the way. Table 1 presents proposed metrics for each of the Plan’s recommendations and lists the corresponding strategies. For each recommended strategy there are suggested near-term actions to guide implementation, consisting of both internal HSEO next steps to organize and deploy resources as well as external activities to advance innovation. Table 1 also includes proposed milestones for each strategy to enable tracking and evaluation. HSEO can use this information to develop annual work plans, establish short-term priorities, assign tasks and actions to each staff person, and allocate the required resources. As HSEO moves forward with plan implementation, these action steps and milestones can be reviewed and revised as needed.

This plan recognizes HSEO’s current funding constraints and the consequent need to carefully set priorities and undertake efforts that provide the greatest value. In the short-term, it is assumed that minimal additional resources will be available, and that HSEO will assign existing staff and apply existing resources to plan implementation as well as foster public-private partnerships to leverage other potential ecosystem resources. In the medium-term, the Plan calls for one additional full-time employee (FTE) to or reassignment of current staff to the “energy innovation facilitator” position.

Over the medium- and longer-terms, robust implementation of the Plan’s recommendations will require new funding—to provide for additional staffing and contractor support for data and research, market support, policy solutions, and for convening and coordination. A consistent long-term funding source will be necessary, with a systems-benefit charge suggested by stakeholders as one possible option. More work will be needed during implementation to develop a viable, sustainable approach to funding.

### NEAR-TERM PRIORITY ACTIONS

Creating initial momentum for the Plan and “early wins” will be crucial to securing funding and for HSEO’s success in this endeavor. These early wins will demonstrate HSEO’s value to the ecosystem, elected officials, key stakeholders, and the public. Recommended near-term actions to create this momentum are outlined below. These and related actions over a five-year timeframe are summarized in Table 2.

1. Demonstrate HSEO's commitment to include innovation as a priority focus and to develop its core competency in this field (Strategies #1.1 and #2.3):
  - Host a workshop with stakeholders to discuss the plan recommendations and create a shared vision of success and priorities.
  - Incorporate innovation elements into the work plans throughout HSEO.
  - Conduct ongoing outreach to clean energy businesses and key stakeholders.
2. Satisfy the immediate needs of innovators, advocates, and other stakeholders by providing and enabling access to high-value data and information. (Strategy #2.1):
  - Begin by conducting a system-wide assessment of data availability, convening stakeholders to develop a prioritized list of needs.
  - Address the issue of the status and ownership of customer energy data. Facilitate the development and implementation of solutions that balance customer privacy, transparency, and access, as well the proprietary interests of the private sector.
  - Beginning with the next legislative session, serve as a clearinghouse by tracking and reporting on the status of legislation that is the most highly relevant and significant to clean energy stakeholders during session. Include in this service, information on PUC dockets, and related processes.
3. Provide programmatic market support services that address and resolve existing key "pain points" and barriers (Strategy #2.2):
  - Develop one-stop "energy innovation facilitator" services for clean energy businesses:
    - Provide services on a limited basis with existing staff in year one.
    - Dedicate a staff person to fill the role of "energy innovation facilitator" in year two.
  - Services to provide include:
    - Maintain a web portal with relevant information for entrepreneurs, such as what businesses can expect when undergoing permitting reviews.
    - Coordinate access to existing testing facilities.
    - Organize a training for county energy coordinators on permit requirements.
4. Advance policy solutions (Strategy #2.3):
  - Complete the ongoing utility and regulatory model study; work with stakeholders to develop and implement recommendations for new utility models, policies, and incentives.

- Monitor PUC dockets to identify opportunities to provide data and analyses, facilitate stakeholder discussions, and broker agreements on policies and solutions.

### HIGH-LEVEL METRICS TO MEASURE PROGRESS

As noted, Table 1 provides metrics for the Plan goals and milestones for each strategy. Recommended metrics to track progress at a higher “landscape” level across all strategies and linked to the HSEO innovation mission and vision include:

#### 100 percent Renewable Energy by 2045

- Quantity and percent of renewable capacity and generation in electricity, including both utility-scale and distributed
- Number of clean energy projects in active testing and early deployment (capture the innovation pipeline)

#### Energy Efficiency

- Quantity and percent of demand met by energy efficiency
- Reduction in electricity consumption relative to the 4,300 GWH by 2030 target

#### Clean Energy Transportation

- Shares of trips/miles traveled in electric vehicles and using alternative clean fuels
- Electric vehicles purchased; percent market share
- Quantity and percent of alternative energy in transportation

#### Economic Development, Capital, and Jobs

- Number of jobs in the clean energy sector
- Number of businesses in the clean energy sector
- Capital invested in the clean energy sector
- Capital invested in grid modernization
- Value of clean energy exports
- Public satisfaction with clean energy
- Tax revenues generated by the clean energy sector

In addition to these metrics, the Clean Edge Index, which is updated annually, provides a useful indication of Hawaii’s clean energy position relative to other states overall and for the level of innovation in technology, policy, and capital.

**Table 1. Strategies, Initiatives, Near-Term Action Steps, and Milestones**

| Strategy/Initiative   | Near Term Action Steps   | Metrics  | Milestones  |
|---|--|--|---|
| <b>1. DEVELOP &amp; MAINTAIN A CORE COMPETENCY IN INNOVATION FOCUSED ON 100 PERCENT RPS, EFFICIENCY, &amp; CLEAN TRANSPORTATION</b> |  |  |   |
| <b>1.1 Continuously monitor ecosystem needs and innovation opportunities.</b>   | <ul style="list-style-type: none"> <li>• Develop innovation focused work plan; assign innovation responsibilities to HSEO staff.</li> <li>• Create database of clean energy businesses, projects, and resources.</li> <li>• Conduct one-on-one and small group meetings with clean energy businesses and stakeholders.</li> <li>• Establish “energy innovation facilitator” position.</li> </ul> | <ul style="list-style-type: none"> <li>• Stakeholder approval (through market surveys)</li> <li>• Clean energy sector satisfaction (measured through surveys)</li> <li>• Stakeholder support for clean energy projects (measured through surveys)</li> <li>• Funding provided</li> </ul> | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• All HSEO branches have innovation-focused responsibilities in work plan</li> <li>• Database established</li> </ul> <p><b>Year 2:</b></p> <ul style="list-style-type: none"> <li>• FTE position for “energy innovation facilitator” filled</li> </ul> |

| Strategy/Initiative  | Near Term Action Steps   | Metrics   | Milestones   |
|--|--|---|--|
| <p><b>1.2 Prioritize innovation to achieve 100 percent RPS that includes energy efficiency and clean transportation.</b></p> | <ul style="list-style-type: none"> <li>• After completion of the utility business model study, facilitate support for recommendations from executive, legislature, PUC, utility sector, and clean energy stakeholders.</li> <li>• Engage with PUC to develop, test, and adopt new tariffs and other incentives for clean energy.</li> <li>• Evaluate and develop proposals for performance-based contracting.</li> <li>• Work within HCEI to convene working group to develop framework and policies for transportation electrification.</li> <li>• Convene stakeholders across all efforts (e.g., 100 percent RPS, transportation electrification, energy efficiency).</li> </ul> | <ul style="list-style-type: none"> <li>• Percent renewables capacity &amp; generation (percent market share)</li> <li>• Dollars invested in grid modernization, smart grid infrastructure, DER, behind the grid applications, etc.</li> <li>• Dollars invested in energy efficiency</li> <li>• Percent of demand met through energy efficiency</li> <li>• Dollars invested in electrification infrastructure</li> <li>• Number of charging stations</li> <li>• Percent market share of EV</li> <li>• MWh consumed for transportation</li> </ul> | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Utility business model study completed</li> <li>• Policy analyses/rate studies initiated</li> </ul> <p><b>Year 2-3:</b></p> <ul style="list-style-type: none"> <li>• Policy/analyses/rate studies completed</li> <li>• Pilot projects implemented</li> <li>• Tariff &amp; business model recommendations adopted</li> <li>• Performance-based contracting policies adopted</li> </ul> <p><b>Year 4-5:</b></p> <ul style="list-style-type: none"> <li>• Transportation electrification recommendations advanced &amp; adopted</li> </ul> |



| Strategy/Initiative  | Near Term Action Steps   | Metrics  | Milestones   |
|--|--|--|--|
| <b>2. PROVIDE NEEDED SERVICES TO ACCELERATE INNOVATION</b>   |  |  |  |
| <p><b>2.1 Collect and distribute data and conduct research to guide, inform, and track progress. This information would be geared to enable the private sector to develop new energy innovations that help the State of Hawaii reach its energy goals.</b></p> | <ul style="list-style-type: none"> <li>• Further assess needs and priorities; convene workshop with stakeholders.</li> <li>• Develop work plan to provide needed data.</li> <li>• Assess existing policies and concerns about privacy; develop solutions to address issues.</li> <li>• Develop tracking and reporting system to monitor metrics developed in this strategic plan.</li> </ul> | <ul style="list-style-type: none"> <li>• Number of citations of HSEO data reports in testimony, proposals, etc.</li> <li>• Utility sector R&amp;D budget</li> <li>• PUC staffing; docket backlog; length of time to process dockets</li> <li>• Number of clean energy businesses developing, testing, deploying, and operating in Hawaii</li> <li>• Number of clean energy jobs</li> <li>• Dollars invested in clean energy (including military)</li> <li>• Dollar value of clean energy exports</li> <li>• Requests of HSEO for policy analysis, solutions</li> </ul> | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Work group convened</li> <li>• Work plan developed</li> </ul> <p><b>Year 2-3:</b></p> <ul style="list-style-type: none"> <li>• Implement work plan</li> </ul> |

| Strategy/Initiative   | Near Term Action Steps   | Metrics   | Milestones   |
|---|--|---|--|
| <p><b>2.2 Deliver innovative programmatic market support to help businesses move expeditiously through Hawaii’s business requirements, correctly complete applications, and efficiently develop and deploy new innovations that bring the State closer to its energy goals.</b></p> | <ul style="list-style-type: none"> <li>• Permitting:                             <ul style="list-style-type: none"> <li>– Convene work group to examine systemic issues and propose solutions.</li> <li>– Provide hands-on support to clean energy businesses.</li> <li>– Engage with county authorities.</li> <li>– Provide training and education about the permitting process.</li> </ul> </li> <li>• Establish “energy innovation facilitator” position.</li> <li>• Partner to seek grant funding for innovation projects/convene partners.</li> </ul> | <ul style="list-style-type: none"> <li>• Length of time to receive a permit</li> <li>• Number of streamlined processes for clean energy deployment and pilot projects</li> <li>• Number of pilot projects implemented</li> <li>• Stakeholder understanding of and satisfaction with permitting processes (from opinion survey)</li> </ul> | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Work group convened</li> </ul> <p><b>Year 2:</b></p> <ul style="list-style-type: none"> <li>• FTE position for “energy innovation facilitator” filled</li> <li>• Trainings provided</li> </ul> <p><b>Ongoing:</b></p> <ul style="list-style-type: none"> <li>• Grant funding secured</li> <li>• Permitting issues resolved</li> </ul> |

| Strategy/Initiative  | Near Term Action Steps   | Metrics  | Milestones   |
|--|--|--|--|
| <p><b>2.3 Develop innovative state-level policy solutions to spur economic development, attract capital, and enable new business models that are focused on the State’s energy goals.</b></p>            | <ul style="list-style-type: none"> <li>• Conduct policy analyses and propose solutions for 100 percent RPS and transportation electrification.</li> <li>• Conduct deep decarbonization study.</li> <li>• Incorporate report on innovation &amp; energy efficiency into annual energy sector report.</li> </ul> | <ul style="list-style-type: none"> <li>• Implementation of recommended tariffs</li> <li>• Adoption of recommended business models</li> <li>• Availability of new financing mechanisms</li> <li>• Policies and incentives for clean transportation adopted</li> </ul> | <p><b>Ongoing:</b></p> <ul style="list-style-type: none"> <li>• Policy analyses completed; recommendations advanced to governor and legislature</li> <li>• Annual report on status of clean energy innovation</li> </ul>     |
| <p><b>2.4 Coordinate and convene agencies and stakeholders to align innovation interests, activities, and initiatives that advance clean energy innovations through private-public partnerships.</b></p> | <ul style="list-style-type: none"> <li>• Convene working groups, coordinate agencies, and form partnerships as needed.</li> <li>• Convene participants in PUC dockets to facilitate consensus agreements.</li> </ul>   | <ul style="list-style-type: none"> <li>• Number of convening processes leading to agreements</li> <li>• Number of projects forged with partners</li> </ul>   | <p><b>Ongoing:</b></p> <ul style="list-style-type: none"> <li>• Workgroups &amp; partnerships formed in coordination with HCEI, HEPF, DERC, etc.</li> <li>• Processes successfully influence and achieve outcomes</li> </ul> |

| Strategy/Initiative   | Near Term Action Steps   | Metrics   | Milestones   |
|---|--|---|--|
| <p><b>2.5 Inform and engage the public to build support for innovative clean energy deployment.</b></p> | <ul style="list-style-type: none"> <li>• Develop public-facing web, social media, and collateral materials.</li> <li>• Engage in renewables project siting processes to better understand community needs and issues.</li> <li>• Partner with education institutions for education and community engagement.</li> <li>• Develop 'best practices' approach for clean energy businesses to engage communities in developing and obtaining approval for pilot and full-scale project.</li> <li>• Incorporate public oriented technology showcase into the energy innovation center.</li> </ul> <p>Create/implement public facing campaign on the benefits of clean energy innovation.</p> | <ul style="list-style-type: none"> <li>• Public support for clean energy (through opinion research)</li> <li>• Number of requests for assistance</li> </ul> | <p><b>Year 1-2:</b></p> <ul style="list-style-type: none"> <li>• New public facing materials developed</li> <li>• Public-private partnerships established</li> </ul> <p><b>Year 3-4:</b></p> <ul style="list-style-type: none"> <li>• Best practices approach developed</li> <li>• List of testing and demonstration facilities</li> </ul> <p><b>Ongoing:</b></p> <ul style="list-style-type: none"> <li>• Community groups involved in and supportive of testing and deployment of clean energy projects</li> </ul> |

| Strategy/Initiative   | Near Term Action Steps   | Metrics | Milestones   |
|---|--|---------|--|
| <b>3. FOSTER HAWAII'S LEADERSHIP IN CLEAN ENERGY INNOVATION</b>   |  |         |  |
| <b>3.1 Work towards long-term partnerships and stakeholder network designed to continuously usher and incorporate innovative solutions into state-level planning.</b> | <ul style="list-style-type: none"> <li>• Convene stakeholders around system-wide energy planning.</li> <li>• Conduct discussions with stakeholders on how to establish and maintain long-term partnerships and a stakeholder network.</li> </ul> |         | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Discussions occurring</li> </ul> <p><b>Year 2-3:</b></p> <ul style="list-style-type: none"> <li>• Partnerships and networks proposed and considered</li> </ul> <p><b>Year 3-4:</b></p> <ul style="list-style-type: none"> <li>• Value-added partnerships and networks formed and operational</li> </ul> |

| Strategy/Initiative   | Near Term Action Steps  | Metrics   | Milestones   |
|---|---|---|--|
| <p><b>3.2 Market Hawaii as a hub for innovative clean energy testing and application to increase opportunities for economic development that fulfills the State’s clean energy goals.</b></p> | <ul style="list-style-type: none"> <li>• Incorporate global orientation into HSEO innovation work plan online communications regarding HSEO Energy Directives.</li> <li>• Establish partnerships with other economic development/export entities and key players potentially including: HSDC, HTDC, Oahu Economic Development Board, Hawaii Business Roundtable, HECO, Elemental Excelsior.</li> <li>• Inventory existing testing facilities and interested partners; assess potential for new facility.</li> <li>• Conduct feasibility study of establishing a large-scale testing facility and attracting global companies for testing; assess and quantify export potential of innovative clean energy solutions.</li> </ul> | <ul style="list-style-type: none"> <li>• Number of studies and pilot projects completed testing new approaches</li> <li>• Number of pilot projects implemented</li> </ul> | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Incorporate global orientation into HSEO innovation work plan and update Energy Directives</li> <li>• Consider energy innovation industry clusters (e.g., transportation, e-commerce distribution, construction, etc.)</li> </ul> <p><b>Year 2:</b></p> <ul style="list-style-type: none"> <li>• Partnership established</li> <li>• Inventory completed</li> <li>• Feasibility study completed</li> </ul> |

| Strategy/Initiative   | Near Term Action Steps   | Metrics | Milestones  |
|---|--|---------|---|
| <p><b>3.3 Align Hawaii Clean Energy Initiative’s goals and missions with the innovation economy by opening and connecting the energy ecosystem while collectively focusing on the State’s energy goals.</b></p> | <ul style="list-style-type: none"> <li>• Obtain HSEO Coordinator, DBEDT Director, and HCEI Program Executive Management Team (EMT) support for the review</li> <li>• Organize and facilitate the review.</li> <li>• Present results to the HSEO Coordinator, DBEDT Director, and EMT.</li> </ul> |         | <p><b>Year 1:</b></p> <ul style="list-style-type: none"> <li>• Obtain support for review</li> <li>• Organize review</li> </ul> <p><b>Year 2:</b></p> <ul style="list-style-type: none"> <li>• Complete review; present results</li> </ul> |

Table 2. Implementation Timeline

|   | Year 1   | Year 2  | Year 3   | Year 4  | Year 5                                   |
|---|--|---|--|---|--|
| <b>STRATEGY 1</b> Maintain a core competency in innovation focused on the 100 percent Renewable Portfolio Standard, energy efficiency, and clean transportation.  |  |   |  |   |  |
| <b>1.1: Continuously monitor</b> ecosystem needs and innovation opportunities.  | All HSEO branches have innovation focused responsibilities in work plan      |   |  |   |  |
|   | Utility business model study completed                                       |   |  |   |  |
| <b>1.2: Prioritize innovation</b> to achieve 100 percent RPS that includes energy efficiency, and clean transportation  | Policy analyses/rate studies initiated                                       |   | Pilot projects implemented   |   |  |
|   |  |   | Tariff & business model recommendations adopted                      |   |  |
|   |  | Clean transportation working group established                          | Clean transportation working group                                   | Clean transportation recommendations advanced & adopted   | Clean transportation working group ...   |
|   |  |   | Performance-based contracting policies adopted                       | Performance-based contracting policies adopted & reviewed |  |
| <b>STRATEGY 2</b> Provide needed services to accelerate innovation.   |  |   |  |   |  |
| <b>2.1:</b> Collect and distribute <b>data and</b> conduct <b>research</b> to guide, inform, and track progress. This information would be geared to enable the private sector to develop new energy innovations that help the State of Hawaii reach its energy goals               | Work group convened/developed  | Implement work plan   |  |   | Assess work plan                         |
|   | Database construction  | Database 1.0 w/ regular release schedule                                | Database 2.0 w/ regular release schedule                             | Database 3.0 w/ regular release schedule                  | Database 4.0 w/ regular release schedule |
| <b>2.2:</b> Deliver <b>innovative programmatic market support</b> to help businesses move expeditiously through Hawaii’s business requirements, correctly complete applications, and efficiently develop and deploy new innovations that bring the state closer to its energy goals | Work group convened  | FTE position for “energy innovation facilitator” established and filled | FTE position for “energy innovation facilitator”                     |   |  |
|   | Address permitting issues  | Secure (grant) funding for program support                              |  |   |  |
|   |  | Provide trainings w/ Elemental Exceleator                               |  |   |  |
| <b>2.3:</b> Develop innovative <b>state-level policy solutions</b> to spur economic development, attract capital, and enable new business models that are focused on the State’s energy goals   |  | Policy analyses & recs advanced to government & legislature             |  |   |  |
|   |  | Annual report on status of clean energy innovation                      |  |   |  |
| <b>2.4: Coordinate and convene</b> agencies and stakeholders to align innovation interests, activities, and initiatives that advance clean energy innovations through private-public partnerships   | Work groups & partnerships formed/progressed to influence & achieve outcomes |   |  |   |  |
| <b>2.5: Inform and engage the public</b> to build support for innovative clean energy deployment  | New public facing materials developed  | Best practices approach developed                                       | Best practices monitored & reviewed                                  |   |  |
|   |  |   | Community support & involvement of clean energy testing & deployment |   |  |
|   | Secure (grant) funding for public education                                  |   |  |   |  |
|   |  | Provide trainings w/ HI Energy  |  |   |  |
|   |  |   |  | Public facing showcase created                            | Public showcase rotates                  |
|   | Initiate education and research partnership discussions;                     | Form partnerships   | Provide education and training                                       | Ongoing education and training                            |  |



|  | Year 1   | Year 2   | Year 3  | Year 4                                | Year 5 |
|--|--|--|---|---------------------------------------|--------|
| <b>STRATEGY 3</b> Foster Hawaii's leadership in innovative clean energy.   |  |  |   |                                       |        |
| <b>3.1:</b> Work towards <b>long-term partnerships and stakeholder network</b> designed to continuously usher and incorporate innovative solutions into state-level planning.                                    | Partnership and network discussions occurring  | Consideration and assessment of options  | Value added partnerships and networks established | Partnerships and networks operational |        |
| <b>3.2:</b> Market <b>Hawaii as a hub for innovative clean energy testing and application</b> to increase opportunities for economic development that fulfills the State's clean energy goals.                   | Incorporate global orientation into HSEO innovation work plan and update Energy Directives   | Long-term partnerships w/ other economic development, innovation organizations. & private businesses |   |                                       |        |
|  | Conduct research and, as justified, develop energy cluster industries for export (construction; knowledge production & performing arts/efficiency, transportation/distribution/e-commerce) |  |   |                                       |        |
| <b>3.3:</b> Align <b>Hawaii Clean Energy Initiative's</b> goals and missions with the innovation economy by opening and connecting the energy ecosystem while collectively focusing on the State's energy goals. | Obtain support for review/Organize review  | Complete review; present results   |   |                                       |        |

- Key**
- Milestone**
  - Ongoing**

## Appendix A: Clean Energy Innovation Center

*Note: This appendix is included based on the Consultant team's scope to provide preliminary strategies and options for an energy innovation center as well as additional information related to strategic planning for the energy innovation center.*

The purpose of an innovation center is to provide a physical space where energy stakeholders can convene, learn, collaborate, and access value-added market support services and facilities. A physical center also provides an opportunity to showcase clean energy technologies and solutions, informing and engaging the broader public and enhancing support for Hawaii's clean energy policies and goals. Finally, with state-of-the-art communication systems, a center can connect businesses, government officials, and other stakeholders across islands and oceans, facilitating design, collaboration, and problem solving. In short, a center can spark innovation to advance the clean energy transition and be a resource for the entire energy ecosystem.

In the workshops, many stakeholders voiced support for such a facility and offered suggestions about how it could best be managed and operated as well as the services that should be provided. These stakeholders also shared their concerns, particularly related to the potential opportunity cost of investing in such a facility and the need for the center to fill a niche and complement—rather than compete with—existing offerings. Research into innovation centers on the mainland also provided guidance on best practices including:

- **Proximity to existing innovation hubs:** Whether close to a university or other research institutions or located within innovation districts, most centers are closely linked to established innovation hubs.
- **Diverse use of space:** Successful innovation center offer an array of usage options on site, including office and co-working spaces as well as labs or machine testing areas.
- **Variety of partners:** Strong partnerships with businesses, non-profits, universities, utilities, and municipalities ensure ample funding sources, broad support from the local community, and strong networking resources.
- **Support for businesses:** Business support, including mentoring and educational programs, fundraising assistance, and frequent networking opportunities, enable participants to effectively implement their ideas and technologies.

This input informed the development of this conceptual approach to a clean energy innovation center to be supported by HSEO, centrally located in Honolulu, and serving entrepreneurs, investors, trades, government, NGO stakeholders, counties, and, secondarily, the general public.

## Key Elements

### MISSION

To bring together the resources and partners that can inform, coordinate, and catalyze clean energy innovation in Hawaii.

### VISION

The facility will provide a central physical space for energy stakeholders to convene, learn, and collaborate. Innovation will be driven by networking, industry trainings, and resource coordination, especially across islands.

### LOCATION AND PARTNERS

As conceived, the innovation center will be centrally located in or near downtown Honolulu.

The innovation center is anticipated to become the central hub for clean energy businesses and stakeholders on Oahu and across the state, in part as a result of partnerships, use of technology, and co-location. Potential core partners in the effort are the Elemental Excelerator, Hawaii Energy, and HNEI. The Elemental Excelerator and Hawaii Energy have expressed a willingness to locate their offices at the center, while HNEI along with HSEO are interested in satellite office space. At least one co-working business has expressed interest in leasing space to operate a co-working space catering to clean energy and sustainability-related entities. As this initiative proceeds, other partnerships should be pursued with organizations, including advocates and investors interested in sharing and coordinating resources to advance Hawaii's clean energy economy.

Ideally, the center, along with the rest of the building, will be a living laboratory for clean energy innovation, designed and built to LEED Platinum or equivalent standards, and with cutting-edge features such as advanced technologies and smart systems for efficiency and HVAC controls, on-site solar, and a demonstration microgrid with storage. In addition, it is recommended that lobby space be dedicated to showcasing new technologies, innovations, and pilot projects, and a real-time energy supply and demand information data center be installed and made accessible to the public. These standards and features will need to be incorporated into the building design, with the incremental cost estimated at an early stage in the process. Additional funds, if needed, could potentially be secured through sponsorships from vendors, partnerships with the private sector, and/or support from foundations.

## FUNCTIONS AND SERVICES

The clean energy innovation center is envisioned as a flexible facility offering an evolving set of functions and services to meet the needs of the ecosystem. The initial set of functions and services to be provided are:

- Office and co-working space
- Convening, training, and meeting space
- Improve remote meeting and working experience
- Resource-planning facilitation
- CyberCANOE
- Technology showcase
- Testing and lab facilities

### Office and co-working space

Intended for startups and later-stage companies, satellite offices for agencies, service providers, and investors, this space would consist of:

- Open co-working space with natural light and a modern design aligned with today's start-up culture
- Facilities to enable and promote remote collaboration
- Private offices and office space for larger tenants
- Meeting and conference rooms of different sizes
- Café/kitchen
- Access to larger convening and meeting space
- Shared common/gathering space to encourage mingling and cross-pollination of ideas.

It is recommended that a co-working business—such as the Impact Hub, BoxJelly, or Regus—manage and operate this service under a lease agreement with the building owner.

### Convening, training, and meeting space

Stakeholders expressed a strong need and desire for accessible, affordable, and attractive convening and meeting space centrally located in Honolulu. Key features include:

- A large, flexible, dividable room for meetings, trainings, and events of different sizes
- Projection and high-quality video conferencing capabilities
- The ability to handle break-out sessions
- Networking space
- Parking

Potential trainings, events, and uses of this space (as suggested by stakeholders) include:

- Trainings for the trades in installation and deployment of new renewables and efficiency technologies
- Training in permitting processes for counties and permitting agents/companies
- Mentoring of mainland companies new to Hawaii in how to do business in the state and identification of local, place-based solutions
- Mentoring and training in customer development, global engagement, and exporting
- Information-sharing and discussion forums
- Meetings of the Hawaii Clean Energy Initiative Advisory Board
- Location for investors to meet with entrepreneurs and provide a base of operations while doing business in Hawaii

## CyberCANOE

Assuming available resources, a CyberCANOE for data visualization and collaboration across geographies focused on Hawaii's energy sector could be located at the center. This system, to be designed and operated through a partnership with the University of Hawaii (UH), would increase stakeholder literacy and enable problem solving by providing a visualization of complex systems such as the energy flows across the electricity grid and throughout Hawaii's economy. The CyberCANOE could potentially be used to enhance resiliency and emergency management, display real-time energy generation and usage, and provide mapping functions, such as the location of charging stations and concentrations of electric vehicles across the islands. It could also be useful to clean energy businesses and utilities to visualize and design the electric grid of the future, which is likely to be very different than today's system and consist of multiple distributed energy sources, microgrids, and demand response technologies.

Stakeholders interviewed in the research phase expressed keen interest in advanced video communication systems to connect across geographies but did not express a strong need for this type of data visualization—a "nice to have" as opposed to a "must have." However, in this digital information age, the ability to rapidly analyze and visualize big data could become quite valuable and useful for clean energy product and service design, and thus a potential future revenue source for the center under a fee-for-service model.

## Resource Facilitation Services

This plan calls for HSEO to provide a one stop shopping energy innovation support service, recommended as part of market support, to be housed at the center. The "energy innovation facilitator" would be physically located at the center serving the needs of clean energy businesses and with an "ear to the ground" to learn about ecosystem needs, issues, and concerns. As such, the "energy innovation facilitator" would contribute to HSEO's core competency in

understanding these needs and potential innovation opportunities. Services offered on-site by the “energy innovation facilitator” could include:

- Serving as an initial point of contact, providing new businesses with an orientation to Hawaii’s energy ecosystem and local market needs
- Connecting businesses to available facilities, partners, and services
- Organizing and/or coordinating events, trainings, tours, and delegation/investor visits
- Assisting with resolving permitting issues

The “energy innovation facilitator” would likely require staff support, also housed at the center, and would need to maintain a database of key players, facilities, services, and other features of the ecosystem to efficiently and effectively meet customer needs.

### Technology Showcase

As recommended earlier, ideally the center will “walk the talk” in terms of its design and operation as an ultra-efficient, sustainable building that uses renewable energy; minimizes water consumption, waste, and the use of toxics; and operates as its own microgrid. As such, it has the potential to become a draw for the public, students, and stakeholders who want to learn about sustainable design and clean energy.

A curated, revolving set of displays located in the lobby and easily accessible would add to this appeal by providing a means to educate and inform the public. The displays could include real-time data on energy usage, information on pilot studies, videos, and displays of the latest renewable energy technologies (e.g., battery storage, EVs, demand response systems, lighting, etc.)

The “energy innovation facilitator” could be assigned responsibility for curating and managing the showcase space, but may need additional support to handle these duties.

### Testing and Lab Facilities

Several of the clean energy businesses interviewed expressed a desire for access to a test yard, sandbox facilities, and technical lab facilities that could lower the cost and speed the process of testing and proving performance. Some thought this was particularly important given staff and resource constraints at HECO.

HTDC’s Cube is expected to have technical lab facilities that could be accessed by clean energy businesses located at the center; others are located at the University and HECO and could be accessed through HNEI and the utility, respectively. Rather than developing additional facilities at the center, it is recommended that the “energy innovation facilitator” connect businesses to

these other services, monitor how well their needs are met, troubleshoot as required, and document significant unmet needs for future study and potential investment.

## Appendix B: Statutes

This appendix provides a summary of Hawaii Revised Statutes that the Consultant reviewed as part of this project. These statutes pertain to energy resources in Hawaii and guide the powers and duties of HSEO.

### Findings and Declaration of Necessity (section 196-1)

The global demand for petroleum and its derivatives has resulted in:

- An increase in the price of oil.
- Economic hardships throughout Hawaii.
- Threats to public health, safety, and welfare.

Hawaii is particularly vulnerable to dislocations in global energy markets; great endowment of non-polluting, renewable power sources.

#### ACTORS

Many actors are engaged in this space, including:

- The University of Hawaii
- The Department of Land and Natural Resources
- The Department of Business, Economic Development, and Tourism
- The Division of Consumer Advocacy
- The Public Utilities Commission
- The State Emergency Management Agency
- The Federal Energy Office
- Various county agencies
- Hawaii's energy and energy-related companies

#### STATE NEEDS

The State has identified the need for comprehensive strategic planning to achieve full and efficient allocation of Hawaii's energy resources. Short- and long-range planning should outline:

- Broad policies, goals, and objectives.
- Criteria for measuring and evaluating accomplishments of objectives.
- Identification and implementation of programs that will carry out objectives.



- A determination of necessary (financial) requirements for the optimum development of Hawaii's energy resources.

Planning efforts should identify present conditions and major problems related to exploration, development, production, and distribution. Reports should include rate of change, current and future conditions (based on current trends), and initiatives to:

- Accelerate the production of renewable and alternative energy.
- Develop and adopt new technologies.
- Increase energy efficiency.
- Ensure the State's energy security.

## Powers and Duties of HSEO and Energy Resource Coordinator (section 196-4)

### COORDINATE

- Coordinate efforts of statewide industry and government energy interests.
- Coordinate the State energy programs with other governmental programs, including those of the federal government, other state governments, and governments of nations with interest in common energy resources, and political subdivisions of Hawaii.
- Establish and coordinate programs to preserve and protect the State's energy security.

### PROVIDE TECHNICAL ASSISTANCE

- Assist public and private agencies in developing indigenous energy sources and implementing energy conservation and efficiency programs.
- Maintain technical capability and adequate capacity to evaluate, analyze, develop, and coordinate energy planning efforts.

### ADVISE AND ENCOURAGE

- Develop programs to encourage private and public exploration, research, and development of indigenous energy resources that will benefit the state.
- Consult on energy-related matters to the governor, public agencies, and private industry.
- Recommend market-based policies to develop energy resources, systems, and markets.
- Review proposed state actions.

- Formulate a systematic process, including requirements, to identify and designate renewable energy zones (geographic areas rich with renewable energy resources that can be developed cost-effectively and in an “environmentally benign” manner).
- Develop the criteria or requirements for identifying and qualifying specific transmission projects and infrastructure that are critical to the development of renewable energy resources, including aiding in accessing the use of special purpose revenue bonds to finance the projects or infrastructure.
- Formulate plans to develop and use alternative energy sources.

## EDUCATE AND ENSURE

- Conduct public education programs about the current state of energy landscape and any government actions.
- Ensure the equitable distribution of energy resources.
- Maintain a robust energy emergency preparedness programs.

## Hawaii Clean Energy Initiative (section 196-10.5)

The Department of Business, Economic Development, and Tourism is mandated to manage Hawaii’s clean energy initiative program. The clean energy program shall design, implement, and administer activities that include:

- Strategic partnerships for research, development testing, deployment, and permitting of clean and renewable technologies.
- Engineering and economic evaluations of Hawaii’s potential for near-term project opportunities.
- Electric grid reliability and security projects that enable the integration of substantial amounts of renewable energy.
- A statewide clean energy public education and outreach plan, developed in coordination with Hawaii’s institutions of public education.
- Promotion of Hawaii’s clean and renewable resources to potential partners and investors.
- State and county level plans to transition to a clean energy economy that will be implemented from 2011 to 2030.

## State Support for Achieving the Renewable Portfolio Standard (RPS) (section 196-41)

The Department of Land and Natural Resources and the Department of Business, Economic Development, and Tourism shall facilitate the private sector's attainment of the RPS.

The Department of Business, Economic Development, and Tourism shall provide "meaningful support" associated with:

- Developing programs to maximize the use of renewable energy and cost-effective conservation measures by state government agencies.
- Working with federal agencies to develop research, development, and demonstration funding—and technical assistance—to support Hawaii in its efforts to achieve its RPS.
- Issue a biennial progress report to the governor and the legislature.

The Department of Land and Natural Resources will 1) assist with publishing a catalog of potential site for renewable energy development and 2) work with electricity utilities and renewable energy developers on permitting and planning processes to expedite development.

## State Program for Energy Planning and Conservation (section 201-12)

The Department of Business, Economic Development, and Tourism shall develop a state program for energy planning and conservation that shall consist of short- and long-range planning for the development and promulgation of methods to encourage voluntary conservation of:

- Gasoline
- Diesel oil
- Natural gas
- Propane
- Heating oils
- Other fuels
- Electrical Energy
- Efficient development of new or alternative sources of above fuels and energy

With possible assistance from state and county public information offices, information resulting from such methods is to be disseminated through:

- Mass communication media
- Public and private schools,
- Private and civic organizations
- All other appropriate means.

## Renewable Energy Facilitator (section 201-12.5)

The Department of Business, Economic Development, and Tourism shall hold a full-time, temporary position to:

- Facilitate the efficient permitting of renewable energy projects, including:
  - The land parcel on which the facility is situated;
  - Any renewable energy production structure or equipment;
  - Any energy transmission line from the facility to a public utility's electricity system; and
  - Any on-site infrastructure necessary to produce electricity or biofuel from the renewable energy site;
- Initiate the implementation of key renewable energy projects by permitting various efficiency improvement strategies identified by the department;
- Administer the day-to-day coordination for renewable energy projects on behalf of the department; and
- Submit periodic reports to the legislature on renewable energy facilitation activities.

This position is funded by the energy security special fund.

## Energy Security Special Fund (section 201-12.8)

Subject to legislative appropriation, moneys from the fund may be expended for the following purposes:

- To support the Hawaii clean energy initiative program, including its energy division, including funding staff positions within the division, and projects that ensure dependable, efficient, and economical energy, promote energy self-sufficiency, and provide greater energy security for the State;

- To fund the “energy innovation facilitator” position pursuant to section 201-12.5 and any other positions necessary for the purposes of paragraph (1) as determined by the legislature; and
- To fund, to the extent possible, the greenhouse gas emissions reduction task force, climate change task force, grants-in-aid to the economic development boards of each county, and grants-in-aid to economic development agencies of each county to meet the stated objectives of the Hawaii clean energy initiative program.

## Hawaii Climate Change Mitigation and Adaptation Commission (section 225P-3)F

The Commission shall:

- Provide policy direction, facilitation, coordination, and planning among state and county agencies, federal agencies, and other partners as appropriate.
- Establish climate change mitigation and adaptation strategies and goals to help guide planning and implementation statewide using the latest scientific analysis and risk assessment to monitor and forecast climate change related impacts at the regional, state, and local level, including any additional information deemed necessary.
- Identify vulnerable people, communities, industries, ecosystems, and the potential economic ramifications for climate change related impacts.
- Identify existing climate change mitigation and adaptation efforts at the federal, state, and local levels and make recommendations for how to meet or exceed Hawaii's state mitigation goals and shall adopt a liberal approach in preparation, so as to minimize future risk to the people and environment of Hawaii.
- Assess the capacity and availability of existing resources and identify new sources of revenue necessary to address climate change mitigation and adaptation and shall advise the governor, legislature, and counties on the economic and budgetary ramifications of climate change impacts, mitigation, and adaptation.
- Identify the information necessary to track progress in implementing climate change mitigation and adaptation efforts and shall submit an annual report to the governor and legislature no later than twenty days prior to the convening of each regular session of the legislature.
- Maintain a website that includes a mission statement as well as access to climate change related actions, plans, policies, and results.
- Conduct a comprehensive review of the implementation as required by this section and submit a report to the governor, legislature, and the counties no later than twenty days prior to the convening of the regular session of 2023 and every five years thereafter.

- As a first step, focus on and develop sea level rise vulnerability and adaptation reports that shall include:
  - Identification of the major areas of sea level rise impacts affecting the State and counties through 2050;
  - Identification of expected impacts of sea level rise based on the latest scientific research for each area through 2050;
  - Identification of the economic ramifications of sea level rise;
  - Identification of applicable federal laws, policies, or programs that impact affected areas; and
  - Recommendations for planning, management, and adaptation for hazards associated with increasing sea level rise.

The reports shall be made publicly available no later than December 31, 2017, and the commission shall reevaluate and update the sea level rise vulnerability and adaptation report every five years.

## Objectives and Policies for Energy Systems (section 226-18)

Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives:

- Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;
- Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawaii's dependence on imported fuels for electrical generation and ground transportation;
- Greater diversification of energy generation in the face of threats to Hawaii's energy supplies and systems;
- Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and
- Utility models that make the social and financial interests of Hawaii's utility customers a priority.

To achieve the energy objectives, it shall be the policy of this State to ensure the short- and long-term provision of adequate, reasonably priced, and dependable energy services to accommodate demand.

To further achieve the energy objectives, it shall be the policy of this State to:

- Support research and development as well as promote the use of renewable energy sources;
- Ensure that the combination of energy supplies and energy saving systems is sufficient to support the demands of growth;
- Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;
- Promote all cost-effective conservation of power and fuel supplies through measures, including:
  - Development of cost-effective demand-side management programs;
  - Education;
  - Adoption of energy efficient practices and technologies; and
  - Increasing energy efficiency and decreasing energy use in public infrastructure;
- Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems uses the least-cost energy supply option and maximizes efficient technologies;
- Support research, development, demonstration, and use of energy efficiency, load management, and other demand-side management programs, practices, and technologies;
 

Promote alternate fuels and transportation energy efficiency;
- Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;
- Support actions that reduce, avoid, or sequester Hawaii's greenhouse gas emissions through agriculture and forestry initiatives;
- Provide priority handling and processing for all state and county permits required for renewable energy projects;
- Ensure that liquefied natural gas is used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and does not impede the development and use of other cost-effective renewable energy sources; and
- Promote the development of indigenous geothermal energy resources that are located on public trust land as an affordable and reliable source of firm power for Hawaii.

## Renewable Portfolio Standard (RPS) (section 269-92)

The Public Utilities Commission is responsible for ensuring that each electric utility company that sells electricity for consumption in the State shall establish a renewable portfolio standard of:

- 10 percent of its net electricity sales by December 31, 2010
- 15 percent of its net electricity sales by December 31, 2015
- 30 percent of its net electricity sales by December 31, 2020
- 40 percent of its net electricity sales by December 31, 2030
- 70 percent of its net electricity sales by December 31, 2040
- 100 percent of its net electricity sales by December 31, 2045

## Energy Efficiency Portfolio Standards (section 269-96)

The Public Utilities Commission shall establish energy efficiency portfolio standards designed to achieve 4,300 gigawatt hours of electricity use reductions statewide by 2030 with interim goals for electricity use reduction by 2020 and 2025.

Electricity energy savings brought about by the use of renewable displacement or off-set technologies, including solar water heating and seawater airconditioning district cooling systems, shall count toward portfolio standard.



## Appendix C: Summary of Stakeholder Findings

The strategies presented in this plan are supported by the Consultant's stakeholder workshops and interviews with key players in Hawaii's clean energy ecosystem, including entrepreneurs, government officials, non-governmental organizations, and other actors. The Consultant used stakeholder input to gain third-party perspectives on the needs and opportunities to advance clean energy innovation in Hawaii, and potential roles for HSEO and an innovation center in this effort.

Stakeholder perspectives were gathered in two phases:

1. **Stakeholder Interviews:** During in-person and telephone interviews conducted in January and February with entrepreneurs, government officials, non-governmental organizations, and other key stakeholders working in Hawaii, interviewees contributed their perspectives on Hawaii's needs and opportunities, HSEO's strengths and weaknesses, and innovation priorities. These interviews were used to draft key findings, develop a SWOT analysis for HSEO, and formulate draft strategies for HSEO. A total of 46 stakeholders from 33 organizations provided input. A list of organizations interviewed and findings organized by stakeholder group is provided in *Appendix C: Attachment 1 – Hawaii's Energy Ecosystem Stakeholders* and *Appendix C: Attachment 2 – Interview Findings by Stakeholder Group*.
2. **Stakeholder Workshops:** During four in-person workshops conducted from June 20-21, a total of 16 stakeholders provided feedback on the Consultant's findings and draft strategies. Input from these workshops was used to finalize strategies and guide the implementation plan. Complete workshop notes, including a list of workshop attendees, is provided in *Appendix C: Attachment 3 – Summary of June Workshops*.

A summary of key findings gathered from both workshops and interviews is presented below.

### Stakeholder Interviews

Forty-eight stakeholders at thirty-four organizations were interviewed to provide third-party perspectives on the needs and opportunities to advance clean energy innovation in the state and potential roles for HSEO and an innovation center in this effort. Initial findings were presented to HSEO and the HCEI Steering Committee in January with responses and clarifications reflected in the sections below. Findings include both the ecosystem needs

presented by stakeholders as well as the broader ecosystem conditions and constraints affecting innovation.

Interviews were based on a discussion guide to ensure that multiple perspectives were gathered on core topics, while retaining the flexibility to customize questions based on the interviewees' position in—and perspective on—the energy ecosystem. Questions were open-ended and focused on the following topics:

- The strengths, weakness, opportunities, and threats in the energy ecosystem in Hawaii, including gaps, “pain points,” barriers, unique opportunities, and areas of unmet demand.
- The optimal role of HSEO and the energy innovation center in addressing the opportunities.
- The best ways to improve transparency and communication around clean energy innovation.
- Examples of (un)successful projects and what led to their (lack of) success.
- The feasibility of opportunities identified in desktop research and discussed in previous stakeholder interviews.
- Demographics—such as population density, urban vs. rural, income—and other socioeconomic or cultural factors that may affect local support for renewable energy in different parts of the state.

Please keep in mind that interview findings are presented to accurately reflect the input received from stakeholders and therefore may be subject to disagreement. Stakeholders were selected to provide a wide cross-section of perspectives. Particular emphasis was given to entrepreneurs, as their perspective is less commonly available to governmental organizations.

## KEY NEEDS TO ADVANCE INNOVATION

This section presents the key needs for advancing clean energy innovation in Hawaii. Specifically, stakeholders expressed the need to overcome barriers within the energy ecosystem, such as capacity constraints, physical barriers to implementation, alignment of incentive structures, and access to data to support businesses and decision-making processes. Key themes are summarized below.

### **Increased capacity at organizations and for independent analysis and priority-setting.**

Capacity concerns were raised for multiple organizations, including the Public Utilities Commission (PUC), utilities, HSEO, and others. People view capacity constraints as a key source of bottlenecks. For example, several people mentioned that the number of requests for piloting

technologies has overwhelmed the capacity of HECO to test these innovations. There is also limited capacity across multiple ecosystem actors to provide independent analysis of policies and other innovative proposals. That said, one interviewee mentioned that analysis can sometimes bog things down, stifling innovation, so the need for analysis should be balanced against the need for decisive action. Additionally, there is currently no actor that is appropriately tasked with providing strong policy leadership to help move policy innovations forward and play a visionary role.

### **Access to data and transparency in analysis.**

Several stakeholders mentioned that having access to customer utility data would support energy innovation in three important ways. First, data accessibility, especially in an electronic format or at a 15-minute interval, would unlock potential software technology solutions. Second, greater data access would enable people to tell better stories about energy use in Hawaii to help increase “energy literacy” across the state. Third, access to data would enable ecosystem players to critically engage with the analysis presented by other actors and allow actors to actively monitor activities and changes over time, rather than limited studies related to specific regulatory proceedings. For example, one person mentioned that cost estimates for proposed policies are a “black box” and another organization mentioned that key players in PUC proceedings do not have equal access to confidential customer data.

### **Improved collaboration and coordination across sectors and entities.**

The role of the Energy Resource Coordinator is broadly defined compared to other actors in the energy ecosystem, such as the Consumer Advocate of the Public Utilities Commission. Additionally, current mandates require HSEO to coordinate with others, but there is no reciprocal mandate for organizations to coordinate with HSEO. Specific opportunities for collaboration and coordination include increased integration with counties and the provision of online support tools such as links to other ecosystem actors, bill tracking, and increased use of HSEO and HCEI email distribution lists to share sector updates and events. One organization also expressed the need to coordinate funding requests and resources, as some entities have land but no money and vice versa. Finally, several stakeholders expressed the need for greater clarification of roles within the clean energy ecosystem for all involved actors, and identified HSEO as the natural entity to lead this effort.

### **Education and mentorship.**

Stakeholders identified education and mentorship as key needs for several reasons. For one, providing mentorship to mainland companies will help them move expeditiously through Hawaii’s business culture and increase the likelihood that the company will remain in Hawaii. In addition, it would be helpful to provide increased mentorship within Hawaii to increase the

participation of businesses and individuals within the state. This could involve 1) assisting Hawaii-based companies to think and grow globally outside the limited Hawaii market; and 2) training Hawaii residents to better meet the needs of energy sector businesses to increase employment opportunities within the sector.

### **Permitting efficiencies.**

Permitting was identified as a major barrier to project implementation at both the state and county levels. Specific solutions suggested by stakeholders included standardizing permitting processes, providing “one-click solutions”, providing permitting trainings for county employees, and piloting temporary permitting solutions.

### **Demonstration and testing facilities.**

Several businesses and research institutions mentioned that due to limited testing facilities in Hawaii, the grid itself often becomes the laboratory, meaning that piloting or testing technologies involves high stakes and is costly. Additionally, the waitlist for piloting technologies with utilities mean that tests, when they happen, are “make or break” for some entrepreneurs. Others mentioned that utilities can be wary of new technologies, so testing facilities located near utility offices could enable lower-stakes, lower-cost testing and increase the likelihood of utility staff buy-in. Most stakeholders were agnostic to the ownership structure of the testing facility, though HNEI mentioned that they would be well-suited to operate this type of facility.

### **New rate structures and utility model(s).**

New rate structures were discussed in the context of providing customers with the correct market signals to change their behavior or incent adoption of solutions that will save the utility money. For example, stakeholders mentioned the need for rate structures that incorporate the benefits to the grid of distributed generation and utility solar, as well as the need for rate structures to reflect cost drivers such as coincident demand. Similarly, alternative utility models could support more innovative outcomes; for example, performance-based models may better support innovation compared to a model based on returns for building and owning infrastructure. Finally, stakeholders mentioned the need to support residents that are pursuing both grid-connected and off-grid solutions, especially where funds are provided by taxpayers instead of ratepayers.

## **CONDITIONS AND CONSTRAINTS AFFECTING INNOVATION**

Throughout the interviews, and during the HSEO workshop, many stakeholders voiced the importance of ensuring that strategies for clean energy innovation are responsive to Hawaii’s unique context. For example, one person mentioned that to be taken seriously, any credible strategic plan needs to demonstrate a clear understanding of local conditions and constraints.

Accordingly, this section summarizes the relevant conditions and constraints for Hawaii and its citizens as voiced by stakeholders as well as how those considerations may influence the strategies developed to accelerate innovations that meet Hawaii's ecosystem needs.

**Business is based on relationships and decisions are made based on consensus.**

Stakeholders felt that Hawaii's culture can slow down the pace of doing business, create friction between mainland and island businesses, and make it unclear when others truly support proposals. Importantly, the focus on relationships and consensus has also influenced views of failure. While many startups operate with a "fail fast" mentality, Hawaii culture does not support moving quickly or accepting failure as a necessary part of the process.

**Hawaii has a high cost of living, low wages, and a high poverty rate.**

Low wages make it difficult to attract professionals to open positions and those in the service industry usually must work multiple jobs. The high cost of living can make it around 15 percent more expensive to operate in the state and poverty rates make equity a prominent concern, especially since some view innovations as being inherently expensive. Stakeholders cited these conditions as a constraint to innovation because comparatively high costs and low compensation discourage capital formation, talent acquisition, and entrepreneurial initiatives.

**Electricity costs are the highest in the country, but incentives are low.**

High energy costs make renewable energy options, including self-generation, relatively more cost-effective. However, current rate structures, such as the elimination of zero net energy metering and demand charges, have removed some of the incentives for self-generation and do not provide incentives for demand response technologies.

**There is a mismatch between degrees and career options.**

Hawaii residents, educated within and outside of Hawaii, may not be able to find jobs in their fields, which leads to "brain drain" as people move to the mainland for work. At the same time, there is a lack of trained labor in the energy sector, which leads to businesses importing labor from the mainland or pursuing opportunities in Hawaii while the labor remains on the mainland. Stakeholders mentioned this condition to encourage HSEO to ensure the benefits of clean energy innovation reach citizens of Hawaii to the greatest extent possible, especially in the form of increased employment opportunities.

**Hawaii is both geographically small and a small energy market.**

There is limited land area to develop utility-scale renewables. Additionally, electricity loads in Hawaii limit the number of innovations that can be applied on the same grid and can reduce the incentives for businesses to pursue Hawaii as a market for their products.

**Hawaii has a diverse set of renewable resources, though they are dispersed across islands.**

Hawaii has many options for generating renewable energy, though they are not always aligned with the energy needs of each island. Meanwhile, some resources are better suited than others for export to global markets. For example, ocean thermal technologies are only exportable to markets with sufficient access to deep waters.

**Current funding sources are limited and tapering.**

Currently, a significant amount of HSEO funding is from a portion of a tax levied on distributed fossil fuels. This funding has remained static since 2011 and will decline as the state moves towards decarbonized energy sources. Additionally, HSEO has several unfunded mandates, and there is a reluctance to provide more funding through increased taxes or an increased share of taxes.

**Hawaii has a visionary RPS and high penetration of renewables.**

Hawaii's 100 percent RPS provides confidence for some actors that the state will continue to support renewable energy, while others believe the RPS does not have sufficient "teeth" to drive the necessary changes. Importantly, the current market share of intermittent renewables is attractive to companies that have solutions regarding integrating renewable loads.

Figure 1. Initial HSEO Strengths Weaknesses Opportunities and Threats (SWOT) Analysis

|          | Assets   | Liabilities  |
|----------|--|--|
| Internal | <p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Ability to collect and distribute data<sup>20</sup></li> <li>• Ability to provide objective analysis</li> <li>• Author of some effective products (e.g., permitting wizard and investor center)</li> <li>• Natural position to work with and convene a variety of stakeholders</li> <li>• Potential for advocacy or visioning</li> </ul>  | <p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Deskbound; currently lacks high visibility and relevancy</li> <li>• Bureaucratic institution, slow-moving, and difficult to work with</li> <li>• Staff and budget constraints</li> <li>• Tapering funding source</li> <li>• Structurally embedded deep within the Department of Business, Economic Development, and Tourism</li> <li>• Lacks incentives or authority to convene</li> <li>• Risk-averse; reluctant to take positions</li> <li>• Being nimble in a bureaucracy</li> </ul>  |
| External | <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Increase support for entrepreneurs and other ecosystem actors involved in innovation, through networking and other initiatives,</li> <li>• Engage with other agencies to define and clarify roles and responsibilities in the clean energy ecosystem</li> <li>• Alleviate cultural barriers to innovation implementation</li> <li>• Develop HI’s clean energy brand as viewed by Asia and Mainland</li> <li>• Provide leadership to coordinate existing entities in support of key innovation-enabling policies</li> <li>• Encourage information sharing and accessibility of data</li> </ul> | <p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Duplication of existing efforts</li> <li>• Potential to endanger independent reputation if an advocacy role is pursued</li> <li>• Picking winners through resource allocation and solution choice (privileging electricity solutions)</li> <li>• Navigating Hawaii cultural incompatibilities with startup/innovation culture</li> <li>• Keeping pace with rapid advances and changes in the clean energy innovation field</li> <li>• Limited, diminishing funding source(s)</li> <li>• Reduced federal support under Trump Administration</li> </ul> |

<sup>20</sup> Several stakeholders specifically identified data as a strength of HSEO.

## Stakeholder Workshops

During the June 2017 project trip, four workshops were organized to enable key stakeholders to review and provide feedback on the Consultant's findings and draft strategies for HSEO and an innovation center. A total of 16 stakeholders attended these workshops from June 20-21, providing their input in an open-discussion format focused on the following questions:

- Are the presented strategies right for HSEO?
- Where should HSEO prioritize its resources to receive the greatest return on investment?
- Should the State invest in a physical innovation center?
- What else is needed to advance clean energy innovation in Hawaii?

This section presents summary themes from the workshops. These findings were used to finalize the plan's strategies and shape an implementation plan. A detailed summary of each workshop is available in Attachment 3 to Appendix C.

### INNOVATION CENTER

#### Process

All stakeholders agreed that the process for designing and developing an innovation center should be an open and transparent to include all relevant actors. The State's incubation, startup, and co-working community is small, so implementing this idea thoughtfully without encroaching upon other entities is vital. Furthermore, this will ensure that efforts are not being duplicated within the ecosystem.

#### Strategic Role

Most stakeholders emphasized that the center should be implemented alongside and in alignment with a broader strategic plan. It would not be impactful as a stand-alone entity, but if it solved multiple ecosystem problems and connected relevant entities, it would be extremely beneficial.



## Partnerships

Related to the strategic role, all stakeholders agreed that the innovation center is a perfect opportunity to coordinate partnerships with universities, industry, banks, policy actors, and regulators (see more below).

## SANDBOX

Stakeholders in most workshops agreed that there is a need for a larger “sandbox” facility that could be used by businesses and entrepreneurs for testing. This facility would exist in addition to, and perhaps be connected to, a potential innovation center. A sandbox would also reduce barriers to entering the HI market by enabling alternative permitting processes and familiarizing regulators, utilities, investors, and citizens with new technologies. Several stakeholders suggested Kalaeloa as a location for such a sandbox. While this is an ecosystem need, it is unclear what role HSEO might have in supporting or enabling the creation of a sandbox.

## PARTNERSHIPS

All stakeholders agreed that HSEO should undertake its activities, especially surrounding a potential innovation center or sandbox, in partnership with universities, energy industry businesses, banks, policy experts, regulators, and other ecosystem actors. Several stakeholders thought that strong partnerships with relevant UH programs (e.g. engineering, marketing, business) would be feasible, while businesses and banks seemed to be more aspirational, though not unreasonable. Including policy and regulatory actors in an innovation center was well-supported by stakeholders.

## FOCUSING RESOURCES

Whether within the innovation center specifically, or for the HSEO strategy more broadly, many stakeholders emphasized the need within the ecosystem to direct resources towards areas where the greatest benefits are possible. One stakeholder emphasized the need to vet incubated energy businesses, while others described the need for support pushing through crucial permitting and regulatory barriers for distributed energy. Another stakeholder thought that government should focus on creating a harbor so that businesses are not always “hitting the reef” when trying to work in Hawaii.

Most agreed that HSEO can enable the focusing of resources by playing an active role in the energy ecosystem and then identifying and articulating key needs or challenges. By highlighting these needs and challenges, HSEO will enable other ecosystem actors to create solutions, provide relevant analysis, etc.

## ORIENTATION OF INNOVATION

There was some disagreement in different stakeholder groups over whether HSEO-supported clean energy innovation should be oriented toward the 100 percent renewables goal or toward economic development. Some argued that because other actors in the system are addressing innovation more broadly, HSEO should support the RPS, while others argued that having a global orientation would make HI's startup scene larger and more impactful.

## BUSINESS ENVIRONMENT IN HAWAII

In one of the workshops, attendees identified cultural and political challenges as the biggest barriers to innovation in Hawaii, but also proposed a set of solutions that could help understand and overcome these barriers. Specifically, Hawaii could make emerging technologies less risky and radical by orienting Hawaii clean energy innovation globally, providing sandboxing space with alternative permitting guidelines, and establishing partnerships for a potential innovation center or sandbox. Together, these solutions would create easier permitting pathways, enable testing and evaluation of new technologies, and familiarize the Hawaii community with technologies, all of which help businesses overcome the initial barriers to working in Hawaii. These solutions would build and support cultures or institutional structures that begin with a "yes" attitude toward innovative technologies and businesses. While these ideas sound promising, it is unclear what role HSEO should play in enabling some or all of these solutions.

# Appendix C: Attachment 1 – Hawaii’s Energy Ecosystem Stakeholders

The table below lists relevant entities engaged in Hawaii’s energy ecosystem, identified by staff from HSEO and the Consultant team. This list focuses on entities involved in clean energy, but includes utilities and fossil fuel companies as well. It is a working list, not meant to be comprehensive, but does provide a summary of known entities potentially engaged in clean energy innovation activities in the state.

| Entity  | Type    | Policy | Regulator | Other Govt | Finance/Capital | R&D | Market Support incl education | Advocacy/ Trade Association | Clean Energy Entrepreneur/ Startup | Clean Energy Commercial Scale | Utility | Fossil Fuel |
|---|---------|--------|-----------|------------|-----------------|-----|-------------------------------|-----------------------------|------------------------------------|-------------------------------|---------|-------------|
| Hawaii State Energy Office (HSEO)                         | State   | ✓      | ✓         |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Hawaii Office of the Governor                             | State   | ✓      |           |            |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Public Utility Commission                          | State   | ✓      | ✓         |            |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Clean Energy Initiative Advisory Board             | State   | ✓      |           |            |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Dept. of Business, Economic Development, & Tourism | State   | ✓      |           |            |                 |     |                               |                             |                                    |                               |         |             |
| State of Hawaii Office of Planning                        | State   | ✓      | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii State Legislature Energy & Environment Committees  | State   | ✓      |           |            |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Dept. of Agriculture                               | State   |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Dept. of Transportation                            | State   |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Dept. of Land & Natural Resources                  | State   |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii Technology Development Corporation                 | State   |        |           | ✓          | ✓               | ✓   | ✓                             |                             |                                    |                               |         |             |
| Natural Energy Laboratory of Hawaii Authority             | State   |        |           |            | ✓               | ✓   | ✓                             |                             |                                    |                               |         |             |
| Hawaii Strategic Development Corporation                  | State   |        |           |            | ✓               |     | ✓                             |                             |                                    |                               |         |             |
| Hawaiian Electric Company                                 | Private |        |           |            |                 |     | ✓                             |                             |                                    |                               | ✓       |             |
| Hawaii Energy   | Private |        |           |            |                 |     | ✓                             |                             |                                    |                               | ✓       |             |
| Hawaiian Electric Light Co.                               | Private |        |           |            |                 |     |                               |                             |                                    |                               | ✓       |             |

| Entity                               | Type    | Policy | Regulator | Other Govt | Finance/Capital | R&D | Market Support incl education | Advocacy/ Trade Association | Clean Energy Entrepreneur/ Startup | Clean Energy Commercial Scale | Utility | Fossil Fuel |
|--------------------------------------|---------|--------|-----------|------------|-----------------|-----|-------------------------------|-----------------------------|------------------------------------|-------------------------------|---------|-------------|
| Maui Electric                        | Private |        |           |            |                 |     |                               |                             |                                    |                               | ✓       |             |
| Paniolo Power Company (Parker Ranch) | Private |        |           |            | ✓               |     |                               |                             | ✓                                  | ✓                             |         |             |
| Pacific Light and Power              | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Stem                                 | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| SolarCity                            | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Sunverge                             | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| REC Solar                            | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Hitachi                              | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Google                               | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Advanced Microgrid                   | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Ambri                                | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Bidgely                              | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Geli                                 | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Go Electric                          | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Shifted Energy                       | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Generate Capital                     | Private |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Credit Suisse                        | Private |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Bank of America                      | Private |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Enphase                              | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Varentec                             | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Facebook                             | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| ConnectDER                           | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| kWh Analytics                        | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| SunPower Corporation                 | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Ameresco                             | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Chevron                              | Private |        |           |            |                 |     |                               |                             |                                    |                               |         | ✓           |
| Hawaii Renewable Fuels LLC           | Private |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Hawaii Gas                           | Private |        |           |            |                 |     |                               |                             |                                    |                               |         | ✓           |
| Sultan Ventures                      | Private |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| SunEdison Hawaii                     | Private |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |

| Entity   | Type       | Policy | Regulator | Other Govt | Finance/Capital | R&D | Market Support incl education | Advocacy/ Trade Association | Clean Energy Entrepreneur/ Startup | Clean Energy Commercial Scale | Utility | Fossil Fuel |
|--|------------|--------|-----------|------------|-----------------|-----|-------------------------------|-----------------------------|------------------------------------|-------------------------------|---------|-------------|
| Lanikahana Solar   | Private    |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| NextEra Energy Hawaii  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| First Wind   | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Calpine  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| NRG  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Honeywell  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| EnerNOC  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| Pacific Biodiesel  | Private    |        |           |            |                 |     |                               |                             |                                    | ✓                             |         |             |
| TerViva  | Private    |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Holu Energy  | Private    |        |           |            |                 |     |                               |                             | ✓                                  |                               |         |             |
| Blue Startups  | Private    |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Startup Hawaii   | Private    |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Startup Capital Ventures   | Private    |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| mBloom   | Private    |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Wells Fargo  | Private    |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Blue Planet Energy   | Private    |        |           |            | ✓               |     | ✓                             |                             |                                    |                               |         |             |
| Doosan   | Private    |        |           |            |                 |     |                               |                             |                                    |                               |         |             |
| XLR8UH   | Private    |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Impact Hub   | Private    |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Ulu pono Initiative  | Non profit |        |           |            | ✓               |     |                               | ✓                           |                                    |                               |         |             |
| Kauai Island Utility Cooperative                                       | Non profit |        |           |            |                 |     |                               |                             |                                    |                               | ✓       |             |
| Hawaii Venture Capital Association                                     | Non profit |        |           |            | ✓               |     |                               | ✓                           |                                    |                               |         |             |
| Elemental Exceleator   | Non profit |        |           |            | ✓               |     | ✓                             |                             |                                    |                               |         |             |
| Hawaii Energy Policy Forum   | Non profit |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| The Pacific International Center for High Technology Research (PICHTR) | Non profit |        |           |            |                 | ✓   |                               |                             |                                    |                               |         |             |
| Coalition for Green Capital  | Non profit |        |           |            | ✓               |     |                               |                             |                                    |                               |         |             |
| Energy Storage Association   | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Geothermal Energy Association  | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| American Wind Energy Association                                       | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |

| Entity  | Type       | Policy | Regulator | Other Govt | Finance/Capital | R&D | Market Support incl education | Advocacy/ Trade Association | Clean Energy Entrepreneur/ Startup | Clean Energy Commercial Scale | Utility | Fossil Fuel |
|---|------------|--------|-----------|------------|-----------------|-----|-------------------------------|-----------------------------|------------------------------------|-------------------------------|---------|-------------|
| GridWise Alliance                                     | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Smart Electric Power Alliance                         | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Advanced Energy Economy                               | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii Solar Energy Association (HSEA)                | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Blue Planet Foundation                                | Non profit |        |           |            | ✓               |     |                               | ✓                           |                                    |                               |         |             |
| Kohala Center   | Non profit |        |           |            |                 |     |                               |                             |                                    |                               |         |             |
| Renewable Energy Action Coalition of Hawaii           | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Solar Energy Industries Association                   | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii Renewable Energy Alliance                      | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Green for All   | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii PV Coalition                                   | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Sierra Club   | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| The Alliance for Solar Choice                         | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| The Nature Conservancy Hawaii                         | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Distributed Energy Resource Council HI                | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Enterprise Honolulu - Oahu Economic Development Board | Non profit |        |           |            |                 |     | ✓                             | ✓                           |                                    |                               |         |             |
| Hawaii Island Economic Board                          | Non profit |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Maui Economic Development Board                       | Non profit |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Kauai Economic Development Board                      | Non profit |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Hawaii Chamber of Commerce                            | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii Business Roundtable                            | Non profit |        |           |            |                 |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii Venture Capital Association                    | Non profit |        |           |            | ✓               |     |                               | ✓                           |                                    |                               |         |             |
| Hawaii County Energy Office                           | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Honolulu City and County Energy Office                | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Kauai County Energy Office                            | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Maui County Energy Office                             | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Honolulu County Office of Planning                    | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Maui County Office of Planning                        | Local      |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |

| Entity   | Type     | Policy | Regulator | Other Govt | Finance/Capital | R&D | Market Support incl education | Advocacy/ Trade Association | Clean Energy Entrepreneur/ Startup | Clean Energy Commercial Scale | Utility | Fossil Fuel |
|--|----------|--------|-----------|------------|-----------------|-----|-------------------------------|-----------------------------|------------------------------------|-------------------------------|---------|-------------|
| Kauai County Office of Planning  | Local    |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| Hawaii County Office of Planning   | Local    |        | ✓         | ✓          |                 |     |                               |                             |                                    |                               |         |             |
| DOE Energy Innovation Hubs   | Federal  |        |           |            | ✓               | ✓   |                               |                             |                                    |                               |         |             |
| DOE Energy Frontier Research Centers (EFRCs)                               | Federal  |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| DOE National Laboratories  | Federal  |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| EPA Clean Energy Program   | Federal  | ✓      | ✓         |            |                 |     |                               |                             |                                    |                               |         |             |
| Office of Naval Research   | Federal  |        |           |            | ✓               | ✓   | ✓                             |                             |                                    |                               |         |             |
| United States Pacific Command  | Federal  |        |           |            | ✓               | ✓   | ✓                             |                             |                                    |                               |         |             |
| Dept. of Navy and Air Force*   | Federal  |        |           |            | ✓               | ✓   |                               |                             |                                    |                               |         |             |
| Hawaii Natural Energy Institute  | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| University of Hawaii Economic Research Organization                        | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| Applied Research Laboratory at the University of Hawaii                    | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| Research Corporation of the University of Hawaii                           | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| University of West Oahu  | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| Hawaii Pacific University  | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| University of Hawaii Maui College  | Academia |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |
| Chaminade University of Honolulu   | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| University of Hawaii at Hilo   | Academia |        |           |            |                 | ✓   | ✓                             |                             |                                    |                               |         |             |
| Community Colleges (Hawaii, Honolulu, Kapiolani, Kauai, Leeward, Windward) | Academia |        |           |            |                 |     | ✓                             |                             |                                    |                               |         |             |

## Appendix C: Attachment 2 – Interview Findings by Stakeholder Group

Appendix C of the strategic plan summarizes the consulting team’s findings from stakeholder interviews and workshops. This attachment supports the overview of key findings from January-February in-person and telephone interviews by providing an in-depth summary of stakeholder input organized by stakeholder group.

As shown on the next page, the 46 interviews of stakeholders at 33 organizations were divided into four stakeholder groups: Entrepreneurs and Clean Energy Businesses, State Government and Affiliates, County Energy Coordinators, and Advocates/NGOs. Responses from interviewees within each category are presented below, and, as appropriate, are aggregated to present the perspective of each group. Interviewees were not selected to represent each group equally, so some groups have more extensive perspectives than others. The Consultant intentionally interviewed a larger number of entrepreneurs and clean energy businesses, as the opinions of this group are the least known to the HSEO.

The Consultant used a discussion guide to structure all interviews to ensure that multiple perspectives were gathered on core topics, while retaining the flexibility to customize questions based on the interviewees’ position in and perspective on the energy ecosystem. Responses in this addendum are organized by the following topic areas:

- **Clean Energy Innovation in Hawaii:** perspectives on Hawaii’s clean energy ecosystem, including strengths, gaps, pain points, and barriers.
- **Needs and Opportunities:** most significant issues to address or opportunities to pursue to spur clean energy innovation in Hawaii.
- **Hawaii State Energy Office:** perspectives on HSEO as an organization, including potential roles HSEO could play to encourage clean energy innovation, the structure of HSEO within Hawaii’s government, and opinions regarding a potential HSEO-sponsored Innovation Center.

This addendum is intended to provide insights and background information prior to engaging stakeholders in the strategy development phase of this planning effort.



## Stakeholder Groups

Note: If more than one person was interviewed at an organization, the number of individuals is shown in parentheses after the organization's name.

### Entrepreneurs and Clean Energy Businesses

- SunPower Corporation
- Holu Energy
- Pacific Light and Power
- Stem
- ConnectDER (2)
- kWh Analytics
- Doosan GridTech
- Go Electric
- Shifted Energy
- TerViva
- Geli
- Elemental Exceleator

### State Government and Affiliates<sup>21</sup>

- Department of Business, Economic Development & Tourism
- Hawaii State Energy Office (7)
- Hawaii Technology Development Corporation
- Hawaii Strategic Development Corporation
- Applied Research Laboratory at the University of Hawaii
- Office of Naval Research
- Hawaiian Electric Company (HECO) (2)
- Hawaii Natural Energy Institute (4)
- University of Hawaii Economic Research Organization
- Natural Energy Laboratory of Hawaii Authority
- Hawaii Energy (2)

### County Energy Coordinators

- Honolulu City and County Energy Office
- Hawaii County Energy Office
- Kauai County Energy Office
- Maui County Energy Office

### Advocates/NGOs

- Blue Planet Foundation (2)
- Oahu Economic Development Board (Enterprise Honolulu)
- Ulupono Initiative
- Distributed Energy Resource Council
- Green for All
- Hawaii Energy Policy Forum

<sup>21</sup> Including one military entity

## Entrepreneurs and Clean Energy Businesses

Entrepreneur and clean energy business interviewees consistently identified Hawaii, with its substantial penetration of renewables and the high visibility of projects, as a very desirable place to do business. However, they also identified many barriers to implementing innovative products in the state, such as limited capacity or efficiency of government agencies and utilities, difficulty attracting investment dollars, a lack of data availability, and some cultural challenges. These stakeholders had few opinions about the Hawaii State Energy Office (HSEO) as they were generally unfamiliar with the office, but they thought HSEO could potentially help increase access to data and advocate for important policy changes. Reactions to a potential Innovation Center were mixed, with concerns about the state/HSEO as the owner of such a facility. There was a desire for office/lab/testing space, especially for later-stage companies, and strong support for a facility where entrepreneurs could test products on a simulated grid and interact with utility and facilities staff more easily.

### CLEAN ENERGY INNOVATION IN HAWAII

#### Hawaii is an Excellent Test Bed

- Hawaii has the potential to build a “Grid of the Future,” integrating new technologies and energy sources into the grid, pioneering new government policies, and testing new utility business models.
- The high penetration of solar in Hawaii helps companies test the capacities of their products.
- Companies working in Hawaii build skills developing utility relationships and addressing the needs of the local population.
- Companies receive high visibility for projects deployed in Hawaii.
- There are many opportunities to pilot off-grid solutions with customers.

#### Barriers to Innovation

- Policies that incentivize one type of technology implicitly over others can create disincentives to develop products and solutions.
- Slow permitting, especially at the County level, significantly inhibits project deployment.
- The slow pace of distributing funds (e.g., GEMS) is frustrating and reduces faith in government effectiveness at accelerating innovation.
- Utility incentive structure and the exclusivity of the utility business model make it difficult to pursue projects that do not provide rate base or other financial incentives to the utility.

- Rate structures also limit the types of technologies developed by entrepreneurs.
  - Demand reduction technologies will not develop in a market without rate structures that send price signals about demand.
- Government funding and tax incentives should be available to all citizens, even if they are not utility rate payers, as they are taxpayers supporting government programs.
- Limited data restricts the development of products that help customers better understand and manage their energy usage.
- There is a lack of data availability on which some products and innovations depend.
- Cultural differences can create issues if not addressed. Differences include:
  - Differing paces of doing business (slower in Hawaii than on the mainland).
  - Negative view of failure in Hawaii, whereas start-ups are accustomed to “failing fast” and moving on to the next idea.
- There are also important differences between counties in approach, and nuanced perspectives that entrepreneurs must understand and adapt to.
- Investment challenges include a lack of visibility regarding financial opportunities and not having enough deal flow to attract investors.
- Lack of institutional capacity at HECO limits opportunities for piloting or testing and interfacing with new technologies.
- The NextEra merger consumed most of the Public Utility Commission’s (PUC) capacity and it is difficult for startups to wait out long periods.

## NEEDS AND OPPORTUNITIES

### Data Availability

- Many smart grid technologies rely on both historical and real-time data in the testing, evaluation, and deployment phases. Entrepreneurs need these data at a granular level (e.g., time-of-day usage data) so that they can design their products appropriately and test their effectiveness.

### Objective Analysis

- Clean energy businesses expressed a desire for independent analysis of policies, rate structures, and other initiatives, particularly those related to PUC dockets. Some see this analysis as essential to moving the market share of renewables on the grid from 20 to 45 percent.

## Lab and Testing Space/Capacity

- Many interviewees expressed a desire for a lab and testing facility that would provide opportunities to test and demo new technologies instead of all tests occurring on the grid.
- This facility would ideally be in a central/accessible location where HECO can become familiar with the technology.
- This space could potentially be used to demonstrate products to investors as well.
- Several entrepreneurs spoke of capacity constraints at HECO, including staffing and funding for pilots. These constraints can severely limit the pace of innovation.

## Policy Innovation

- Clean energy businesses discussed the need for policies that enable innovation, such as new tariff structures and incentives for microgrid and “behind the meter” solutions.

## HAWAII STATE ENERGY OFFICE

### Perspective on HSEO

- HSEO is not generally seen as highly relevant to many of the clean energy businesses interviewed.
- HSEO has low visibility with this group and is not seen as highly engaged.

### Potential Role for HSEO

- Provide a space or facility that enables product testing on simulated grids.
- Provide cultural trainings to non-Energy Excelsator companies.
- Provide permitting training to county inspectors.
- Play a stronger advocacy role in furthering important policies; specifically, lobby for options to have a temporary permit track.

### Innovation Center

- Some interviewees were concerned that the state would not be the best long-term owner for such a facility because funding may only be available for initial capital investments and not necessarily upkeep.
- A center could be helpful to provide a “landing place” for later-stage companies trying to locate and do business in Hawaii.
- If a center was combined or linked to a utility testing site, it could serve as place for HECO to interface with new products and technologies at low cost and staff time.

## State Government and Affiliates

State Government and Affiliates aligned with other stakeholders by identifying data availability and objective analysis as important needs within Hawaii's energy ecosystem. These stakeholders discussed opportunities to leverage Hawaii's clean energy goals to support Hawaii's economy by linking job trainings with an emerging clean energy industry. One stakeholder also mentioned the relationship between energy and other job sectors within Hawaii, including the water-energy nexus. State Government and Affiliates generally viewed HSEO as a limited, somewhat deskbound institution, but thought HSEO could provide valuable support to businesses by being an early adopter of new technologies and by creating programs to help companies grow globally. Some were excited about the possibility of co-location of different tenants in an Innovation Center and thought a center could encourage companies to locate in Hawaii. Others were somewhat concerned about the potential for duplication of efforts with other entities. Some would like to run the center themselves.

### CLEAN ENERGY INNOVATION IN HAWAII

#### Barriers to Innovation

- Lack of available data.
  - For example, Advanced Metering Infrastructure data is not available, which restricts ability to pursue time-of-use pricing.
- Lower fossil fuel costs are a barrier to expanding the market for cleaner technologies as it reduces the avoided costs. That said, current fossil fuel prices could increase the potential for successful proposals to implement a carbon tax or increase the barrel tax.
- Goals are not always shared across government departments, and there is a general lack of coordination between government entities.

### NEEDS AND OPPORTUNITIES

#### Data Availability

- Interviewees expressed the need for greater data transparency for technical matters and the energy economy more broadly.
- Privacy concerns restricting data availability are overblown. Data could be aggregated and have a grouped protection order for a specific set of stakeholders (Hawaii Energy, HSEO, Public Advocate, etc.).

## Objective Analysis

- There is a need for independent analysis for input into PUC dockets, to document benefits of distributed energy technologies, etc.
  - Both technological and economic analysis is needed. For example, analyzing how many jobs will be created in the transition to 100 percent Renewable Portfolio Standard.
  - There needs to be better accounting for the value of solar.

## Economic Development

- There is a need to better match high-education opportunities with available jobs/industries, especially in the growing clean energy field.
  - Something like the TechHire initiative, where students can go through a brief training and be well prepared for a 6-figure salary, could be created.
- There are opportunities in the space-energy nexus as space exploration requires discreet energy generation technologies that may be cross-developed with off-grid energy solutions.
- The water-energy nexus is important to consider as water is a limited resource and energy generation can be water intensive.

## Business Needs

- Increased broadband access to support all businesses, including highly innovative technology companies.
- A commercialization office (doesn't have to be specific to energy) to increase benefits associated with licensing technologies.
- Increases in the number of quality-of-life businesses, such as restaurants and microbreweries, and decreased annoyances such as traffic (could promote flexible work hours and rail) would help all economic sectors prosper.

## Grid Modernization

- Many interviewees discussed the need to modernize the grid to accept more technologies and help reach the State's 100 percent renewables goal.

## HAWAII STATE ENERGY OFFICE

### Perspective on HSEO

- It can be burdensome to contract with the state (comment by academia).
  - There is limited time to respond to RFPs, which can limit who can make bids.
- The Energy Office is deskbound and does not interface with other players in the field.
- The Energy Office is a bureaucratic institution and moves slowly and inefficiently at times.

### Role for HSEO

- Provide trainings or programs to help companies conceptualize and prepare to expand globally.
- Some interviewees suggested that HSEO could play a stronger role in attracting and retaining companies.
- There are opportunities to support startups in clean energy space by becoming an early adopter of their products.

### Structure of HSEO

- If HSEO took on an advocacy role, HSEO would have a stronger incentive to coordinate with other entities and be a more active, impactful player in the field.
- HSEO could become the policy shop for the governor.

### Innovation Center

- Several interviewees were excited about the possibility of co-locating different tenants in an innovation center.
  - The center would need to have flexible, shared space. Real Office Center is a good example.
- A center is an opportunity to encourage more companies to have a presence in Hawaii instead of just testing products while being located on the mainland.
- Strong interest in a center providing a place to test and showcase innovations, enabling investors and utilities to interact with products before buying/installing them.
- There is concern about potential duplication of efforts with other entities already working in space, including Energy Excelerator, XLR8 UH, Manoa Innovation Center, and the hydrogen test facility.

## County Energy Coordinators

County Energy Coordinators' most consistent input was their desire for HSEO to be more involved at the county level, possibly in the form of a funded position. Related to this, they thought HSEO could help coordinate funding requests and match resources with capital. They were tepid on the Innovation Center as they were cautious about a physical center's ability to increase innovation.

### CLEAN ENERGY INNOVATION IN HAWAII

#### Barriers to Innovation

- Utilities are inherently risk averse, with their primary responsibility to provide reliable energy to their customers.
- The State Energy Office does not have a point person at the county level to coordinate efforts.
- The small grid size means that a limited number of innovations can be incorporated before reaching capacity.
  - A possible solution is to grow EV load to increase “headroom”—demand, energy consumption, and revenues for the utility.
- Counties have limited capacity to work on energy issues, and positions are based on current leadership priorities.

### NEEDS AND OPPORTUNITIES

#### Data Availability

- There is a desire for data to be available at the most granular level possible.
- Coordinators want the ability for customers to have access to their own data electronically (even if only monthly).
  - Could potentially use DOE's Green Button format as it's quickly becoming the standard.



## HAWAII STATE ENERGY OFFICE

### Roles for HSEO

- Coordinate funding requests.
- Coordinate resources to create better results. Some stakeholders may have land but no resources, and vice versa; could capitalize by bringing these resources together.

### Structure of HSEO

- A funded position serving counties could give them more leverage; this position could potentially be embedded within County Economic Development boards.

### Innovation Center

- Some coordinators said they were unsure that a physical Innovation Center is necessary or would effectively support innovation.

## Advocates/NGOs

Advocates and NGOs expressed a variety of opinions about clean energy innovation in Hawaii. Some were concerned that the HCEI has unwisely left transportation out of the goals, which results in a potential over-investment in clean energy versus aviation, marine, and ground travel. Advocates also raised equity concerns about the benefits of tax credits and rate structures that are not distributed equally. As with other stakeholders, data and objective analysis were key ecosystem needs. Advocates widely agreed that HSEO could capitalize on its role as coordinator to convene involved stakeholders and share information much more than they do now. They also identified the possibility for HSEO to advocate for policy changes and take on a stronger visioning role, with some suggesting an alteration in the structure/placement of HSEO within government to take on this role. Regarding an Innovation Center, advocates expressed concern for the state as its owner and were unsure about the appropriateness of a physical center, but saw possible benefits in co-location and to provide a landing place for later-stage companies. One NGO discussed the need to address the development of human capital as the key to innovation in the state.

## CLEAN ENERGY INNOVATION IN HAWAII

### Hawaii as Test Bed

- Hawaii is not a good place for R&D, but it is a good place for testing and evaluation.
- Companies can use Hawaii tests as a first step to refine products and expand to other markets.

### Barriers to Innovation

- Customers are risk averse and some just want cheap, proven technologies that provide reliable electricity, making them unwilling to support intermittent renewables.
- There is a lack of permitting expertise at county level, which makes product implementation difficult.
- There is low energy literacy among customers and others in the ecosystem.
- Utility incentive structure and exclusivity of utility business does not encourage innovation.
  - Rate of return on assets; investors want a steady dividend instead of a more volatile high risk, high return type of investment.
  - Hawaii needs a low-income rate so that innovation can happen without causing inequities.
- Goals are not always shared across government departments, making it hard to coordinate activities and initiatives.
- The role of HSEO as the Energy Resource Coordinator is not as well defined as other ecosystem actors, such as the Consumer Advocate, and no entities are required to collaborate with HSEO, so collaboration does not always occur when needed.
- The desire by government to study issues in-depth before changing positions can slow progress.
- Roles and responsibilities between organizations are not always clear, leaving a gap in coordination.
- There is a lack of transparency in decisions and processes. For example, Department of Taxation cost estimates are not transparent.
- Hawaii has a limited land area to pursue a variety of solutions, meaning there is competition between various land uses (for example, solar vs. biofuels).
- With HECO as the only main client, there is a lack of client access for startups.

## Equity Concerns

- Tax credits only help those who pay taxes, meaning they do not extend to lower income residents.
- Increasing direct generation moves burden to lower-income customers, increasing their rates.

## Alignment of State Energy Focus with Energy End Use

- HCEI does not focus enough on transportation, causing a potential over-investment in clean energy relative to ground/air transportation.
- Ground and air transportation innovations are important (e.g., biofuels and hydrogen).
- There are potential conflicts over land use (e.g., solar panels vs. biofuels); do not want to favor one solution over others.
- Considering the linkage between transportation fuel costs and Hawaii tourism, HSEO/DBEDT need to recognize their economic vulnerability and pursue clean energy transportation solutions.

## NEEDS AND OPPORTUNITIES

### Data Visualization

- This must be well thought through and not too technical to be effective.
- This effort needs to be intentional and have strategies for how to ensure that data visualization will be relevant.

### Data Availability

- Advocates want more data! Some consider this the most valuable contribution of the HSEO.

### Objective Analysis

- There is a need for independent analysis as input into PUC dockets; for example, documenting the benefits of distributed energy technologies, etc.
- There is a need for both technological and economic analyses to make case for clean energy economy.
  - The function could be contracted out to others, including UH or Rocky Mountain Institute, if capacity is difficult to build internally.

## Economic Development

- The state could better match high-education opportunities with available jobs/industries, especially in clean energy sector.
- The state should capitalize on specific technologies that can be supported by Hawaii resources and companies.

## Utility Business Model

- There is a need for on-bill financing to enable lower-income ratepayers to benefit from distributed energy.

## Infrastructure Investments

- Grid modernization would enable more integration of products.
- EV charging infrastructure is a need, but the private sector should fill this need.

## HAWAII STATE ENERGY OFFICE

### Perspectives on HSEO

- Strengths
  - A variety of stakeholders go to HSEO for advice/input on study findings, etc.
  - The VERGE conference is well respected and attended.
  - HSEO's data and reporting functions are considered highly valuable.
  - The permitting wizard is effective and appreciated.
- Weaknesses
  - Hesitance to take strong policy positions.
  - Not central to activities in the energy ecosystem.

### Role for HSEO

- Provide later-stage space for startups that want to locate in Hawaii.
- Provide training to non-Energy Excelsior companies to help them understand and effectively address local needs.
- Become more relevant by being a visible community partner and participating more actively in events.
- Provide permitting training to county inspectors to ease deployment.

- Take on an advocacy and visioning role. Serve as an advocate within government to encourage progressive policymaking.
- Make more data available to all interested parties.
- Increase coordination and information sharing, including:
  - Get people/entities aligned, playing their respective roles. (Luis is strong at this.)
  - Provide continuity between annual conferences and quarterly events.
  - Provide weekly/monthly summary of information via the HCEI/HSEO mailing list. This is currently done internally at several organizations, but HSEO could expand the mailing list.
  - Collect and distribute data to clean energy stakeholders.
- Provide a service to reduce the burden on organizations to track 220-300 bills introduced per year in the legislature.
- Improve coordination with other players in the ecosystem by taking on an advocacy role.

### Structure of HSEO

- Serve as a policy shop for the governor—report more directly to the Office of the Governor.
- HSEO could become a separate government or not-for-profit entity with its own board, like the Tourism Board.

### Innovation Center

- Some of the advocates are unconvinced that a physical innovation center would spur innovation; others note that physical space for contractors is difficult to come by in Hawaii.
- Some expressed the concern that the state may not be the best long-term owner; not the nimblest, and does not have consistent long-term funding.
  - Some suggested that the Excelsior should be involved in running/managing space.
- The center would be helpful to have as a landing pad for later-stage companies (for example, after the Energy Excelsior).
- There is value in co-location and unexpected interactions that come from being in the same space.

## Appendix C: Attachment 3 – Summary of June Workshops

Appendix C of the strategic plan summarizes the consulting team’s findings from stakeholder interviews and workshops. This attachment supports the overview of key findings from June stakeholder workshops by providing notes on participants’ aggregated comments, feedback, and input during these sessions.

The information presented in this document is organized by workshop. A total of 16 stakeholders attended these workshops from June 20-21, providing their input in an open-discussion format focused on the following questions:

- Are the presented strategies right for HSEO?
- Where should HSEO prioritize its resources to receive the greatest return on investment?
- Should the state invest in a physical innovation center?
- What else is needed to advance clean energy innovation in Hawaii?

### Workshop #1

#### CULTURAL CHALLENGES

- Everyone agreed that innovation in Hawaii struggles with a culture that is often wary of change, concerned with failure, and based upon relationships. It is a challenge to instill the belief that something can be done better and for less money.
- Often, the challenge is just getting through the first barrier and familiarizing people with a new idea, technology, or process.
- True political will to enable solutions is also lacking.
- A private business representative asserted that solar deployment thus far is only economically driven, and the culture of clean energy innovation has yet to be established. Still, companies want to locate in Hawaii – they see opportunity here and want to be engaged; however, his company has moved its focus to Australia due to the country’s rate structures.

#### GLOBALLY-ORIENTED INNOVATION

- There was broad agreement from attendees that innovation in HI should not be confined to achieving the 100 percent goal, but rather that Hawaii should position itself as a *global* hub for energy innovation testing and evaluation.

- A global orientation means expanding beyond the Asia-Pacific and other island economy markets to frame Hawaii as informing the national and international energy frontier.

## SANDBOX

- There was strong agreement around the need for a “sandbox” area for companies to test and evaluate technologies in a larger complex with grid-simulation capabilities.
- A sandbox would potentially help address the permitting difficulties by establishing a new permitting process and set of practices for temporary installation that “starts with yes” and/or exists outside of Hawaiian Electric construct.
- Sandboxing would help familiarize utilities, investors, and citizens with new ideas and technologies.
- Someone suggested the sandbox could be in Kalaeloa, with potential partnerships available with UH West Oahu.

## PARTNERSHIPS

- Stakeholders agreed that an innovation center or sandbox would achieve the greatest benefit through strategic partnerships with *industry, universities, and banks*.
  - Universities: partner with Hawaii institutions, especially to provide engineering and marketing capacity to startups. Additionally, partner with research universities outside of Hawaii to develop the innovation pipeline (R&D to T&D).
  - Industry: partner with established companies like GE and Cummins that can provide an engineer on a short-term basis for a small fee.
  - Banks + real estate: partners that can provide financing.

## HSEO'S ROLE

- A PUC rep suggested that HSEO should provide information and analysis for dockets but not enter into cases.
- The rep also suggested that there is a need for a mediator between different intervenors to reduce the number of disputes for PUC to handle.
- A private business representative suggested that HSEO should advocate for businesses and help them cut the red tape.
- Everyone was supportive of whatever role HSEO can play in enabling a sandbox facility with larger-scale testing capabilities.

## Workshop #2

### INNOVATION CENTER CONCEPT AND SPACE

- Attendees agreed that it would be excellent to co-locate multiple parties into a physical space that would ensure face-to-face interaction.
- They especially emphasized the value of having policy and regulatory representatives in the same space to ease business compliance.
- There was a positive reaction to this being accompanied by a potential HSEO-sponsored regulatory facilitator who could guide companies through the process or connect them to relevant resources.
- A biofuel company representative expressed the desire for a small lab space to tinker with, modify, and improve products.

### INNOVATION CENTER PROCESS

- There was agreement that the process to create the innovation center, identify and contract an operator, etc. would need to be transparent and accessible to all current accelerators/co-working spaces and ideally would create synergies with existing resources.
- Also, HSEO should ensure that they are adding value to what is already there by involving existing entities and not duplicating efforts.

### PARTNERSHIPS

- Attendees emphasized that the innovation center should be enacted through a series of partnerships, especially with UH to involve research and economics analysis.

### HSEO'S ROLE

- There was generally positive feedback about the idea that HSEO operates as a coordinator of the ecosystem, convening stakeholders, highlighting and defining needs or problems, and setting priorities with a bigger-picture approach.

### TRANSPORTATION

- A county energy coordinator thought that HSEO should develop a robust approach to transportation and land use, coordinating activities with other departments.



## COUNTY COORDINATION

- The same county energy coordinator emphasized that there is interest in both the state and county energy offices to coordinate efforts, but that there is no incentive to do so because they don't get credit for a shared agenda.

## DATA

- One participant showed an app that he developed using Tableau to display Kauai County electricity data and said that it is not difficult to create and distribute this type of data. He suggested that HSEO could expand and deepen this effort (i.e., data for all of Hawaii and at shorter intervals).

## Workshop #3

### PICKING WINNERS AND FOCUSING RESOURCES

- Two stakeholders reflected on the tension between making progress and picking winners. Hawaii government seems hesitant to act in support of certain technologies because they will be picking winners, but this creates roadblocks (e.g., distributed energy resources). If progress is going to happen, HSEO/government needs to be more comfortable focusing the ecosystem's resources on certain roadblocks/topics and facilitating solutions to these key problems, even if it means prioritizing one problem over another.
- After a longer conversation, stakeholders agreed that HSEO can focus resources by *articulating the challenge* (picking topic areas, not winners) and letting the market solve this challenge.
  - Example: need for intelligent communication metering is articulated by the state; they facilitate a series of pilot projects and/or studies on the topic, and help align leadership on a solution based upon results.

## HSEO ROLE

### Permitting

- Stakeholders identified city and county permitting as a significant roadblock and saw a role for HSEO to help advocate for companies in this process and address the systemic challenges associated with permitting innovation.

## Independent Analysis

- HSEO-sponsored analyses will be viewed as more independent and objective than those funded by industry.
- Need for more cost-benefit analyses.

## ROLE OF 100 PERCENT RPS GOAL

- A government agency stakeholder who works in innovation thought that HSEO should focus its emphasis on innovation by aiming it toward the 100 percent goal – stimulating innovation in areas required to reach its 100 percent goal.
- Let NELHA, HSDC, and HTDC address innovation more broadly within the state.

## MILITARY

- Military is a large aspect of innovation in Hawaii, especially around their interest in microgrids and storage.
- Developing strategic partnerships and greater linkages with military interest would be beneficial for making Hawaii an innovation hub.

## INNOVATION CENTER

- Ensure that it is developed in a way to support and add value to existing entities that fill similar roles.
- A stakeholder mentioned that she would not like to see a center unless some “more humble” existing energy ecosystem issues are addressed.

# Workshop #4

## INNOVATION CENTER

### Location

- A second person suggested Kalaeloa for the location of a testing facility/sandbox because there are many warehouses for companies to be located.
- These are also some of the only remaining industrial spaces.
- There is also a place called Hawaiian Homelands with 42 acres, a portion of which could be used for energy.

## Partnerships

- University should be partners in the operation, including UH West Oahu in addition to UH Manoa.

## Strategy

- Someone commented that an innovation center would have to be implemented within a broader strategy. The center needs to be integrated with an approach toward supporting businesses, educating the community, etc. that will address multiple ecosystem needs.

## VETTING PROCESS AND FOCUSING RESOURCES

- A stakeholder described that a large part of the Elemental Excelsior's (EE's) value to the ecosystem is creating a thorough vetting process for the companies they partner with. EE companies emerge with a "seal of approval" that is valuable not just for the business, but also for the ecosystem.
- Incubating companies requires investment of time and resources, and HSEO would have to be careful in how they approach this process as a state entity.
- Need to focus on the technologies that are most likely to succeed.

## IDENTIFYING AND HIGHLIGHTING NEEDS

- Someone described that EE is actively trying to fill a market need by meeting with stakeholders to identify needs and barriers and develop solutions.
- If HSEO could play this role with a mind toward uncovering solutions, this would be very beneficial to the energy ecosystem.
- Having repeated one-on-one conversations with actors in the ecosystem is important to understand their needs and how HSEO can provide value.

## BARRIERS IN HAWAII

- A stakeholder described the challenge of overcoming initial barriers to work in HI. This barrier to entry needs to be alleviated for the system to progress.

## GRANTMAKING/SUPPORT

- One participant described the value of having Small Business Innovation Research (SBIR) grants that come in series—first to get you going, then to scale. Once these grants are made, the government also becomes invested in your success.

## Appendix D: Market Research Findings

As part of the research to inform the development of the strategic plan, Clean Edge, a leader in clean energy economy indexing and a subcontractor on this project, researched Hawaii's position within the country's clean energy market and identified important opportunities and challenges for the state in its transition to 100 percent Renewable Portfolio Standard (RPS). Specifically, the Clean Edge report:

- Documented Hawaii's historical performance and progress based on Clean Edge's state index to: 1) understand Hawaii's key strengths and advantages in the clean energy landscape; and 2) identify areas for growth that would help accelerate the deployment of clean energy technology.
- Identified needs and challenges facing Hawaii as it pursues its clean energy goals and near- to mid-term innovation opportunities within the technology, policy, and capital spheres.

Key findings from Clean Edge's report, including Hawaii's historical performance and progress in Clean Edge's state index, were presented to HSEO and the Hawaii Clean Energy Initiative (HCEI) steering committee and were used to guide strategic plan development. This appendix summarizes key findings on Hawaii's clean energy market position and includes Clean Edge's complete report.

### Methodology

The Clean Tech Leadership Index is comprised of 77 different qualitative and quantitative indicators measured at the state level. It includes Technology, Policy, and Capital categories, with each category contributing equally to a state's final Index score. The categories are each broken into 2-3 subcategories, which are also weighted equally within the category. The quantitative indicators are normalized so that large states and small states are treated equally; indicators are generally normalized on a per capita, per-million-residents, or percentage basis.

Quantitative indicators are calculated based on a 0 to 100 spectrum, with the best state on each indicator achieving a score of 100, the worst state receiving a 0, and the other states receiving scores based upon how closely they compare to the top state. Subcategory scores are calculated similarly, with the state with the highest average indicator score getting 100 and the lowest scoring state receiving 0. Subcategory scores then roll up to category scores, and the category scores are averaged to obtain a final Index score.

The Index is used by a variety of public, private, and NGO clients, including Wells Fargo, the Sierra Club, and numerous cities and states. Organizations use these data to publicize successes their jurisdictions are having, highlight areas for improvement, and conduct economic development outreach.

## Hawaii's Clean Energy Position

Hawaii ranked tenth overall in Clean Edge's 2016 Clean Tech Leadership Index; the state ranked fourth in Technology, eleventh in Policy, and twenty-second in Capital. This ranking reflects recent improvement by the state, which was nineteenth overall in 2010, while also identifying areas for further development. Hawaii's 100 percent RPS goal has attracted attention to the state as a clean energy leader, a position Hawaii must maintain against the significant challenges posed by its high reliance on oil and a transportation sector that consumes a large portion of total energy.

### **Strong in Technology Deployment**

Ranked fourth, Hawaii is a leader in technology deployment. This strength is highlighted by an overall solar generation share (utility and distributed) that is second only to California, a high adoption rate of electric vehicles (EVs), and a leading green building market. However, as Hawaii's grid becomes increasingly saturated with intermittent renewables, incorporating additional renewable energy sources—including utility and distributed generation (DG) solar—may become difficult without innovative utility business models or additional technological innovations. The termination of net metering in 2015 and resultant slowdown of solar distributed generation deployment is one example of the way in which utilities, and Hawaii more generally, will face challenges in continuing its rapid deployment of solar, particularly in the DG sector.

### **Additional Clean Tech Policies Available to Support Leading RPS**

Hawaii's rank of eleventh indicates that while its RPS goal leads the nation, Hawaii has room for policy and regulatory improvement to accelerate the adoption of clean energy technologies. Clean Edge tracks 38 best practices in clean tech policy, including market mechanisms such as an RPS DG solar carve-out, purchasing incentive for electric vehicles, zero-emissions vehicle requirement, and mandated green power purchasing options. Adopting a suite of these would improve Hawaii's overall policy ranking in the Index and enable a more rapid clean energy transition.

### **Financial, Human, and Intellectual Capital Lagging**

Perhaps the most challenging area for Hawaii is financial, human, and intellectual capital, where the state ranks twenty-second at the category level and is far behind leaders such as California and Massachusetts. Hawaii scores low on venture capital and patent activity and lacks national labs and top-ranked 'green' MBA programs. For example, while the state is home to National Energy Laboratory of Hawaii Authority (NELHA), which has received funds from Department of Energy (DOE), it does not have a DOE lab. Clean Edge does not track Department of Defense (DOD) clean energy expenditures, which would certainly improve Hawaii's overall capital performance if tracked.

### **100 percent RPS Goal is a Rallying Point**

Hawaii's 2015 goal to be powered by 100 percent renewable electricity by 2045 has attracted attention to the state, a trend that is been buoyed by an abundance and variety of renewable resources, high renewables penetration on the grid, and high-cost imported energy. Many other states and utilities are looking to Hawaii for lessons on how to effectively make the clean energy transition. California and Massachusetts, for instance, are both considering increasing their RPS goals to 100 percent, and could look to Hawaii for lessons on how to achieve those goals.

### **Transportation Remains a Significant Energy Use**

As of 2014, half of total energy (petroleum, natural gas, coal, and renewables) in Hawaii was consumed in the transportation sector (including automobiles, trucking, mass transit, air and water transport). This rate is almost double the country's average of 27.5 percent, which demonstrates the need to aggressively pursue transportation electrification and explore alternative fuel technologies for a comprehensive transition to a clean energy economy.

### **Challenging Road to 100 Percent RPS**

The transition from 70 percent reliance on oil to 100 percent renewable electricity will be difficult. Stanford researchers, led by Mark Jacobsen, studied how Hawaii could achieve this goal by 2050 with a fuel mix comprised of 40 percent solar, 30 percent geothermal, 28 percent wind (16 percent offshore), and 2 percent tidal, along with a 50 percent reduction in overall demand<sup>22</sup>. Another study from National Renewable Energy Laboratory (NREL) emphasized the need for inter-island ties to address the unequal distribution of renewable availability and energy

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<sup>22</sup> Mark Jacobson et al., "100% clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States," Energy & Environmental Science, 2015, <https://web.stanford.edu/group/efmh/jacobson/Articles/I/USStatesWWS.pdf>.

demand on Hawaii's various islands.<sup>23</sup> These studies are not exhaustive of the opportunities available to Hawaii for its clean energy transition, but rather present one path forward to achieving 100 Percent RPS.

## Clean Edge's Report

See the Appendix D Attachment 1, provided separately, for Clean Edge's report.

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<sup>23</sup> R. Braccio, P. Finch, and R. Frazier, "Hawaii Clean Energy Initiative Scenario Analysis: Quantitative Estimates Used to Facilitate Working Group Discussions (2008-2010)," National Renewable Energy Laboratory, March 2012, <http://www.nrel.gov/docs/fy12osti/52442.pdf>.

## Appendix E: Innovation Center Research Findings

Clean Edge conducted a high-level review of ten mainland innovation centers, identifying key themes and common traits among successful models. Clean Edge's research aimed to 1) better understand how innovation centers meet ecosystems needs elsewhere; and 2) identify attributes that maximize the likelihood of a successful center. Findings from this research contributed to the development of the plan for HSEO's potential energy innovation center.

This appendix summarizes important success factors for the reviewed innovation centers and includes Clean Edge's report.

### Mainland Innovation Center Success Factors

#### Proximity to an Innovation Hub

Whether close to a university, other research institutions, or located within innovation districts, most centers are closely linked to established innovation hubs.

#### Diverse Use of Space

Successful innovation centers offer an array of usage options on site, including office and co-working spaces, as well as lab or machine testing areas.

#### Variety of Partners

Strong partnerships with businesses, non-profits, universities, utilities, and municipalities ensure ample funding sources, broad support from the local community, and strong networking resources.

#### Support for Businesses

Business support, including mentoring and educational programs, fundraising assistance, and frequent networking opportunities enable innovation center members to effectively implement their ideas and technologies.



## Clean Edge's Report

See Appendix E Attachment 1, provided separately, for Clean Edge's report.

## Appendix F: Workshop PowerPoints

See Appendix F, provided separately, for the Workshop PowerPoints.