




HCEI Road Map

2011 Edition

Summary:
HCEI Goals and Strategies

The Hawaii Clean Energy Initiative (HCEI) was founded based on a Memorandum of Understanding (MOU) between the State of Hawaii and the U.S. Department of Energy on Jan. 28, 2008. Upon inception, the State and the Department worked to form a series of working groups incorporating a variety of stakeholders throughout the state, including local government, not-for-profit organizations, private sector companies, trade associations, Department of Defense representatives (including PACOM) and academic organizations, among others. These working groups form the core of HCEI: a representation of all of the important constituencies within the State which allow HCEI to create a balanced and locally focused strategy to attain its goal of reaching 70% clean energy by 2030. These working groups were established and active by March, 2008, shortly after HCEI's founding. Through the HCEI process, information is gathered from multiple perspectives within the State, across all of the counties, and analyzed and refined into a coherent vision for the State moving forward. The results of this process are then shared with a wider audience throughout the State and feedback gathered and reincorporated into the process for use in improving decision-making as the HCEI progresses. This process is highlighted in the diagram below:

The critical goal of HCEI is to coordinate between the many groups within the State working across the various energy sectors, evaluate the complex problems affecting them, and to devise strategies for achieving the clean energy goals of the State that can be adopted to ultimately benefit the citizens of the State with a clean, secure, supply of energy going forward. It is essential to note that without the participation and cooperation of all of the key stakeholders involved in HCEI and the support of the general public, HCEI will not succeed in its goals. While the process can reduce duplication of efforts, highlight areas for improvement or essential areas of need, the vast majority of the recommendations laid out in this Road Map will be undertaken by one or many of the stakeholders already at work throughout the State. At its core, HCEI has been designed to be a collaborative effort between all of the citizens of the State of Hawaii to leverage their respective strengths in achieving a clean energy future that will benefit not just its constituents but the future citizens of the State as well. As a reflection of the initial success of HCEI, the State Legislature has chosen to formally ratify its role in coordinating the ongoing clean energy efforts as of April, 2010, in section 8 of HB 2421[1] .

[1]http://www.capitol.hawaii.gov/session2010/Bills/HB2421_CD1_.HTM

Summary: HCEI Goals and Strategies

The HCEI structure is essential to addressing the primary issues facing the State: the Hawaii energy system is a complex system based on multiple core components that overlap in many ways.

To recast this complex system into manageable components, HCEI began by targeting the four key energy sectors (Electricity Generation and Delivery, Buildings & Industry End Use, Fuel Sources and Delivery, and Transportation End Use) and creating stakeholder working groups tasked with evaluating clean energy options for each. Equally important, there are many areas of overlap across all these sectors that require coordination and complementary actions. For example:

- Installation of distributed generation and smart meters on the electrical grid, along with increasing end use efficiency will mean that demand patterns and corresponding generation needs will shift over time. This affects both the Electricity Generation and Delivery and Building End Use sectors.
- As electric vehicles are deployed in the State, EV owners will be adding electric vehicle charge stations into their homes, leading to a corresponding increase in their residential electricity use (and overall electricity demand.) Additionally, over time, large numbers of grid-connected electric vehicles may be able to provide energy storage solutions to the grid. Thus, strategies in the Transportation sector affect both the Building End Use and the Electricity Generation and Delivery sectors.
- Investment in integrated bio-refinery capabilities would allow the production of electricity from biomass in conjunction with the production of liquid biofuels. Thus, the Fuels sector is capable of having a potentially large impact on both the Electrical Generation and Transportation sectors.

To ensure that these interactions are addressed, an “Integration” working group (now the HCEI Steering Committee) was created and tasked with coordinating between the groups. The working groups use a set of tools that include policy and regulatory change, project development, outreach and education and overall planning and management. The goal of the Steering Committee is to ensure that a comprehensive strategy is reached for the State where all energy sectors are working together to achieve the 70% clean energy goal.

The overall vision adopted by the State of Hawaii in transforming its energy infrastructure to a more sustainable path is based on a three-part planning process:

1. Identifying key sectors of the energy economy
2. Setting of clean energy goals for attainment in each area
3. Creating multi-faceted critical strategies to attain sector goals

Summary: HCEI Goals and Strategies

The key sectors, strategies, and goals are outlined in the table below:

ENERGY SECTOR	STRATEGIES	2030 GOALS
Electricity (Generation and Delivery)	Align electricity regulatory and policy framework with clean energy goals	Renewable Portfolio Standard: 40% of delivered MWh renewable energy
	Increase certainty in the process for developing new renewable energy	
	Deploy renewable generation and grid infrastructure	
	Explore next generation technologies/new applications of existing technologies	
End Use Efficiency	Align efficiency regulatory and policy framework with clean energy goals	Energy Efficiency Portfolio Standard: 4,300 MWh reduced
	Retrofit residential and commercial existing buildings	
	Strengthen new construction policies/building codes	
	Identify non-building related energy efficiency measures	
Transportation	Improve standard vehicle efficiency of fleet	Reduce petroleum used for ground transportation by 70%*
	Reduce vehicle miles traveled (VMT)	
	Incorporate renewable fuels into transportation sector	
	Accelerate the deployment of electric vehicles (EVs) and related infrastructure	
Fuels	Evaluate local agricultural industry and support its development	Meet as much of in-State demand for renewable fuels as is feasible
	Invest in key infrastructure at scale	
	Evaluate and develop renewable fuel processing infrastructure	
	Match potential fuels supply to sources of in-State demand	

*HCEI will develop an expanded understanding of the needs of the large buyers in the aviation and defense sector. In the future, marine and aviation biofuel alternatives may be substituted to help meet the goal by displacing the equivalent of 70% of ground transportation demand with non-fossil fuels.

Summary: HCEI Goals and Strategies

These strategies were developed through extensive collaboration between the members of the HCEI working groups. They are based on targeted analysis conducted throughout the first two years of HCEI (Appendix C – Completed HCEI Analysis), as well as the technical and policy expertise of the various members of the working groups.

Five- and ten-year strategies for the State are outlined in the following section. These strategies are based on data received from many stakeholders within the State, including the members of the HCEI working groups. While specific examples are given throughout the body of this report, the full list of action items considered of strategic significance are outlined in Appendix B. It is important to note that all of the action items outlined here may significantly contribute to the attainment of the overall goal of 70% clean energy by 2030; however, given the uncertainty around the development of technology and the corresponding costs of adoption over time, HCEI has adopted a multi-stage planning process to ensure that the best options for the State are the ones ultimately utilized for the attainment of the goals. As more information is received with developments in research and development and pilot projects over time, HCEI will evaluate and amend these strategies to better reflect the needs of the State from a reliability, cost and impact perspective.

The Role of the Counties in HCEI

While the overall goals of the Hawaii Clean Energy Initiative are set at a State level, it is important to note that each of the counties within the State has its own ongoing clean energy initiative that HCEI considers a key partner. Clean energy plans for each county have already been published. Each has been leveraged by HCEI throughout its goal-setting and data gathering process.

As members of the working groups and Steering Committee, representatives of each county have provided HCEI with unique feedback on the issues particular to their island. These have been highlighted throughout this Road Map. Additionally, it must be noted that many of HCEI's recommended actions may apply to certain counties only. The achievement of these actions will be the result of extensive work of stakeholders at both the local and state levels, and are critical to the attainment of the HCEI goals.

The following sections of the Road Map outline, in five year increments, the strategies for each of the four energy sectors targeted by HCEI. The first five year block, from 2011-2015, identifies the goals of HCEI for that period, and lays out the strategies for attaining them in more detail, along with concrete examples of actions that are the essential components of each strategy. The second five year block, from 2016-2020, outlines the mid-term goals of HCEI, as well as showing the progression of the HCEI strategies over time to adapt to changing market and technological landscapes. Finally, a brief overview of how success will be measured, and goals adapted, will be outlined for each sector. For now, these metrics are tied solely to achievements in renewable energy produced, energy saved, biofuels produced and petroleum use avoided; however, as HCEI progresses and additional data becomes available over time, HCEI will also track the impacts of its strategies on the State economy through other metrics to measure its impact on the State from an energy security and economic perspective as well.

It should be noted that all of the strategies, goals and achievements outlined in this document will be updated on a regular basis to ensure that they truly reflect the current energy market realities of the State. As such, this Road Map will be a living document that will retain its strategic importance over time, rather than providing just a simple snapshot as of our vantage point today.

II. Electricity Sector (2011-2020)

The first of the core energy sectors to be addressed in this Road Map is Electricity. HCEI defines "Electricity" as the generation, transmission and distribution infrastructure necessary to deliver electrical service to the citizens of Hawaii. Detailed goals and strategies will be laid out in five year increments to help highlight the evolving nature of HCEI as we look further into the future. We will begin by reviewing the current status of HCEI, then summarizing our critical strategies for the future, and finally showing how these strategies will be expanded upon as HCEI moves forward.

Throughout this sector, it is important to note that many of these strategies and actions will have significance throughout the other energy sectors of HCEI as well, as the Electricity sector is intricately entwined with End Use Efficiency (e.g., load balancing on the grid, particularly in a Smart Grid future), Transportation (e.g., electric vehicles will both increase demand for electricity and provide a potential future source of battery storage), and Fuels (e.g., biofuels may provide a significant source of firm generation capacity for the State).

The HECO Energy Agreement with the State of Hawaii

On October 20, 2008, an Energy Agreement was signed by the State of Hawaii and the Hawaiian Electric Companies to accelerate the accomplishment of Hawaii's energy objectives in the regulated electric utility sector.

The Agreement includes renewable energy commitments, measures to increase energy efficiency, and improvements to grid operation and infrastructure.

Signatories to the Agreement include The Governor of the State of Hawaii, the State Energy Resources Coordinator, the State of Hawaii Consumer Advocate and the Hawaiian Electric Companies.

Finally, a fundamental aspect of this sector in the State of Hawaii is the separate, but parallel, efforts of the two types of utilities (Investor-Owned and Cooperative) to evaluate and implement high levels of renewable energy on the grid. HCEI acknowledges that there are different challenges associated with each utility ownership model, and is committed to working with each to attain the goals laid out in this Road Map, particularly within the Clean Energy Scenario Planning (CESP) framework outlined in the next section. In addition to the HECO Energy Agreement with the State of Hawaii (sidebar), which covers the investor-owned utilities in the State, the Kaua'i Island Utility Cooperative (KIUC) developed its own corresponding Strategic Plan in 2008 which sets a target of 50% renewable energy for the island by 2023[2]. These agreements, in conjunction with one another, are the core of the Electricity strategies for years 1-10 of HCEI.

[2]http://www.kiuc.coop/pdf/SP_2010-2025%20Strategic%20Plan12-22-09.pdf

II. Electricity Sector (2011-2020)

CLEAN ENERGY SCENARIO PLANNING (CESP)

HECO companies, KIUC, Consumer Advocate, Counties and other interveners are required to submit for consideration by the Public Utilities Commission (PUC) a CESP to replace the Integrated Resource Planning (IRP) process. These plans are to be submitted either separately or as a whole by the participants to the PUC, and will lay out 5 year and 10-20 year goals and actions the utilities deem necessary to attainment of the Renewable Portfolio Standard (RPS) goals.

It is essential to note that this Road Map is not an attempt to replace the CESP process, but rather a means of providing HCEI a framework for aligning its goals and strategic plan with that of the electric utilities. HCEI recognizes that certain areas of the Electricity sector are complementary to the work of the utilities that will be essential to the attainment of RPS goal (e.g., research and exploration of next generation technologies, alignment of the regulatory framework). To this end, any critical projects/actions identified through the CESP process should be recorded here during the periodic review of this document, and should be incorporated both into the "Representative Critical Actions" table above, as well as the full list of critical actions laid out in Appendix B.

ACCOMPLISHMENTS TO DATE (2010)

In the Electricity sector, four areas of critical strategic significance have been identified based upon the long lead time necessary for the evaluation and implementation of renewable generation projects, as well as the significant corresponding grid analysis and investment needed to maintain the reliability of service simultaneously. Thus, the four areas of critical importance for the development of an Electricity sector with high levels of renewable energy are based on the regulatory fundamentals of the sector, as well as a standard project development time line. A summary of critical actions completed in each of these areas is given in the table below:

STRATEGY	REPRESENTATIVE* ACCOMPLISHMENTS TO DATE
Align electricity regulatory and policy framework with clean Energy Goals	• RPS set to 15% by 2015, 25% by 2020, and 40% by 2030 • HECO Companies Feed-in Tariff for Variable Renewable Energy Generation Docket in progress • HECO Energy Agreement with State of Hawaii signed (see side bar, on previous page) • KIUC Strategic Plan (50% renewable energy by 2023) Implemented
Increase certainty in the process for developing new renewable	• Created permitting inventories and guidebook for renewable development • Resolving permit issues through DBEDT staff facilitation
Deploy renewable generation and grid infrastructure	• Lanai photovoltaics (PV) project installed (1.2 MW) • Kahuku wind (30 MW) began commercial operation • Fastest growth in PV installation in the Nation
Explore next generation technologies/ new applications of existing technologies	• Wind Power Grid Integration Studies completed for all islands • Inter-island cable technical review completed • Solar resource potential and grid impact studies ongoing • Initiated smart grid demos on Maui and Kauai • Geothermal Working Group established (SCR 99) to analyze the potential of geothermal to meet baseload demand on the Big Island

*For a full list of accomplishments, please see Appendix A

II. Electricity Sector (2011-2020)

YEARS 2011-2015

GOALS

For the Electricity sector, the primary 5-year milestone is the RPS: 15% of demand (approximately 1,200 GWh delivered).

All projects identified as "critical" in this section have been identified based upon a combination of scale, projected cost-effectiveness and strategic importance to each island's overall energy strategy. Many of these items will not be completed within the first 1-5 years of HCEI. However, it is essential to begin as many of these actions as possible now to ensure that both the short and long term RPS goals are met. Critical items are outlined below.

CORE STRATEGIES

In addition to the actions already completed, many key actions across this range of strategies are currently underway, the full list of which are available in Appendix B. Representative samples of these actions are summarized below, and are building blocks for HCEI's next five year period.

STRATEGY	REPRESENTATIVE* IMPORTANT ACTIONS: YEARS 1-5 (2015 TARGET DATE)
Align electricity regulatory and policy framework with clean energy goals	• Conclude all open PUC dockets (outlined in Appendix A) • Evaluate expansion of feed-in-tariff to include renewables not currently within its scope (e.g., biomass)
Increase certainty in the process for developing new renewable	• Reduce ambiguity in permitting requirements and create online application process • Reduce engineering and regulatory barriers for new renewables on to the grid • Work with counties to coordinate efforts on streamlining permitting process
Deploy renewable generation and grid infrastructure	• Develop "Big Wind" project – includes wind farm, inter-island cable and Oahu grid integration components (400 MW) • Evaluate/deploy four medium scale wind projects (all islands, ~142 MW) • Evaluate/deploy multiple biomass/biofuel generation projects across all islands (~250 MW) • Install solar technologies on a scale allowed by the PUC (>80 MW)
Explore next generation technologies/ new applications of existing technologies	• Complete solar grid integration studies (all islands) • Undertake 10MW Ocean Thermal Energy Conversion demonstration (OTEC) • Demonstrate 3-4 storage systems options across the islands • Demonstrate 3-4 smart grid systems across the islands • Monitor progress of wave energy pilots in-State

*For a full list of critical actions, please see Appendix B

One overall theme of years 1-5 is developing a better understanding of the factors limiting deployment of renewable energy on each of the islands. In some cases, such as Oahu, identifying a source of renewable energy on scale with the level of demand may be the primary issue. In others, such as the Big Island, where renewable resources are plentiful in comparison to energy demand, it may be that the limitation in deploying high levels of renewable energy is actually the grid itself. To this end, Smart Grid components, such as Advanced Metering Infrastructure (AMI), energy storage, and renewable energy forecasting technology will be highly critical to the attainment of the RPS goals. This holds true across all islands, but particularly those already deploying renewable energy on a large scale relative to their current electricity demand (e.g. Maui, the Big Island). See Appendix B for specific action items in this regard.

YEARS 2016-2020

GOALS

The primary key milestone to be attained is defined by the RPS itself; in this case the 10-year RPS goal is 25% of demand by December 31, 2020 (which is forecast to be approximately 3,500 GWh of delivered renewable energy).

STRATEGIC PATH FORWARD

In addition to new technologies which will have matured by the 2016-2020 time period, many of the actions outlined in this time period will be carry-overs from the 1-5 year time period. Given the long term nature of the regulatory and permitting process for renewable energy and grid investment projects, many of the critical items may fall into the 6-10 year period for completion. All efforts to streamline this process should be pursued to ensure that the RPS goals are met in as timely a manner as possible. However, it is critical to the HCEI partnership to begin the research and project development process in years 1-5 in order to ensure that the goals are met in years 6-10. Building on the strategies outlined in the 1-5 year period, HCEI considers the following to be of strategic importance in the 2016-2020 time period:

Align electricity regulatory and policy framework with clean energy goals:

At this juncture, the basic regulatory framework to allow the incorporation of large scale renewable energy into Hawaii's electricity systems should be well established. However, additional issues related to grid reliability, utility cost-recovery, the structuring of the new "decoupled" utility and many other next generation issues may require new or updated policies and legislation during this timeframe. These goals will be determined as variable energy projects occur and subsequent impacts are identified.

Deploy renewable generation and grid infrastructure:

In this time period, specific focus should be placed on three types of projects:

1. Those begun in the previous time period that are already in development.
2. Those technologies that have moved up the commercialization curve to become more cost-effective, particularly at scale (e.g., widespread deployment of distributed generation PV).
3. Those technologies that may not be required at low levels of variability, but that will be required to enable the deployment of the next round of variable renewable technologies (e.g., smart grid, energy storage – these are examples where the groundwork for these technologies needs to be established with demonstrations over the next few years – several are currently underway).

In addition, how to handle the ramp down of the existing petroleum infrastructure to avoid stranding investment and/or passing through exorbitant costs to the rate-payer is an essential item for consideration in future years. A comprehensive strategy for the placement of less-efficient existing fossil generation into standby status as firm capacity requirements for each system allow should be developed in this time period as more renewable resources come online.

Explore next generation technologies/new applications of existing technologies:
Certain second-generation technologies should be re-evaluated by HCEI and other private-sector parties based on their technological developments and commercialization progress. Some of these technologies for re-consideration include:

1. Expanded geothermal capacity, specifically for loads on the Big Island.
2. Expansion of any geothermal potential discovered on Maui during the short-term (i.e., in years 1-5).
3. Technical feasibility of expanding undersea cable connections between all islands, not limited to Lanai/Molokai/Maui and Oahu.
4. Commercial, large-scale development of OTEC and wave power technologies.
5. The use of biofuels for generation, either directly or in a blend with standard petroleum fuels to provide firm renewable generation capacity (preferably from local sources). This subject is evaluated in detail in the "Fuels" section of this document.

MEASURING SUCCESS AND ADJUSTING GOALS OVER TIME
As a function of the RPS, the HECO Companies and KIUC will report their achieved renewable energy progress to the PUC to verify their attainment of the RPS. All other progress towards HCEI goals will be recorded by the Hawaii State Energy Office and incorporated in the "Accomplishments to Date" section of this report.

It should be noted that moving forward, there will be interactive effects between the End Use Efficiency and Transportation sectors, as End Use Efficiency will progressively lower projected electricity demand, and electric vehicles will tend to increase electricity demand. These trends must be monitored carefully (see End Use Efficiency and Transportation "Measuring Success" sections for details) in order to forecast the necessary amount of renewable energy that will have to be installed to attain the RPS goal for each time period.

This list of critical items should be revisited periodically to determine which are moving forward, and to adjust or replace those that are not progressing with alternatives. The RPS goal should also be revisited based on the success of implementing the proposed renewable energy projects on or ahead of schedule.

III. End-Use Efficiency Sector (2011-2020)

The next of the core energy sectors in this Road Map is End-Use Efficiency. HCEI defines "End-Use Efficiency" as the reduction in the use of electricity by end users, including homes, businesses and the industrial and military sectors. Goals, core strategies and critical actions are outlined below.

As with Electricity, End-Use Efficiency improvements over time will have spill-over effects into other sectors of the energy system in Hawaii. By increasing efficiency throughout the end use sector, the process of balancing the demand on the grid against increasing variability in generation may have repercussions on demand management practices. Ideally, achieving advanced efficiency will allow the utilities to ramp down the more expensive generation units (essentially replacing them with cheaper efficiency savings), but the real-time impacts of this change must be monitored and better understood as more efficiency is deployed on the grid.

ACCOMPLISHMENTS TO DATE (2010)

In the End-Use Efficiency sector, four areas of critical strategic significance have been identified based upon the unique nature of efficiency options for various building types. A summary of critical actions completed in each of these areas is given in the table below:

STRATEGY	REPRESENTATIVE* ACCOMPLISHMENTS TO DATE
Align efficiency regulatory and policy framework with clean energy goals	• Energy Efficiency Portfolio Standard (EEPS) set to 4,300 GWh offline by 2030 • HECO Companies revenue stream decoupled from kWh usage • Public Benefits Fund created to help finance the retrofitting of the existing building stock
Retrofit residential and commercial existing buildings	• State "Lead-by-Example" program deployed • HECO company retrofit programs transferred to Public Benefits Fund Administrator (PBFA), and new monitoring and verification program created • Existing KIUC/PBFA programs fully operational and are working to attain efficiency savings • Building stock data collected and needs identified
Strengthen new construction policies/building codes	• All counties have adopted new, more efficient building codes (IECC2006 for Maui, Oahu and The Big Island, IECC2009 in the case of Kauai) • Pilots of highly efficient new homes have been conducted through the Department of Defense and Department of Hawaiian Homelands (DHHL) • New Construction Efficiency Savings Potential Analysis Conducted
Identify non-building related energy efficiency measures	• Potential efficiencies from improving transmission/distribution infrastructure evaluated • Industrial and military electricity applications identified for future efficiency potential study

*For a full list of accomplishments, please see Appendix A

III. End-Use Efficiency Sector (2011-2020)

YEARS 2011-2015

GOALS

The End-Use Efficiency goals are based on estimated savings targets from previous HCEI Analysis (see Appendix C), while interim milestones are currently under review in PUC Docket 2010-0037. Upon the resolution of the docket, these milestones may be adjusted to align with those set by the PUC.

- 2015 Existing Building Savings Target: 1,000 GWh[3]
- 2015 New Construction Savings Target: 365 GWh[4]

CORE STRATEGIES

The strategies for End-Use Efficiency are based on the fundamentals of the energy efficiency market, acknowledging that significant differences exist between efficiency measures available to new and existing buildings, residential and commercial buildings, and non-building energy users. It also relies on much of the regulatory system that governs the generation, transmission and distribution sectors, as reductions in energy use are very much a part of the overall electricity system overseen by the electric utilities and the PUC.

All items listed below may be subject to amendment pursuant to specific PUC rulings, including Docket 2010-0037, which is reviewing specific recommendations for the attainment of the EEPS as well as the EEPS target itself.

STRATEGY	REPRESENTATIVE* IMPORTANT ACTIONS: YEARS 1-5 (2015 TARGET DATE)
Align efficiency regulatory and policy framework with clean energy goals	• Evaluate rate design options for efficiency and demand response • Gain PUC approval to install and pilot smart meters • Ratify the increase in the PBFA Fund outlined in the HECO Energy Agreement with the State of Hawaii (increase to 1.5% after 2 years, 2% by 4 years), and evaluate other options for enhancing energy efficiency program funding (e.g. tax credits for efficiency)
Retrofit residential and commercial existing buildings	• Expand and leverage State "Lead-by-Example" program • Implement or expand key policies and business models to leverage private capital (e.g., property assessed clean energy financing, energy savings performance contracts) • Expand current benchmarking efforts for building stock energy usage • Expand retrofit market outreach/education programs • Allow PBFA and KIUC more flexibility to explore new metrics that will allow them the freedom to explore non-directly measured energy savings options (e.g., metrics re: the successes of education and outreach programs)
Strengthen new construction policies/building codes	• Update building code levels to 2015 efficiency standards • Improve enforcement of building codes, by working with the counties to help train and educate plan checkers and inspectors • Provide training and information on updated building codes to design professionals
Identify non-building related energy efficiency measures	• Invest in transmission/distribution system efficiencies • Collaborate with military on industrial and fleet efficiency opportunities

*For a full list of critical actions, please see Appendix B

Key players in the End-Use Efficiency sector may vary, depending on which island a building stands on. Overall targets and guidelines for efficiency fall under the jurisdiction of the PUC, which has been granted authority over the EEPS by the RPS statute. The existing building programs for Oahu, Maui and the Big Island fall under the jurisdiction of the PBFA, which is responsible for the development of energy efficiency program plans, efficiency program implementation and the evaluation of program progress for each of these islands. The HECO Companies remain responsible for demand response programs and system efficiency efforts, while KIUC is responsible for all existing building efficiency program work, demand response programs and system efficiency efforts on Kauai.

[3]Based off Sept. 2010 EEPS Projected Load and Efficiency Contribution Scenarios, PUC Docket 2010-0037. Jim Flanagan, PBFA. Scenario 2. key assumptions include maintenance of current funding levels, mandatory CFL installation in code, and 30 year Solar Hot Water heater lifespan
[4]Per NREL New Construction Potential Analysis, Sept. 2010

New construction efficiency is the purview of the Hawaii Building Code Council, while individual building code adoption is determined at the county level. All of the critical actions outlined in this section, as well as the appendix, will depend on work done by one or more of these groups moving forward.

YEARS 2016-2020

GOALS

As with years 2011-2015, interim milestones for End-Use Efficiency have been set based on interim savings projections necessary for the attainment of the EEPS. These 10 year milestones are also subject to any rulings by the PUC in docket 2010-0037.

- 2020 Existing Building Savings Target: 1,400 GWh[5]
- 2020 New Construction Savings Target: 730 GWh[6]

STRATEGIC PATH FORWARD

In this time period, measured and steady expansion of energy efficiency progress is expected, although incremental improvements in efficiency will get more expensive as all "low hanging fruit" opportunities are capitalized on. Therefore, the emphasis in the out years should be on comprehensive retrofits, integrated new construction design, and attempting to lower cost barriers to generating deeper efficiency improvements. HCEI considers the following to be of strategic importance in the 2016-2020 time period:

Align efficiency regulatory and policy framework with clean energy goals:

At this juncture, the basic regulatory framework to allow the incorporation of large-scale end use efficiency into the utility business model will have been implemented. However, additional issues regarding information sharing via intelligent appliances, net-metering, and similar items centered on the management of electricity demand may require future policy or regulatory actions. Likewise, policies to help leverage private capital in innovative manners will always be necessary to ensure that efficiency gets done on the scale necessary to attain the EEPS. These policies and regulatory improvements will be determined as the need for deeper efficiency cuts down the line becomes a reality.

Retrofit residential and commercial existing buildings:

In the retrofit markets, continued emphasis should be placed on evaluating innovative efficiency business cases and financing best practices throughout this time span. Leveraging private sector capital to make efficiency improvements to the existing building stock remains one of the most critical elements in attaining the goals outlined in the EEPS.

Specific attention should also be paid to the incorporation of next generation technologies into retrofit practices, and quantifying the additional savings resulting from them.

Strengthen new construction policies/building codes:

On the new construction side of things, three areas for consideration in the 2016-2020 timeframe are:

1. Evaluation and adoption of the future IECC code (est. 2021) with a goal of zero net energy for new construction
2. Leveraging information from net-zero energy building pilots from across the country to identify and apply best practices in new building design and construction
3. Identification of new technologies (e.g., solar dehumidification) for incorporation into new construction

[5]Based off Sept. 2010 EEPS Projected Load and Efficiency Contribution Scenarios, PUC Docket 2010-0037. Jim Flanagan, PBFA. Scenario 2. key assumptions include maintenance of current funding levels, mandatory CFL installation in code, and 30 year Solar Hot Water heater lifespan
[6]Per NREL New Construction Potential Analysis, Sept. 2010

Identify non-building related energy efficiency measures:
Specific non-building related energy efficiency measures have been identified in the previous timeframe. Certain new technologies, which may not become viable in the previous five year period, should be re-evaluated in this period. One example of this is sea water air-conditioning, which raises difficulties in avoiding stranded costs on many existing AC units in the areas being considered.

Moreover, certain existing technologies, whose functionality and economics are well understood today, may discover that incremental improvements will become cost-effective within this time frame, and should require additional attention. One example is the reduction of line-losses from the transmission/distribution system, particularly if increased energy storage and smart grid capability are built into the grid itself.

MEASURING SUCCESS AND ADJUSTING GOALS OVER TIME
By the end of year 5, there should be momentum in the implementation of energy efficiency policies. From years 2-5, a process for measuring success needs to be implemented to ensure that progress is being made. While not all of this progress will be measurable in numeric terms, all of these critical elements of HCEI should count towards the measurement of success. To this end, a "top down" policy for the measurement of quantifiable savings should be used to determine progress towards HCEI goals. While it may include other market factors at work (e.g., the overall performance of the economy, the price of oil), we can better account for these factors than we can reliably project the impact of specific policies whose impact may not be directly measureable. The utilities, DOE's Energy Information Administration and DBEDT track relevant electricity usage statistics for the State. These figures have been used to set the baseline fuel usage estimates highlighted in the introduction to this Road Map (based in particular on the utility IRP-3s). These same services will continue to measure these statistics over time, allowing HCEI to measure progress against the original numbers by evaluating year-to-year electricity usage against that forecast in the IRPs.

However, because of the high margin for error associated with this basic approach to external variables, all top down estimated savings should be cross-checked in a "bottom up" fashion against numbers tracked by individual players in each field, including, but not limited to, the utility companies (HECO, MECO, HELCO, KIUC), the PBFA and DBEDT.

Finally, in focusing on attaining an interim EEPS goal for years 1-5, the PUC will periodically review progress towards the goal laid out in the standard to determine if progress is sufficient to attain the goal. Penalties for non-compliance or adjustments to the EEPS itself will be made accordingly. Therefore, all savings measurements should be compared to the appropriate milestone as determined by the PUC.

At the end of each year, this section should be revisited to reflect any updates to the EEPS and interim milestones documented by the PUC.

IV. Transportation Sector (2011-2020)

The strategies and goals for this section are tied to ground transportation at the present time. HCEI will develop an understanding of the needs of large buyers in the aviation and defense sector. In the future, marine and aviation biofuel alternatives may be substituted to help meet the goal by displacing the equivalent of 70% of ground transportation demand with non-fossil fuels. This is considered in more depth in the Fuels section of this Road Map.

ACCOMPLISHMENTS TO DATE (2010)

Using a comprehensive fuel reduction strategy, HCEI developed four savings measure categories for potential action which include:

STRATEGY	REPRESENTATIVE* ACCOMPLISHMENTS TO DATE
Improve standard vehicle efficiency of fleet	• Oahu Transit Services took delivery of 20 new HEV buses, bringing the total to 80 HEV transit buses • Sales of hybrid electric vehicles (HEVs) reached approximately 2% of annual vehicles sales for a total of 6,500 HEVs on the road by 2009.
Reduce vehicle miles traveled (VMT)	• Oahu public transit system is one of the most highly ridden per capita in nation
Incorporate renewable fuels into transportation sector	• 10% of the gasoline fueled transportation fleet fuel (~50 MGY) displaced through use of ethanol in blending standards • Renewable hydrogen production, refueling, and hydrogen fleet demonstration established at Honolulu's Joint Base Pearl Harbor-Hickam • Continued use of locally produced biodiesel (B20) in the City and County of Honolulu fleet
Accelerate the deployment of electric vehicles (EVs) and related infrastructure	• Initiated Hawaii EV Ready Program, which will provide $4M in grants and rebates through ARRA funding for the installation of EV charging network and the purchase of new, commercially-available full-speed electric and plug in vehicles • EV pilot rates approved by the PUC and went into effect on October 1st, 2010 (HECO/MECO/HELCO) • The state is promoting vehicle industry participation through numerous partnerships with automotive and infrastructure suppliers • Accelerate the deployment of electric and hydrogen vehicles and related infrastructure

*For a full list of accomplishments, please see Appendix A

GOALS

All EV goals assume the general availability of vehicles and a decline in estimated purchase price vis-à-vis standard vehicles. Thus, in the short term, these numbers are relatively low, but climb rapidly after year 2015 based on an assumed surge in EV adoption.

As the strategies outlined above are more difficult to measure in terms of a common metric, separate targets/metrics were chosen by the working group for ease of measurement. However, based on HCEI's transportation analysis (Appendix C), this combination of measures together should allow the State to attain its transportation milestones not just in years 1-5, but overall as well.

IV. Transportation Sector

STRATEGY	2015 GOAL
Improve standard vehicle efficiency of fleet	25 MPG – average of all cars on the road 18 MPG – average of all light-duty trucks on the road
Reduce vehicle miles traveled (VMT)	2% VMT reduction over 2010 miles traveled
Accelerate the deployment of electric vehicles (EVs) and related infrastructure	4,000 EVs/year being sold (10,000 EVs on road), and supporting EV infrastructure installed
Incorporate renewable fuels into transportation sector	Maintain current E10 Standard, continue current levels of biodiesel usage

CORE STRATEGIES

The strategies adopted under the Transportation section of this Road Map are specifically designed to provide a comprehensive array of options to generate transportation savings in both the short and the long run. It is expected, due to the lag time for deployment of the more advanced EV and renewable fuel technologies and the uncertain forecast on cost reductions for these vehicle types over time, that the majority of year 2011-2015 savings will come from the vehicle efficiency and VMT reduction options. In the long run, this trend may eventually reverse itself, with EVs and renewable fuel vehicles providing improved efficiency above and beyond standard combustion engines. Alternative vehicle and fuel technologies including EV batteries, hydrogen infrastructure and fuel cells, bio-fuels, and new fuel efficient vehicle technologies are currently undergoing rapid development programs throughout the world. During this time period, the HCEI Transportation Working Group and stakeholders need to continue to monitor progress and adjust goals and strategies as these technologies and market mature.

STRATEGY	REPRESENTATIVE* IMPORTANT ACTIONS: YEARS 1-5 (2015 TARGET DATE)
Improve standard vehicle efficiency of fleet	• Promote purchase of vehicles more efficient than current State efficiency avg. (20 MPG cars, 14 MPG trucks) • Promote current hybrid technologies to assist in the attainment of improved fleet MPG goals • Evaluate the potential of biodiesel fuel switching for trucks and other vehicles that may not have clear electric alternatives
Reduce vehicle miles traveled (VMT)	• Identify VMT reduction options, and reach out to key stakeholders • Promote commute reduction options (e.g., telecommuting, car/van pooling) • Identify ways of quantifying commute cost to drivers (e.g., highlight pass through of parking costs to employees) • Study current public transit service with respect to demand (e.g. evaluate light rail and other public transit alternatives)
Incorporate renewable fuels into Transportation sector	• Evaluate/study alternative fuel vehicle options for the State, along with supporting infrastructure (e.g., hydrogen, flex fuel) through participation in the Hawaii Hydrogen Initiative and other similar programs • Encourage drop-in replacement renewable jet fuel and marine diesel; evaluate the impact of counting delivered volumes against ground reduction target
Accelerate the deployment of EV and related infrastructure	• Complete the development of EV charging network and electric vehicles covered under the Hawaii EV Ready program • Provide incentives for early adopters for both vehicles and charging equipment • Work with automotive industry to continue to increase EV market penetration in quantity and vehicle type • Monitor and refine incentive structures for different types of EVs

*For a full list of critical actions, please see Appendix B

It must be noted that there are significant interactions effects between the strategies outlined above. For example, future improvements to vehicle efficiency standards at the national level may result in more petroleum offsets than they projected from vehicle efficiency, while at the same time lowering the relative MPG savings from VMT and EV options. Conversely, reducing the vehicle miles traveled will lower the potential savings from all other vehicle options, while increasing improvements in the efficiency of electric motors and controls over time will increase EV savings

relative to standard vehicles. To this end, HCEI will modify its goals accordingly as new information becomes available. Also, in many cases, HCEI's transportation fuel reduction ability may be limited by the high impact that outside players (e.g., car manufacturers) will have on local markets. Therefore, all areas over which HCEI has direct control, such as VMT reduction, are deemed critical to the success of HCEI if the market moves in an unexpected direction in some of the other areas.

YEARS 2016-2020

GOALS

For the Transportation sector, the goals for the 2020 time period are identified in the table below:

STRATEGY	2020 GOAL
Improve standard vehicle efficiency of fleet	30 MPG - average of all cars on the road 22 MPG - average of all light-duty trucks on the road
Reduce vehicle miles traveled (VMT)	4% VMT reduction over 2010 miles traveled
Accelerate the deployment of electric vehicles (EVs) and related infrastructure	10K EVs/year being sold (40,000 EVs on road)
Incorporate renewable fuels into transportation sector	50 MGY of renewable fuels

STRATEGIC PATH FORWARD

As noted in the previous section, certain advanced technologies should be commercially available and may be deployable on a large-scale basis from 2016 on. These technologies will form the core of HCEI's long term strategy for reducing transportation fuel usage. As of today, these technologies are concentrated primarily in:

Renewable Fuels

Strategies for the development of domestic renewable fuels industry are outlined in the following section. However, certain overlaps with the transportation critical strategies may occur where the testing and development of alternative vehicles to use non-drop in replacement[7] fuels are needed. Some examples of such a need for an alternative vehicle would be the deployment of hydrogen fuel cell powered or flex-fuel vehicles in the State.

Electric Vehicles

While electric vehicles have been deployed previously on a limited scale, the costs, performance standards and infrastructure needs for the current wave of electric vehicle technologies are just now beginning to be fully understood, particularly in the context of large-scale deployment. By 2016-2020, a better understanding of EVs should be in place, and the appropriate infrastructure installed to allow for their deployment on a wider scale. Thus, the ten year time period will be critical as a launching point for large-scale EV adoption in the State.

On the other hand, opportunities to generate ground transportation savings that do not rely directly on future technology advancement, such as vehicle efficiency and VMT reduction, will still be fully viable as a means of offsetting some measure of petroleum usage throughout the duration of HCEI. Thus, the forecasts for vehicle efficiency improvements and VMT reduction are more incremental in nature. However, alternative business models and policy options to encourage them should continue to be researched and evaluated for deployment in Hawaii as we move forward.

MEASURING SUCCESS AND ADJUSTING GOALS OVER TIME

By the end of 2015, there should be momentum in the implementation of transport policies. From 2011 on, a process for measuring success needs to be implemented to ensure that progress towards the goals is realistically being made.

As each strategy outlined above will have different "success" criteria, a separate monitoring and verification policy will

[7]For the purposes of this report, drop-in replacement fuels are defined as biofuels with chemically similar structures to petroleum products that can be blended with petroleum fuels without causing performance issues

be necessary for each of them to be effectively monitored.

EVs

All EV sales figures should be tracked through new vehicle registrations with Hawaii Auto Dealers' Association (HADA) and DBEDT.

Renewable Fuels

Renewable fuels used in Transportation should be tracked and reported, including the use of ethanol to meet the State's E10 mandate.

Vehicle Miles Traveled Reduction

Annual average VMT per vehicle are available through the Hawaii State Department of Transportation and are summarized in the DBEDT databook. Percent reductions in VMT can be calculated from these annual estimates.

Vehicle Efficiency

Current vehicle fuel usage is recorded by the Hawaii State Department of Taxation, Tax Research and Planning. These are available in the annual DBEDT databook. Total numbers of vehicles registered in the State are recorded by HADA and likewise available through the databook. Average VMT traveled per vehicle/year are available as noted in the VMT reduction section above. Therefore, the total fleet efficiency can be calculated through the simple equation: Total Fleet Efficiency (MPG) = (Total # of VMT per year for State) / (Total gal of fuel used in State per year).

However, this metric is not intended to capture the benefits that will accrue in terms of efficiency due to EVs (those benefits are accounted for in the EV goals already). Therefore, total fleet efficiency must be calculated after removing EVs from the equation. To this end, the fleet efficiency equation must be adjusted as follows: Total non-EV fleet efficiency = [(Total # of VMT per year – Total # of VMT traveled on electricity) / (Total gallons of fuel used per year)

Total VMT traveled on electricity should be based on the mix of EV types sold in State/registered (battery electric vehicle [BEV] vs. plug-in hybrid electric vehicle [PHEV]). BEVs are assumed to operate 100% on electricity.

V. Fuels (2011-2020)

Renewable fuels, including biofuels and other non-petroleum-based fuel types that can be produced sustainably (e.g. hydrogen), are an essential part of the HCEI clean energy strategy. Biofuels, or stored energy, are defined for the purposes of this Road Map as any liquid fuel produced from biomass or natural oils that can be used for electrical generation or transportation purposes. While all types of biofuels will be necessary for the attainment of HCEI goals, a distinction must be made between drop-in replacement fuels, (i.e. biofuels with chemically similar structures to petroleum products that can be blended with petroleum fuels without causing performance issues) and non-drop in replacement fuels, such as ethanol, which is an imperfect substitute for gasoline and may require a corresponding additional infrastructure investment in certain cases. This Road Map does not discriminate between drop-in replacement and non-drop-in replacement fuels, other than to note that not all future fuel usage can be met through the use of non-drop-in fuels only (for example, jet fuel constitutes 30% of current fuel demand in the State, and does not currently have a non-drop-in substitute). Several important considerations form the basis of the need for a strong biofuels policy for the State of Hawaii.

1. Overall, alternative fuels will be an essential component of meeting the 70% goal for both electrical generation and Transportation. This is especially true for transportation since there are a fewer options for attaining the goal of 385 MGY of petroleum fuel reduced
2. Biofuel feedstock production offers a means of preserving traditional agricultural lands and jobs. Ideally, as much of the local demand as possible should be met through local sources. If it is not deemed possible to meet all demand through local sources, imports of domestic U.S. products should be the next option for the State, followed by foreign imports as a lowest priority source of fuel
3. At the present time, there is not a detailed understanding of what feedstock crops at what scale could potentially be grown in Hawaii. Therefore, if local fuels production is the optimal socially desirable outcome, identifying this potential must be the key focus for years 1-5 of this Road Map. If insufficient potential exists, other alternatives to meet this demand must be found. One potential option of this type is hydrogen fuel, which is currently being studied in Hawaii on a small scale
4. If fuels are produced locally, efforts must be taken to ensure that the industry is sustainable in nature. This means that all feedstock production practices must not be just economical, but sustainable from an agricultural perspective as well. As an example of this, the HECO companies have adopted National Resource Defense Council standards for their recent biofuel request for proposals (RFP)[8]. Important areas of concern include: local feedstock support mechanisms, sourcing requirements for palm oil, additional baseline environmental criteria for all feedstock, chain of custody tracking for feedstock and oils, greenhouse gas emissions accounting and reporting, establishment of a biofuels public trust fund, public review and notification and public progress reporting and contingencies

In addition to understanding the true potential of locally produced fuels, significant attention must also be paid to the existing petroleum infrastructure in the State. The critical issues that must be understood in any fuels policy include:

1. Any future reduction in overall petroleum usage will reduce the revenues of the two local petroleum refineries. For them, a shift to refining biofuels will likely be necessary to maintain viability. These refineries provide a reserve of local expertise in chemistry, engineering, and industrial processes that could be helpful in the development of local biorefining capability.

[8]HECO Biofuels RFP, March 31, 2010, http://www.heco.com/vcmcontent/StaticFiles/pdf/RFPrev1.pdf, last accessed 11/23/10

2. Even with a significant demand for biofuels in-State, there will still be a major need for traditional petroleum products for blending in transportation, aviation and electrical generation fuel. By using the existing petroleum refining infrastructure to create these blends, the State preserves a high value option for supplying its future petroleum, as well as biofuel, demand.
3. The existing petroleum shipping infrastructure could also be leveraged to support a biofuel industry in-State

Overall, having a detailed understanding of the future markets for various types of biofuel and how it lines up with the potential supply of feedstock that can be produced in the State, is essential for the development of a sustainable local fuels industry.

ACCOMPLISHMENTS TO DATE (2010)

Understanding the domestic potential of Hawaii's agricultural sector to support a large, sustainable, biofuels industry has been the primary focus of HCEI's activities to date. However the strategy adopted by HCEI in this sector will eventually expand well beyond that to incorporate all aspects of the renewable fuels supply chain.

STRATEGY	REPRESENTATIVE* ACCOMPLISHMENTS TO DATE
Evaluate local agricultural potential/ support its development	• Hawaii Bioenergy Master Plan completed • Phase I of DARPA Algae Study complete (Phase II pending) • Several small-scale crop trials underway across a range of institutions
Invest in key logistical/generation infrastructure	• HECO CIP CT-1 Biofuel Generators Installed and testing of biodiesel in unit is completed • HECO completed test of 100% biodiesel at Kahe power plant
Evaluate and develop renewable fuel processing infrastructure	• Pacific biodiesel Big Island project underway • Several pilot scale drop-in replacement fuel refinery projects underway in State (e.g. Phycal, and UOP/Tesoro projects)
Match potential fuels supply to sources of in-State demand	• HECO RFP issued for 210 MGY of locally produced biofuels (first contract signed) • DoD RFI issued for 25% of current aviation, marine and ground diesel fuel demand • HCEI transportation analysis complete, indicating additional need for ground transportation fuels (~150 MGY by 2030)

*For a full list of accomplishments, please see Appendix A

GOALS

In the short term, the Fuel sector will be a work in progress. By all estimates, advanced technologies for the large scale production of drop-in replacement biofuels are approximately 5 years away from being commercially viable, as the current wave of pilot plants are being constructed now. While viable technologies capable of producing biodiesel are currently in operation on the islands, production has been limited in scale to date by the lack of large-scale availability of oil-based feedstocks. Thus, short term goals and critical items for biofuels are relatively conservative until the results of these pilots are understood and the agricultural sector can be expanded to generate a steady supply of feedstock to support the refineries. The 2015 goals for the fuels sector in Hawaii are:

SOURCE OF DEMAND	ESTIMATED TOTAL GREEN REPLACEMENT FUEL DEMAND (2015)
The HECO Companies	~45 MGY renewable Fuel
KIUC	100,000 gal/year
The Department of Defense	TBD MGY renewable JP8 TBD MGY renewable J5 TBD MGY renewable F76 TBD MGY renewable Diesel Fuel/biodiesel
The Ground Transport Sector	Maintain current E10 standard and biodiesel usage

These goals are based on five key drivers:

1. HECO's estimated 2015 demand is directly related to its ability to attain its RPS goals. Should it exceed its target for generating electricity through other renewable services to meet the RPS, this estimated demand could be revised down, and vice versa
2. The utilities must abide by PUC decisions regarding competitive pricing for any renewable fuels they wish to use in their generators
3. The Department of Defense has set a goal that a quarter of all of its marine, aviation and diesel fuels be met through the use of biofuels
4. All ground transport demand estimates are based on the assumption that the current E10 standard will remain in place through 2015, with renewable drop-in gasoline eventually supplementing ethanol in the 2015-2020 time frame
5. The supply of biofuels from the current biorefineries in the State, while critical to the attainment of HCEI goals, will be unlikely to match the scale of demand forecast here without significant new sources of feedstock

Given the diverse nature of the demand for many different types of biofuels in the market and the relative uncertainty of what local supply will be available to meet them, our core strategies and important actions for the next five years must be centered around evaluating potential feedstock production capabilities in the state and matching them to the various demand niches in the market. These niches are highlighted in the table below:

TYPE OF FUEL	DEMAND TYPE
Ethanol	Ground transportation only
Renewable Gasoline	Ground transportation only
Biodiesel	Ground transportation and generation
Renewable Diesel	Ground/marine transportation and generation
Renewable Residual Fuel (e.g. raw pyrolysis oil)	Generation only
Renewable Jet Fuel	Air transport only

With the different qualities of these various types of fuels, sub-markets may develop around each as we progress. Understanding the nature of these markets and identifying areas where Hawaii can be competitive in the long term are the essential components of our overall strategy for years 2011-2015.

Core Strategies

Biofuels will play a critical role in Hawaii's successful attainment of its 70% clean energy goal. Since biofuels have to compete not just with petroleum, but global imports, cost-effectiveness of production becomes the key item of strategic importance. HCEI seeks to accelerate the process of developing a cost-effective local industry by evaluating and encouraging investment in all core aspects of the fuels supply chain. This chain breaks down into four areas of critical strategic importance to the State (highlighted on the following page):

V. Fuels

STRATEGY	REPRESENTATIVE* IMPORTANT ACTIONS: YEARS 1-5 (2015 TARGET DATE)
Evaluate local agricultural potential/ support its development	• Work with government agencies to resolve land, water and labor issues re: use of agricultural lands • Evaluate optimal business models, matching feedstock production to refining infrastructure needs where possible • Integrate and update recent studies to map agricultural crops to specific lands, factoring in necessary production scale • Expand feedstock demos, with emphasis on identifying highest yielding crops for Hawaii
Invest in key logistical/generation infrastructure	• Analyze the biofuels supply chain to identify key transportation/pre-processing infrastructure needs • Establish work-force training programs to re-build agricultural knowledge base • Expand pre-processing and refining construction sectors
Evaluate and develop renewable fuel processing infrastructure	• Work with counties to streamline permitting process from start (crop growth) to finish (fuel refining) • Complete UOP/Tesoro integrated biorefinery Pilot • Evaluate progress of in-State algae pilots
Match potential fuels supply to sources of in-State demand	• Track subsequent changes in market demand for fuels across all fuel types • Develop long-term contracts for the use of biofuels in generation and military transport • Monitor the development of advanced biofuels technologies, including the National Advanced Biofuels Consortium

*For a full list of accomplishments, please see Appendix A

Given the current pilot phase of many of the technologies being considered for use in the State, and the unknown ability of the State to generate the feedstocks necessary for the production of large-scale biofuels cost-effectively, HCEI expects clearer answers to many of the questions regarding the ability of the local industry to support a biofuel industry of any scale by the 2015 time period when the current round of integrated biorefinery pilots is complete.

Also in this time period, the question of demand for aviation fuel needs to be more fully understood and an aviation fuel goal developed along with a list of prioritized action items. This will require outreach to the private sector airlines operational in Hawaii as well as the U.S. Department of Defense (DoD) to determine estimated future levels of demand. HCEI hopes to have a series of aviation fuels goals outlined within the next 2 years as more information becomes available on the progression of the market.

YEARS 2016-2020

Due to the lag necessary for the development of the technologies needed for large-scale renewable fuels production, 2015-2020 will be critical to the success of HCEI's fuels goals. Both HECO and DoD have stated that they anticipate accelerating biofuel usage significantly in this period, and as such, the goals for this time period represent a significant jump from 2015 levels, as summarized below:

SOURCE OF DEMAND	ESTIMATED TOTAL GREEN REPLACEMENT FUEL DEMAND (2020)
The HECO Companies	80 MGY renewable generation fuel (based off estimated RPS demand)
KIUC	TBD
The Department of Defense[9]	32 MGY renewable fuels
The Ground Transport Sector	50 MGY of renewable fuels

As the long term fuels strategy is based primarily on the continued development of technologies capable of providing large scale renewable fuels production, these goals should be revisited based on the results of pilot studies across all feedstock types.

STRATEGIC PATH FORWARD:

While the need to understand the potential of the agricultural sector and the market demand for biofuels is critical

[9]DoD targets based on prorated share of stated DoD RFI Demand (i.e. 50% of total demand by year 2020)

in years 1-5, moving forward, the State will need to have a firm picture of what the local production capacity for feedstock is, how the logistics of transporting, pre-processing it, and refining it will be by the time years 2016-2020 arrive. To this end, this time period should focus on:

Evaluate local agricultural industry potential and support its development as needed:
By 2016, the optimal business models for the development of a strong agricultural sector will have been identified, and food and fuel feedstock produced in some combination at levels suitable to what is sustainable in Hawaii. This optimal level will largely determine what sort of logistics are needed for feedstock transport.

Understand and invest in key logistical infrastructure to develop economies of scale:
Where possible, economies of scale should be developed throughout the transportation system for both food and fuel products. For example, central pre-processing plants may be optimal for the generation of economies of scale in a scenario where many small plots of land need to combine their feedstock to produce a liquid biocrude for transport and refining. In this scenario, leveraging the previous sugar industry transportation and shipping cooperative model may be one option for moving feedstock to central refining facilities. In another scenario, where fuel is refined and consumed on-site, this investment in large scale transport infrastructure may not be necessary.

Evaluate and develop renewable fuel processing infrastructure:
Depending on local feedstock production capabilities and the logistics chain, additional infrastructure for the development of small-scale, local refining facilities (in the case of low feedstock production capacity) or the leveraging of existing petroleum refining infrastructure to generate large-scale capacity (in the case of high feedstock production capacity) will be necessary in this time period. If large scale capacity is not available, a systematic plan dealing with the need for imports will have to be developed, ideally based on the need to keep the State's current refining infrastructure operational (to continue to provide for cost-effective petroleum products in addition to biofuels.)

Match potential fuels supply to key sources of demand in-State:
While demand is unlikely to wait until the overall local production capabilities are completely clear, secure contracts for the supply of biofuels from local suppliers will need to be negotiated in this time frame, where cost-effective and applicable. Aligning these contracts with specific end use demand and what local production is available is essential to the development of an economically sustainable industry in-State, as the local use of fuels will help local products maintain their competitiveness with imports that bear significant shipping costs.

MEASURING SUCCESS, AND ADJUSTING GOALS OVER TIME

As all fuel goals are set in terms of MGY of fuel produced/consumed in State, tracking the fuel production and use goals will be done via the use of Renewable Identification Numbers (RINs) assigned to specific fuel units by the Environmental Protection Agency (EPA)[10] .

Imports may also be tracked through RIN numbers, although these will need to be recorded by the importer in question in order to verify their use in-State.

[10]EPA RIN Program: http://www.epa.gov/oms/fuels/renewablefuels/compliancehelp/index.htm, last accessed 11/23/10

VI. Fifteen Year Goals (2021-2025)

Unlike Sections II through V, this section evaluates the four energy sectors together. By 2021, significant progress should have been made towards HCEI goals. From a vantage point in 2010, it is difficult to forecast exact projects completed or technologies that may be available; however, a sample of potential progress based on the milestones from the previous time periods for each group is provided in the table below:

HCEI TARGET SECTOR	2025 GOAL
Electricity	32.5% of total generation is renewable
End-Use Efficiency	3,500 GWh reduced (subject to PUC revision)
Transportation	300 MGY of transport fuel reduced
Fuels	350 MGY of renewable fuels consumed

For all scenarios, the future price of oil will be deciding factor, as it will materially impact the bottom line for each of the alternative outcomes under consideration. Likewise, any future price put on the emission of carbon will likely materially impact the potential attainment of our goals. Finally, any new technologies or approaches that suggest major strategy revision or change of direction will need to be factored into our future evaluation as well (e.g., Is OTEC fully developed and cost effective? Has algae oil succeeded in driving the cost of biofuels down significantly?) However, in focusing on the alternatives that are largely within the control of the State, the major decision points that will underpin potential future outcomes are:

1. Island connectivity: Are one or more of the islands connected via undersea cable to allow greater resource flexibility?
2. Energy efficiency: Have the goals of the EEPS been met, alleviating the need for increased investment in generation technology and improving the ratio of firm to variable resources on the grid?
3. Biofuels: Has an in-State biofuel industry been created, allowing a secure source of fuel for generation and transportation? If so, at what scale? If not, how do biofuel imports cloud the economics of HCEI?
4. Electric vehicles: Have EV and hydrogen vehicle technology progressed as hoped, and has the State succeeded in deploying advanced vehicles in significant numbers?

VI. Fifteen Year Goals (2021-2025)

Depending on what combination of these scenarios come about, HCEI's progress towards its goals at year 15 will vary. The potential impact and progress accounted for across these decision points is laid out in the table below:

SCENARIO	LOWER BOUND	UPPER BOUND
Inter-island connectivity	None. This limits Hawaii to only those resources available to each island individually, leading to decreased (or more expensive) renewable energy penetration on Oahu	Oahu, Lanai, Molokai, Maui and the Big Island are all connected via inter-island cable, allowing significant wind and geothermal resources to be harnessed and applied to the areas of greatest need
Energy Efficiency	Progress made during the recession reverses itself, and only limited amounts of MWh are taken offline. This leads to a need for increased investment in potentially expensive generation technologies to meet HCEI goals, especially on Oahu, where most of the load is located and renewable resources are limited	EEPS goals are maintained, or closely matched. This allows Oahu to meet its 70% clean energy goal without investing in more expensive alternative generation technology options
Biofuels	No in-State industry is formed, forcing all biofuels to be imported. Does not materially contribute to HCEI goals of increasing energy security or lowering energy price volatility	A healthy in-State industry is formed, and a significant fraction of electricity generation and transportation demand is offset through contracts with local suppliers/refiners. Allows firm clean generation while meeting HCEI goals
Electric Vehicles	Price premiums for vehicles do not fall significantly, charging equipment is under-invested, and low levels of EVs are purchased. This leads to limited transportation options, either forcing the State to pursue more efficient standard vehicle mix or increased biofuel blending standards to offset the lack of EVs	Price premiums for vehicles fall with battery prices, charging infrastructure is installed, and plug-in vehicles reach up to 20% of the fleet by 2030. Increases need for renewable generation to meet RPS, but lowers need to strengthen blending standards for transportation fuel. High efficiency standard vehicle mix should still be pursued

PROGRESS TOWARDS HCEI GOALS IN YEAR 15, BY SCENARIO

This section should be revisited in five-year increments to be sure that nominal notions of "success" stay in tune with market realities. In year 10, a list of critical items should be generated for the potential end-scenarios identified above, based on progress at that time.

Should the preponderance of these updated goals not be met by the end of year 15, key gaps should be identified and strategies for replacing non-viable items generated. Adjusting the final goals should be considered only as a matter of last resort, if it becomes apparent that the progress of HCEI is far away from the milestones set in year 10.

VII. 2030 Outcome and Conclusions

While the overarching goals of HCEI are relatively straightforward, success will be determined in 2030 by attaining milestones laid out in each of the working group areas. That is:

1. Has the RPS been attained?
2. Has the EEPS been attained? If not, were the PUC and PBFA milestones attained?
3. Have our transport goals been attained?
4. Have DoD, HECO, KIUC and the transport sectors met their biofuel targets?

A scenario in which all of HCEI's 2030 goals are met—a transformation of the energy sector—would look like the following:

ENERGY SECTOR	2030 GOAL
Electricity	40% of electricity demand met through renewable sources of energy
End Use Efficiency	Electricity demand reduced by 4,300 GWh (e.g, 2,800 GWh – existing buildings, 1,500 GWh new construction)
Transportation	385 MGY of petroleum fuels offset (150 MGY renewable fuels, 120 MGY vehicle efficiency, 75 MGY electric vehicles, 40 MGY VMT reduction)
Fuels	All in-State demand met (~500 MGY)

If all of these targets have been met by the review period of 2030, then a future plan for HCEI should be developed in which the State defines its role in the development of clean energy resources moving forward. If these targets have not been met to the satisfaction of the HCEI Steering Committee, an additional gap analysis should be conducted in which remaining critical items are identified for continued action by HCEI and its stakeholders.

Should HCEI deem its mission complete, a debriefing of HCEI's role in the transformation of the energy sector should be given to all key parties involved in HCEI's success. This debriefing will highlight funding spent and the net return in terms of energy savings, carbon savings, and economic savings to the State of Hawaii as a result. Target audiences for this debriefing include, but are not limited to:

1. The Governor's Office
2. DOE
3. The Hawaii State Legislature
4. HCEI Working Group stakeholders
5. The general public

Given the cutting edge nature of these goals, and their relevance to many other energy users globally, attention should also be paid to the development of case studies and best practices to assist others in the replication of Hawaii's success.

Finally, a decision about whether Hawaii should seek to exceed its current target of 70% clean energy will be necessary moving forward from this point. Alternatives and options for continued leadership in all sectors of the energy market should be weighed and evaluated. Whether this is through the continued operation of HCEI or an alternative State strategy will be the primary area for consideration at this time. Either way, successful attainment of HCEI goals should be viewed as a major milestone in the push for a sustainable energy sector, but not the end point itself.

Appendix A:
Enabling Actions/Projects Completed to Date

ELECTRICITY:

Align electricity regulatory and policy framework with clean energy goals:

1. ACT 155 (2009), HB 1464, signed June 25, 2009, RPS set to 15% by 2015, 25% by 2020, and 40% by 2030. EEPS not counted in RPS beyond 2015. In May 2009, the PUC issued an order initiating the Clean Energy Scenario Planning (CESP) docket which will examine proposed amendments to the 1992 IRP
2. ACT 154 (2009), Senate Bill 464, signed June 25, 2009: The Renewable Energy Technologies Income Tax Credit
3. ACT 050 (2009), HB 1270, signed May 6, 2009: De-linking of avoided cost and the price of fossil fuel
4. HCEI Outreach Program launched in 2010 with the use of ARRA funds
5. Hawaii County Geothermal Working Group created (SCR 99, 2010) to analyze potential of geothermal energy to provide base load on the Big Island
6. Policy pertaining to HECO Companies only: HECO Energy Agreement w/ State:
   a. Energy Agreement between State and HECO Companies signed, October, 2008
   b. HECO Companies Feed-in Tariff for Variable Renewable Energy Generation Docket completed. 80 MW of PV approved for installation under the tariff
   c. Pursuant to the Energy Agreement, the HECO companies filed a proposal with the PUC in April 2009 to implement a two-year PV Host Pilot Program, which includes the installation of 8 MW of PV on Oahu.
   d. Other open dockets include; Lifeline Rates; Clean Energy Infrastructure Surcharge; several purchased power agreements; and biofuel testing at the HECO companies' generation units.
7. Policy pertaining to KIUC Only: KIUC Strategic Plan (2008)
   a. 50% renewable energy goal by 2023

Increase certainty in the process for developing new renewables:

8. Created permitting inventories and guidebook for renewable development
9. Resolving permit issues through DBEDT staff facilitation

Deploy renewable generation and grid infrastructure:

OAHU:

10. Kahuku Wind ground breaking and construction completed
11. Installed 8 MW of distributed PV on Oahu
12. Construction has begun on 5 MW Keahole Solar micro-scale concentrating solar power project at Kalaeloa

MAUI:

13. Lanai Photovoltaics (PV) Project installed (1.2 megawatts (MW))
14. Installed 4.3 MW of distributed potovoltaics (PV) on Maui
15. First Wind's Kaweawa 30 MW wind farm is in operation, and 21 MW Kaheawa II expansion is under construction

KAUAI:

16. KIUC installed a building integrated photovoltaic system at its power station and is installing distributed utility pole mount photovoltaic systems.
17. By year end 2010 Kauai will inject 1MW of photovoltaic generation on to a 2MW distribution circuits in an effort to understand the physical limitations of distributed PV.
18 KIUC will be installing a battery energy storage system in 2011 to support a 3MW photovoltaic farm and the system wide effects of distributed renewable generation.
19. KIUC continues its efforts in bringing online multiple new biomass facilities in 2013 that would provide 40% of the islands generation needs

Appendix A: Enabling Actions/Projects Completed to Date

BIG ISLAND:

20. Natural Energy Laboratory of Hawaii Authority-Sopogy Concentrated Solar Project Installed (500 kW)
21. Continued development tools to conduct weather/renewable input forecasting to balance grid

Explore next generation technologies/new applications of existing technologies:

22. Renewable Grid Integration Study: Oahu Wind Integration (Complete)
23. National Renewable Energy Laboratory (NREL)/Sandia Solar Resource Studies – ongoing
24. Electranix Inter-island cable study completed
25. Inter-island cable programmatic Environmental Impact Study (EIS) launched (contract awarded, Sept. 2010)
26. Renewable Grid Integration Modeling Study: Maui (complete)
27. Castle & Cooke Wind Potential Study: Lanai and Molokai completed
28. 400 MW Lanai/Molokai "Big Wind" Project and Inter-island Cable Technical Review Committee process (NREL/HECO) completed (business case pending), August, 2010
29. KIUC/Sandia/Enernex Solar Grid Integration Study draft under review
30. Renewable Grid Integration Study: The Big Island (complete)
31. DOE awards $5M for Hawaii National Marine Renewable Energy Center on Maui
32. DOE awards $7M for Maui Smart Grid upgrade project
33. DOE Awards $5.5M for KIUC Smart Grid project
34. KIUC has secured loans for the development of hydro electric and clean energy technologies
35. PUC approved Hawaiian Electric smart grid project using $5.3 million federal stimulus grant

END USE EFFICIENCY:

Align efficiency regulatory and policy framework with clean energy goals:

1. ACT 155 (09), HB 1464, signed June 25, 2009, EEPS mandated at 4,300 GWh reduction by 2030
2. Establishment of a Public Benefits Fund with an independent administrator to facilitate energy efficiency programs (Oahu, Maui, The Big Island)
3. PUC-approved docket re: decoupling for the HECO Companies
4. Mandatory solar hot water heating for new homes (Act 204, Jan. 1, 2009)
5. PUC adopted increase in the PBFA fund from 1% to 1.5%, set for implementation in 2011

Retrofit residential and commercial existing buildings:

6. ARRA: Energy Efficiency Community Block Grant for Energy Efficient Buildings Program for government, residential, and non-profit buildings
7. ARRA: Efficient Appliance Rebate Program. 4,000 ENERGY STAR® refrigerators were sold on the first day of the program, which ran from May 24 to June 23. At the conclusion of the program, 8,300 replacement ENERGY STAR® refrigerators were purchased and installed
8. ARRA: State Energy Program Award for residential solar water heating rebate and low interest loan programs. Energy Star hospitality industry program, government efficiency rebates, and technical assistance and training programs for high energy efficiency and sustainable buildings
9. State Building Efficiency: Lead-by-Example Program recognized by the American Council for an Energy Efficient Economy as "Five Top Energy Efficiency Award Winning Programs"
10. Department of Land and Natural Resources State Park Greening Initiative Launched
11. State recognized by the Energy Services Coalition as the second in the nation with Energy Savings Performance Contracts (ESPCs); completed nearly 1 MW in power purchase agreements, negotiating another 3 MW; reduce energy consumption from 2009 to 2010 by 2.8% or 18 million kWh
12. Department of Accounting and General Services Rooftop PV ESPC Memorandum of Understanding (MOU) signed
13. KIUC Existing Building Retrofit program expanded

Strengthen new construction policies/building codes:

14. High efficiency pilots constructed on military bases (Actus, Forest City)

15. 4,300 GWh EEPS Viability Study Completed (Booz Allen Hamilton/NREL)
16. DoD FEMP Studies: PTA NZEI study, analysis of Schofield Barracks, Information Support Facility (data center) and design support for the future USARPAC C2F building
17. Updating of Building Codes for all counties to the International Energy Conservation Code (IECC) 2006 level
18. The Department of Hawaiian Home Lands (DHHL) is constructing the nation's first LEED (Leadership in Energy and Environmental Design) Platinum subdivision

Identify non-building related energy efficiency measures:

19. Potential efficiencies from improving transmission/distribution infrastructure evaluated
20. Industrial and military electricity applications identified for future efficiency potential study

TRANSPORTATION:

Improve standard vehicle efficiency of fleet:

1. Sales of Hybrid Electric Vehicles (HEV) reduced approximately 2% of annual vehicles sales for a total of 6,500 HEVs
2. National CAFE Standard Levels raised to 35.5 MPG for light duty cars and trucks (avg.)
3. Oahu transit system took delivery of 20 new HEV buses, bringing the total to 80 HEV transit buses

Reduce vehicle miles traveled (VMT):

4. Oahu transit system is one of the most highly ridden per capita in nation

Expand the use of renewable fuels in transportation sector:

5. 10% of the gasoline fueled transportation fleet fuel (~50 MGY) displaced through use of ethanol in blending standards
6. General Motors, Gas Company And other partners launched the Hawaii Hydrogen Initiative to develop H2 production, distribution and fueling and bring hydrogen fuel cell Equinox vehicles to Oahu
7. Renewable hydrogen production, refueling, and hydrogen fleet demonstration at Joint Base Pearl Harbor-Hickam established
8. The City and County of Honolulu fleet continued use of local produced biodiesel (B20)

Accelerate the deployment of electric vehicles (EVs) and related infrastructure:

9. Act 156 (2009) requires Hawaii government fleets purchase electric, alternative fuel, or highly energy efficient vehicles and that EV parking equipped with charging equipment be designated in all lots with over 100 public parking spaces by December 31, 2011
10. Act 186 (2010) – Expanded existing law where homeowners associations cannot deny solar and energy efficient devices to include EV chargers.
11. Hawaii EV Ready Program will provide grants and rebates through ARRA funding for the installation of EV chargers and the purchase of new, commercially-available full-speed electric and plug in HEVs by Hawaii
12. EV Pilot Rates approved by the PUC and went into effect on October 1, 2010 (HECO/MECO/HELCO) businesses, residents, non-profit organizations, and State and County government agencies
13. PICTHR Hawaii Renewable Energy Development Venture issued a $2.4M solicitation; awards include 3 transportation projects – more to come in 2nd round solicitation
14. The State is promoting vehicle industry participation through numerous partnerships with automotive manufactures, and EV equipment and infrastructure supplies

Appendix A: Enabling Actions/Projects Completed to Date

FUELS:

Evaluate local agricultural industry potential and support its development as needed:

1. Black & Veatch resource potential study
2. Hawaii Bioenergy Master Plan
3. Phase I of DARPA algae study complete (Phase II pending)
4. HNEI algae land potential study
5. Feedstock growth/evaluation pilot studies underway

Invest in key logistical/generation infrastructure:

6. HECO CIP CT-1 biofuel generators installed

Evaluate and develop renewable fuel processing infrastructure:

7. KIUC to supply carbon dioxide to the DARPA algae to jet fuel project
8. Several pilot scale drop-in replacement fuel refinery projects underway in State (e.g. Phycal, and UOP/Tesoro projects
9. Pacific Biodiesel expansion project underway

Match potential fuels supply to key sources of demand in-state:

10. HECO RFP for 210 MGY of locally produced biofuels issued
11. DoD RFI for 25% of current jet and marine fuel demand issued
12. HCEI Transportation Analysis completed identifying potential renewable ground transportation demand

Appendix B:
Critical Actions to Support HCEI Strategies: Years 1-5

ELECTRICITY:

Align electricity regulatory and policy framework with clean Energy Goals:

1. Conclude all open PUC dockets outlined in Appendix A
2. Gather all relevant data on biomass generation costs and operations for evaluation and possible inclusion in Feed-in-Tariff by PUC at 2-year docket review. Hawaii-specific data are needed for all technologies which will be considered for FIT

Increase certainty in the process for developing new renewables:

3. Reduce ambiguity in permitting requirements and create online application process
4. Reduce engineering and regulatory barriers for new renewables on to the grid
5. Work with counties to coordinate efforts on streamlining permitting process

Deploy renewable generation and grid infrastructure:

OAHU:

6. 400 MW "Big Wind" project – includes wind farm, inter-island cable and Oahu grid integration components
   a. Complete Big Wind and inter-island cable environmental impact statement and cable developer selection, complete permitting and get RFP for project development issued
7. Additional biofuel generation installed, and contracts secured as required to fulfill HECO's firm capacity requirements.
8. 100 MW unidentified "non-firm" request for proposal (RFP) (70 MW wind project currently under consideration)
9. Finish installation of Kahuku Wind (30 MW)[11]
10. 20 MW Castle and Cooke PV project

KAUAI:

11. Multiple biomass facilities for electricity and biofuels production
12. Development of 15 MW of new hydroelectric generation
13. 10-15 MW solar thermal facility
14. Kauai County landfill gas generation system (1.5-3 MW)
15. ~350 KW of solar under consideration for Kauai County Facilities

HAWAII:

16. Puna Geothermal Venture expansion as much as practicable to the needs of the utility for base load and firm power, per the recommendations of the Geothermal Working Group
17. Identify options to bring in funding for smart grid demo on Big Island
18. 25 MW biomass (e.g., Hu Honua)
19. Biofuel generation installed, and contracts for indigenous fuel secured as required to fulfill HELCO's firm capacity requirements after all other renewable options have been explored

MAUI:

20. Sempra Wind (21 MW)
21. KWP II (21 MW)
22. Additional biofuel generation installed, and contracts secured as required to fulfill MECO's firm capacity requirements after other renewable options have been explored

[11] Received DOE Loan Guarantee (08/10)

Appendix B: Critical Actions to Support HCEI Strategies: Years 1-5

Cross-Cutting:

23. Smart grid – implement smart grid components and capabilities based on lessons learned from pilots and other utilities as due diligence dictates.
    a. Evaluate short-term and long term storage/load smoothing needs
24. Continue to improve solar/wind minute-to-minute output forecasting capabilities
25. Creation of a workforce development plan and tool to track green jobs created from HCEI
    a. Plan should include impacts on renewable energy support industries such as the construction and fuel transport industries
26. Implement distributed generation installation (40 MW Roof Top PV Host Program as part of Energy Agreement, up to 80 MW under the current feed-in-tariff system)
27. Finalize DBEDT/Department of Health efforts to create an on-line system to shorten and simplify the permitting process for renewable energy projects

Explore next generation technologies:

28. Complete PV grid integration studies for HECO, MECO, and HELCO
29. Evaluate biofuels test runs currently being done by HECO in its Oahu units (HECO)
30. Finalize geothermal potential exploration on Maui
31. Research Lockheed Martin 10MW Ocean Thermal Energy Conversion (OTEC) pilot
32. Evaluate pumped hydro and battery storage options for each island (5-20 MW Size) (Army Corps of Engineers, State, HNEI, etc.) Evaluate other non-battery energy storage and frequency regulation options such as flywheels and demand response
33. Identify key solar (or other renewable energy) lands for protection/zoning
34. Evaluate concentrated solar power options across all islands (projects currently under evaluation, ~100 MW combined)
35. Research and implement generation efficiency measures (such as heat capture) to reduce energy loss for petroleum and biofuel generation

END USE EFFICIENCY:

Align efficiency regulatory and policy framework with clean energy goals:

1. Evaluate rate design options for efficiency and demand response
2. Gain PUC approval to install and pilot smart meters
3. Ratify the increase in the PBFA Fund outlined in the HECO Energy Agreement with the State of Hawaii (increase to 1.5% after 2 years, 2% by 4 years), and evaluate other options for enhancing energy efficiency program funding (e.g. tax credits)

Retrofitting Existing Buildings (Both Residential and Commercial):

4. Implement or expand key policies and business models to leverage private capital (e.g., property assessed clean energy financing, energy savings performance contracts)
5. Improve the ability to benchmark building stock energy usage for both private and government and private buildings
6. Expand retrofit market outreach/education programs
7. End use behavioral modification pilot complete and program evaluated (e.g., O-Power)
8. Provide PBFA more flexibility to expand programs that do not have currently measurable savings metrics
    a. Improve policies for measurement of efficiency savings across a wider range of programs (e.g., efficiency education and outreach)
9. Increase State Lead By Example program efficiency targets to 40% improvement over baseline. Goal is to maintain State leadership as more advanced efficiency levels become more commonplace.

10. Re-evaluate level of PBF contribution to ensure that it is sufficient to meet EEPS goals
11. Promote highly efficient AC units
12. Eliminate master metering in high rises and other multi-family dwellings, in concert with expansion of AMI infrastructure
13. Collect additional data on energy efficiency in existing buildings, including granular data as well as data on different types of buildings
14. Initiate a large scale residential retrofit program for net zero energy capable residential buildings

Strengthen new construction policies/building codes:

15. Update building code levels to 2015 efficiency standards (Should incorporate international green construction code into standard codes)
16. Educate stakeholders (architects and engineers, contractors and builders, realtors, banks and appraisers) on need to continue improving and enforcing codes, with a particular focus on the business case for improving efficiency in new construction
17. Conduct building code compliance reviews and assessments and increase training for design professionals as needed
18. Leverage building industry pilots to determine cost effective mix of efficiency measures for implementation. Next step from pilots is to enhance plans for Net-Zero energy buildings and complete the Department of Hawaiian Homelands net-zero Energy Community
19. Improve enforcement of building codes, by working with the Department of Planning and Permitting to help train and educate plan checkers and inspectors on need to incorporate energy efficient technologies into code (buildings currently estimated to be built to approx. 90% of code[12])
20. Develop public announcement system on recently passed improvements to code
21. Promote highly efficient AC units

Identify non-building related energy efficiency measures:

22. Honolulu sea-water air conditioning project
23. Evaluate opportunities for transmission/distribution system efficiencies

TRANSPORTATION:

Improve standard vehicle efficiency of fleet:

1. Promote purchase of vehicles more efficient than current State efficiency avg. (20 MPG cars, 14 MPG trucks)
2. Promote current hybrid technologies to assist in the attainment of improved fleet MPG goals
3. Evaluate the potential of biodiesel fuel switching for trucks and other vehicles that may not have clear electric alternatives
4. Conduct research to better understand correlations between vehicle efficiency and reduced VMT
5. Determine best manner in which to leverage large fleets as a catalyst for Vehicle Efficiency or EV adoption

Reduce vehicle miles traveled (VMT):

6. Identify VMT reduction options, and reach out to key stakeholders in each area
7. Work with local groups regarding mixed use zoning options and localization of work areas with residential areas
8. Promote telecommute options for local businesses to reduce the number of miles driven per person per year
9. Evaluate 4 day work week options
10. Identify ways of quantifying commute cost to drivers (e.g., highlight pass through of parking costs to employees)
11. Promote expansion of current car and van pooling options
12. Study current public transit service with respect to demand (e.g. evaluate Light Rail and other public transit alternatives)

[12]Based on Energy Code Compliance Survey, Honolulu and Hawaii Counties, Jan. 15, 1999. This study cited a lost energy savings equivalent of 13% of code levels. This figure is projected forward to 2010 and includes some modest progress from this compliance level, per DBEDT estimates

Expand the use of renewable fuels in the transportation sector:

13. Evaluate/study alternative fuel vehicle options for the State, along with supporting infrastructure (e.g., hydrogen, flex fuel)
14. Complete the development of EV charging network and electric vehicles covered under the Hawaii EV Ready program

Accelerate the deployment of electric vehicles (EVs) and related infrastructure:

15. Provide incentives for early adopters for both vehicles, infrastructure, and charging equipment
16. Work with automotive industry to continue to increase EV market penetration in quantity and vehicle type
17. Monitor and refine incentive structures for different types of EVs
18. Identify EV deployment lessons learned outside of Hawaii (via DOE pilots or other) that may apply in-State
19. Evaluate options for improving rate design for vehicle charging
20. Identify creative ways to promote sales of EVs, as well as to increase vehicle turnover in general (e.g., incentives for auto-dealers as well as consumers)
21. Negotiate for the acquisition of appropriate quantities of EVs for sale in-State
22. Work with Electricity group to determine best way to route renewable electricity to vehicle charging (e.g., Combine distributed PV with EVs, charge vehicles at night to capture otherwise curtailed wind)
23. Refine Act 290 (1997) – language to allow the use of HOV lanes by electric vehicles

Crosscutting:

24. Understand relative impacts of accelerating vehicle turnover from a lifecycle cost perspective

FUELS:

Evaluate local agricultural industry potential and support its development as needed:

1. Work with government agencies to resolve land, water and labor issues re: use of agricultural lands
2. Evaluate optimal business models, matching feedstock production to refining infrastructure needs where possible
3. Integrate and update recent studies to map agricultural crops to specific lands, factoring in necessary production scale where applicable
4. Evaluate non-potable water sources and potential synergies with wastewater management
5. Evaluate re-developing the previous sugar plantation “co-op” model where crops from many sites are aggregated for pre-processing into bio-crude at jointly owned facilities
6. Complete current feedstock pilots to determine highest yielding local crops. Particular interest in crops that may yield pyrolysis oil, since a successful pilot by UOP/Tesoro would provide local demand for pyrolysis oil for refining in approximate scale of 150 MGY a year, but without clear information on which refining technologies will prove viable, all feedstocks should be considered
7. Create clearing-house for results of all feedstock trials receiving State or federal funds to share results of trials with public
8. Leverage HNEI Algae Lands study to determine if particular sites with algae potential should be protected
9. Expand feedstock demos, with a particular emphasis on high yielding crops and overall land availability for production of each type of crop
    a. Crops should span a range of options, from jatropha, fast-growing grasses, algae and eucalyptus to sweet sorghum and energy cane
    b. Each crop and pilot site should be chosen strategically. While grasses and sorghum may require flat lands in order to harvest them, woody shrubs and tree crops may be grown on hill sides and still harvested effectively

Understand and invest in key logistical infrastructure to develop economies of scale:

10. Work with counties to streamline permitting process from start (crop growth) to finish (fuel refining and generation emissions standards)
11. Continue to improve and expand upon biofuel sustainability standards and certifications (through work by the Hawaii Biofuels Foundation, the Roundtable on Sustainable Biofuels, the HECO-NRDC biofuels policy, RFS2 and GIFTPAC on GHG requirements)
12. Develop an analysis of the biofuels supply chain to determine what the best option for the State is, with particular attention paid to how to best adapt existing petroleum infrastructure to biofuel uses:
    a. Crop production
    b. Crop transportation
    c. Crop pre-processing (where necessary)
    d. Crude biofuel refining
    e. Fuel storage needs, post-refining
13. Need to establish work-force training programs to re-build agricultural knowledge base as well as expanding pre-processing and refining construction sectors
14. Identify lessons learned outside of Hawaii (via DOE Pilots or other) that may apply locally (e.g., ClearFuels Project, CO)

Evaluate and develop renewable fuel processing infrastructure:

15. Complete UOP/Tesoro integrated biorefinery pilot target completion date: 2014
16. Provide regulatory clarity on biofuel refining and use as generation fuel (specifics include State PPA policy, fuel pricing requirements, and air permitting for generation)
17. Provide support where possible for certification of refined products blended during the hydrotreating process (critical to the use of existing petroleum refineries in supplying domestic biorefining demand)
18. Engage Chevron to determine their interest in leveraging their infrastructure for bio-refining purposes
19. Evaluate smaller-scale vs. larger scale bio-refining processes in terms of most cost-effective use of local agricultural outputs
20. Monitor the development of advanced biofuels technologies, including the National Advanced Biofuels Consortium
21. Complete ClearFuels commercial demonstration integrated biorefinery and build a production facility in Hawaii

Match potential fuels supply to key sources of demand in-state:

22. The State of Hawaii, The Gas Company, General Motors, and others are exploring the potential of hydrogen as a fuel source for ground transportation. If this moves forward as planned, there will be a need for a large captive source of hydrogen in Hawaii, which could prove to be an extra source of revenue for refineries in the State
23. Track subsequent changes in market demand for fuels across all fuel types
24. Develop long-term contracts for the use of biofuels by utilities and the military
25. Monitor the development of advanced biofuels technologies, including the National Advanced Biofuels Consortium

Appendix C:
HCEI Supporting Analysis and Planning Documents

HCEI-SPECIFIC ANALYSIS:

Cross-Cutting:

1. Booz Allen Hamilton Wedge Analysis, prepared for HCEI May, 2008 (subsequent updates Sept. 2008, Jan. 2009)
2. Hawai'i Clean Energy Initiative Working Group Policy Recommendations for the 2010 Hawai'i State Legislative Session, November, 2009, hawaiicleanenergyinitiative.org/reports.html, last accessed 10/1/10

Electricity:

1. HCEI Framework Agreement: "Energy Agreement Among the State of Hawaii, Division of Consumer Advocacy of the Department of Commerce and Consumer Affairs and the Hawaiian Electric Companies", Oct. 28, 2010. heco.com/vcmcontent/StaticFiles/pdf/HCEI.pdf, last accessed 10/1/10
2. OWITS Grid Modeling Study (Wind Integration)
3. Overviews of the Big Island Energy Roadmap Study and Maui Smart Grid Demonstration Project, Jay Griffin, Hawaii Natural Energy Institute, University of Hawaii at Manoa, April 23, 2009

Energy Efficiency:

1. Hawaii 30% Energy Efficiency and Building Code Analysis, Kiatreungwattana, National Renewable Energy Laboratory, hawaii.gov/dbedt/info/energy/efficiency/EUEWG/Kosol%20HCEI%20-%20NC%20Analysis-Final2.pdf, last accessed 10/1/10
2. "Hawaii Clean Energy Initiative: Existing Building Energy Efficiency Analysis," Finch, P., Potes, A. Published by the National Renewable Energy Laboratory, June, 2010. nrel.gov/docs/fy10osti/48318.pdf , last accessed 10/1/10

Transportation:

1. Booz Allen Hamilton, HCEI Transportation Options Analysis, Sept, 2010

Biofuels:

1. Hawai'i DBEDT, Task 1 Assessment of Existing Biomass Feedstocks, Feb. 2008. Black & Veatch
2. Hawai'i Bioenergy Master Plan, prepared for DBEDT by the Hawaii Natural Energy Institute, School of Ocean Earth Sciences and Technology, Sept. 2009

COUNTY ENERGY PLANS:

City and County of Honolulu: honolulu.gov/refs/ahupuaa/sustainability_plan.html, last accessed, 11/23/10
County of Maui: co.maui.hi.us/documents/Office%20of%20the%20Mayor/Office%20of%20Economic%20Development/Maui%20County%20Energy%20Alliance/MCEA%20Report%20Draft%206_9_09.PDF, last accessed 11/23/10
County of Hawaii: co.hawaii.hi.us/bc/eac/Final%20Report%20to%20Mayor%20-%20Exec%20Summary.pdf, last accessed, 11/23/10
County of Kauai: kauainetwork.org/energy-sustainability/, last accessed 11/23/10

Appendix D:
HCEI Working Group DECEMBER 15, 2010

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Appendix D: HCEI Working Group December 15, 2010

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HCEI Road Map
2011 Edition

Date (period of performance): September – November 2010

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Prepared under Subcontract No. LGJ-0-40279-01

Subcontract Report
NREL/SR-7A40-52611 • August 2011

Prepared by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy; NREL is operated by the Alliance for Sustainable Energy, LLC.

August 2011

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.