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Planning Hawaii's 100% Renewable Energy Future

Photovoltaic (PV) system installers and customers are frustrated because the HECO utilities have put the brakes on installations of new PV systems until HECO decides what it is going to do to accommodate more PV systems on its transmission & distribution (T&D) system. Customers are not ordering PV systems and PV system installers are laying off workers because HECO seems to not be making decisions to modify their T&D system to accommodate more PV systems.

Geothermal project developers are frustrated because, after a 3 year process of requesting and evaluating project proposals, HELCO seems to not be making decisions to purchase more geothermal power for the Big Island grid. Project developers are offering firm geothermal power at prices that would lower the cost of electric power to consumers on the Big Island.

The Public Utilities Commission (PUC) is frustrated because, after a two year Integrated Resource Planning (IRP) process involving scores of energy stakeholders, the HECO utilities seem to not be making decisions to systematically replace high-cost imported fuel generation with low-cost renewable generation. HECO is reported to have spent **\$11 million** on an IRP process in which they made no systematic side-by-side comparisons of the costs and benefits of options for replacing imported fuel generation with renewable generation.

The Big Picture

The HECO utilities seem to not be making decisions about their renewable energy options (renewable generation, load & demand management, T&D and energy storage) because they seem to have not yet created a planning process for systematically evaluating and comparing the costs and benefits of those options. They seem to have not yet created a planning process for identifying and systematically evaluating their options

to decide what renewable energy options in what amounts in what order would be of lowest cost and greatest benefit to their customers and to themselves.

They seem to not yet have a planning process for systematically evaluating renewable energy options because they seem to have not yet set *their own* renewable energy goal that they are enthusiastic about achieving. They have a renewable portfolio standard (RPS) goal of 40% renewable generation mandated for them by the State legislature, but they seem to have not yet set their own renewable energy goal that they are enthusiastic about achieving for themselves.

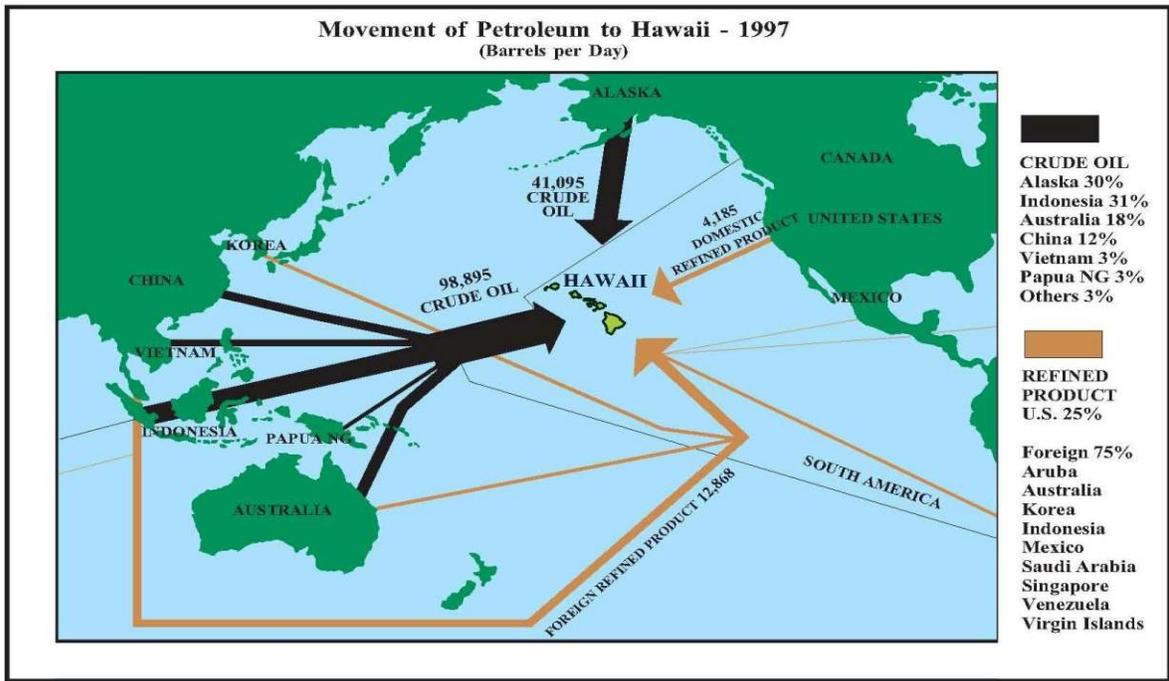
They seem to have not yet set their own renewable energy goal that they are enthusiastic about achieving because they seem to have not yet realized that they have an opportunity to ensure their future prosperity and business success by setting a planning goal of 100% renewable energy for each of the islands of Hawaii.

They seem to have not yet realized that they have an opportunity to ensure their business success by planning for 100% renewable energy because they seem to have not yet recognized the fact that, sooner or later, imported fuels are going to stop flowing to Hawaii, and that their business future is 100% renewable energy, whether they plan for it or not.

When Imported Fuels Stop Flowing to Hawaii

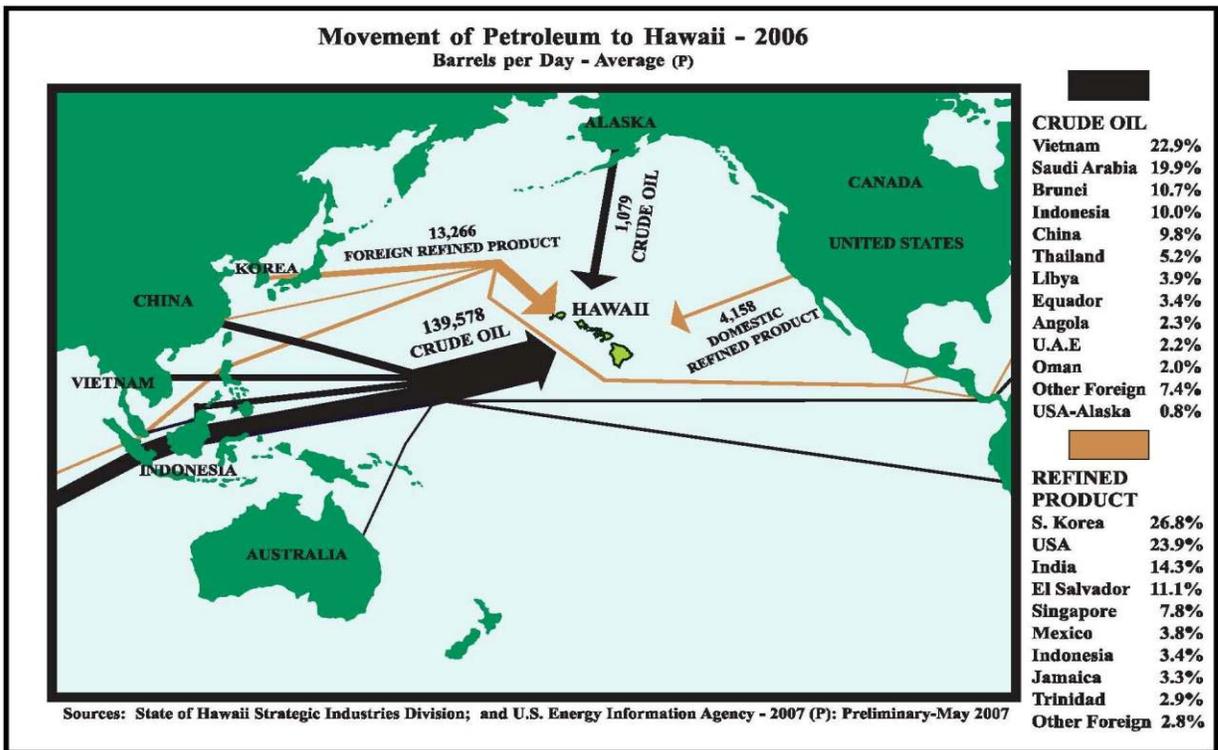
Hawaii relies on imported fuels (oil, coal, gas, municipal solid waste) for about 90% of its electric power and virtually 100% of its transportation needs. Sooner or later, imported fuels will stop flowing to Hawaii. The fuels imported to Hawaii (primarily oil) are becoming harder-and-harder to obtain and more-and-more expensive as fuel-exporting countries use more-and-more of these fuels for themselves and export less-and-less of these fuels to Hawaii, and eventually themselves become importers of fuels from the remaining fuel-exporting countries.

Here is a figure, published by Hawaii's Department of Business Economic Development & Tourism (DBEDT), showing the sources of Hawaii's imported oil in 1997:



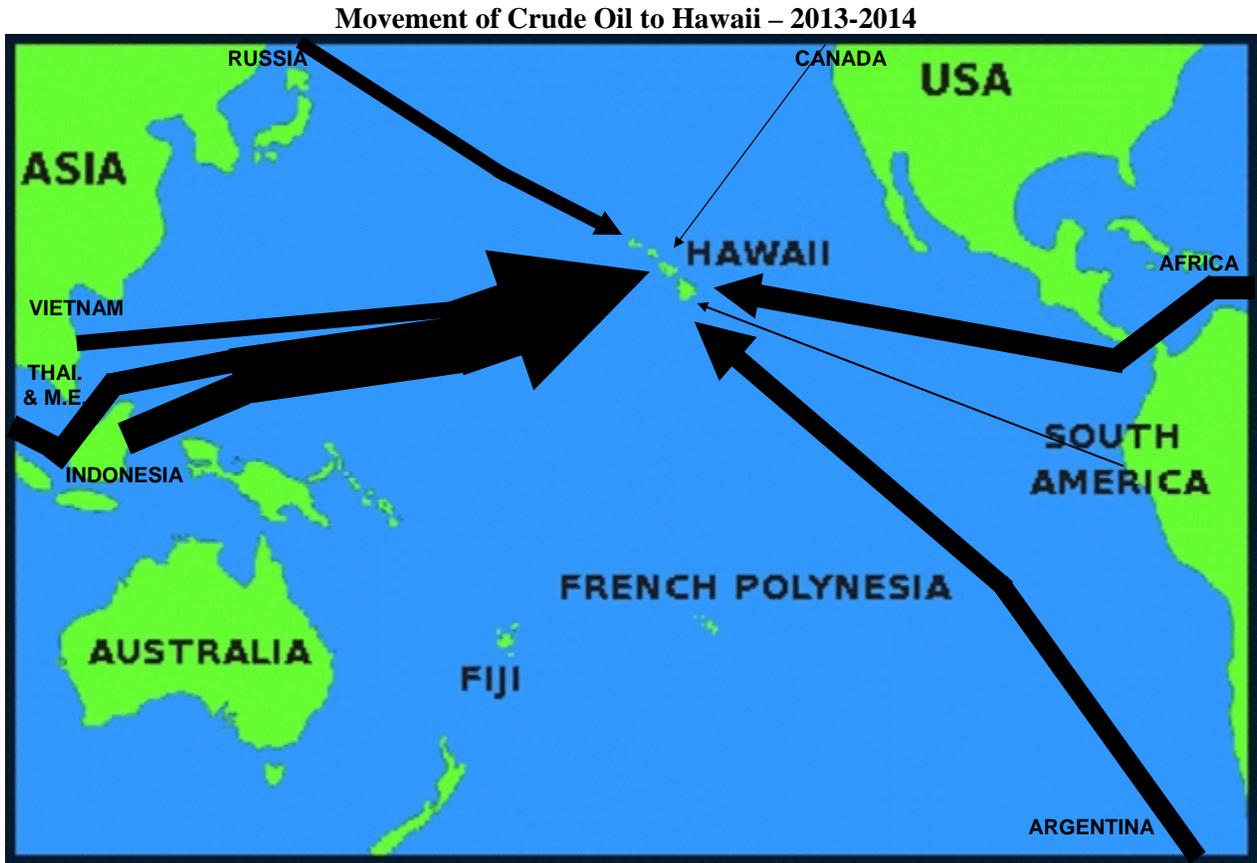
In 1997, Hawaii got about 30% of its oil from the US-Alaska and got the rest from Southeast Asia and Australia. The average barrel of oil traveled about 5000 miles by sea to reach Hawaii.

Here is a DBEDT figure showing the sources and amounts of Hawaii's imported oil 9 years later, in 2006:



In 2006, Hawaii’s oil imports from US-Alaska were reduced to less than 1% of its oil imports. The amount of oil coming from Australia diminished from 18% in 1997 to about 3% in 2006 as that country used more-and-more of its oil for itself and became a net importer of oil. Hawaii got about 59% of its oil from Southeast Asia and almost 30% of its oil from the Middle East. The average barrel of oil traveled about 7500 miles by sea to reach Hawaii.

Here is a figure showing the sources of Hawaii’s oil imports today:



Source: US Energy Information Administration EIA-814 “Company Level Imports” May 2013-Apr 2014

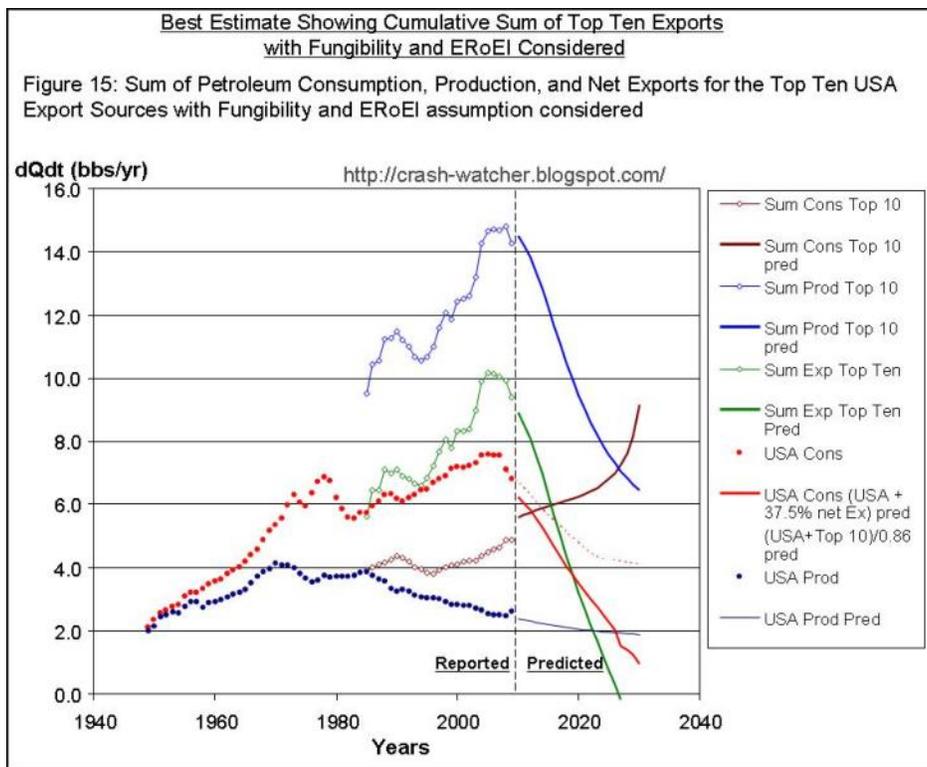
Indonesia	25.5%	Algeria	6.4%
Argentina	14.3%	Saudi Arabia	3.6%
Vietnam	12.0%	Angola	3.3%
Thailand	10.7%	United Arab Emirates	3.1%
Russia	10.2%	Ecuador	1.3%
Gabon	7.6%	Canada	1.0%

By 2013-14, oil imports from Alaska and Australia had ceased entirely. Oil imports from China also ceased entirely as China became the world’s largest net importer of oil. The amount of oil coming from Vietnam fell from 23% in 2006 to 12% in 2013-2014, as Vietnam used more-and-more of its oil for itself. Hawaii is now importing about 10% of its oil from Russia, about 49% of its oil from Southeast Asia, and about

39% of its oil from Argentina, North Africa, West Africa and the Middle East. The average barrel of oil traveled about 7000 miles by sea to reach Hawaii.

A Time Frame to Crisis

The Export Land Model¹ predicts a year – 2027 – when oil imports to the United States are likely to diminish to zero based on the observed facts that: (1) oil is becoming harder-and-harder to obtain and more-and-more expensive as the real cost of oil production (measured by energy-return-on-energy-invested (ERoEI)) increases over time, (2) oil-exporting countries are using more-and-more of their oil for themselves and are exporting less-and-less of their oil to the US over time, and (3) oil-exporting countries are stopping their exports of oil to the US and are becoming importers of oil from the remaining oil-exporting countries over time. The Export Land Model prediction of zero oil imports to the US by the year 2027 is shown by the green line in the figure below:



The Export Land Model suggests that Hawaii is due for a severe energy crisis – both electric power and transportation fuels – in about 13 years when imported oil is predicted to stop flowing to the United States and, by inference, to Hawaii.

Of course, the prediction of zero oil imports to the US and Hawaii by 2027 is *only* a prediction based on long-term trends in the production and consumption of oil, and the real cost (measured by ERoEI) of oil production. Political and economic events beyond

¹ Jeffrey Brown, “An Export Land Model Analysis for the USA – Part 3,” published in *The Oil Drum* on February 6, 2011 (accessed at <http://crash-watcher.blogspot.com/2011/02/export-land-model-analysis-for-usa-part.html> on August 1, 2014).

Hawaii's control (*e.g.*, wars, sanctions, technological innovation, etc.) could affect those trends and delay or advance the day when imported oil stops flowing to the United States and Hawaii.

Still, the Export Land Model gives us what one might call a "time frame to crisis." It tells us -- based on fundamental facts of oil production and consumption -- that, ***unless we start planning now for 100% renewable energy, we can expect a severe energy crisis in about 13 years when imported oil is predicted to stop flowing to the United States and Hawaii.***

What Does It Mean?

What does it mean for Hawaii's utilities to have about 13 years until imported oil stops flowing to Hawaii? It means at least 3 things:

First, it means that Hawaii's utilities are already in the process of transforming to 100% renewable energy because they are going to arrive at 100% renewable energy when imported fuels stop flowing to Hawaii, whether they plan for it or not. The utilities' 100% renewable energy future is inevitable.

Second, it means that the utilities have choices to make: What do they want their 100% renewable energy future to look like? Do they or do they not want to ensure their future prosperity and business success by grasping the nettle, making a virtue of necessity, and *planning* for their inevitable 100% renewable energy future? A time frame of about 13 years to that future means they do not have unlimited time to make that choice.

Third, it means their profits on well-planned investments in renewable energy (including the energy security and resiliency benefits of such investments when properly valued) will increase as imported fuels decrease in availability and increase in price. The sooner those investments are made, the greater will be those profits. Accelerating those investments means decreasing the utilities' imported fuel costs, increasing the utilities' profits, and magnifying the utilities' opportunity for future prosperity and business success.

What Do We Want?

When the Apollo 11 *Eagle* landed on the moon on July 20, 1969, the US achieved a goal set 8 years earlier, when John F. Kennedy asked the nation to "commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."

The US succeeded in putting a man on the moon because the nation committed to a simple and concrete goal that fired the imagination of the American people. The goal of putting a man on the moon worked because it inspired people. It elicited their enthusiasm because it touched people's deep desire to achieve something transcendent. Once it was expressed effectively, a consensus for its achievement emerged almost instantly. Once the nation made up its collective mind about *what* it wanted to achieve,

the creative energies and enthusiasm of the nation aligned with *how* to achieve it, and its achievement became inevitable.

100% renewable energy can be Hawaii's man-on-the-moon project. Hawaii can achieve 100% renewable energy once the people of Hawaii reach consensus on a goal of 100% renewable energy. Once the people of Hawaii make up their collective mind that 100% renewable energy is *what* they want, the creative energies and enthusiasm of the people in Hawaii can align with *how* to achieve it, and its achievement will become inevitable.

The Indispensable First Step

The indispensable first step in reaching consensus on a goal of 100% renewable energy for Hawaii is the utilities making up their collective mind that they *want* 100% renewable energy to ensure their future prosperity and business success, and that they *want* to plan for 100% renewable energy. There are at least 2 reasons why reaching the utilities' consensus on a planning goal of 100% renewable energy is the indispensable first step.

First, the utilities control and decide what renewable energy options in what amounts in what order get interconnected with the grid. To achieve 100% renewable electric power generation, we need utilities that are motivated, enthusiastic and committed to achieving 100% renewable energy. The renewable energy plan that actually gets Hawaii to 100% renewable energy will be the plan that the utilities *make for themselves* because the utilities make up their collective mind that they *want* 100% renewable energy *for themselves* to ensure their future prosperity and business success.

Second, most renewable energy options for transportation (*e.g.*, electric vehicles, electric rail transit, and hydrogen-fueled vehicles) depend directly or indirectly on electric power generation. To the extent that renewable energy options for transportation depend on electric power generation, the utilities are in the best position to identify and systematically evaluate those options, and to compose 100% renewable energy plans that take into account future electric power needs for transportation.

Changing the Utilities' Collective Mind

So how do we change the utilities' collective mind so that they reach consensus on setting a planning goal of 100% renewable energy for each of the islands of Hawaii?

What if we *ask* them?

What if we share with them a perception that (1) they already are in a process of transforming to 100% renewable energy, (2) they have choices to make and a limited time to make them, and (3) the sooner they choose to set a planning goal of 100% renewable energy, the greater will be their prosperity and business success? What if we lay that perception before them and *ask* them to set a planning goal of 100% renewable energy for each of the islands of Hawaii?

What if we *ask* them, “What do you want?”

Asking the “What do you want?” question gives the utilities the opportunity *to convince themselves* that they *want* 100% renewable energy, and that they want to *plan* for 100% renewable energy, to ensure their future prosperity and business success. Once the utilities make up their collective mind that they want 100% renewable energy, the conversation can move to the next question, “How do we get there?”

Changing the utilities’ collective mind means changing the individual minds of the people who work at the utility. When some critical number of individual minds changes to embrace a planning goal of 100% renewable energy, the utilities’ collective mind will change and the utilities will reach consensus on setting a planning goal of 100% renewable energy.

Anyone and everyone in Hawaii can help change the utilities’ collective mind because anyone and everyone can *ask* the individuals at the utilities to set a planning goal of 100% renewable energy. Anyone and everyone can *ask* the utilities’ individuals the “What do you want?” question by which each individual can convince himself or herself that he or she wants 100% renewable energy for his or her prosperity and business success. The people in Hawaii’s renewable energy industry and advocacy groups can ask. The people in Hawaii’s legislature can ask. The people in Hawaii’s state agencies (PUC, DBEDT) can ask. Anyone who is a Hawaii ratepayer or taxpayer can ask.

What Might a Planning Process for 100% Renewable Energy Look Like?

The indispensable first step in planning for 100% renewable energy is reaching consensus on a planning goal of 100% renewable energy. Once Hawaii, including its utilities, reaches consensus on a planning goal of 100% renewable energy, the conversation can move to the questions, “How do we get there?” “What is the plan?” Goal-oriented planning for 100% renewable energy means figuring out what options in what amounts in what order would achieve 100% renewable energy at greatest benefit and lowest cost.

The second step in a planning process for achieving 100% renewable energy might be identifying all the plausible renewable energy options for achieving 100% renewable energy. Plausible options might include the following:

- Fossil fuel unit de-commitment and curtailment mitigation options
- Additions of wind generation, including mitigation options and curtailment compensation options
- Additions of PV generation primarily for on-site loads, including mitigation options and NEM compensation options
- Additions of PV generation primarily for delivery of electricity to the utility, including mitigation options and curtailment compensation options
- Replacement of imported fuel generation with geothermal generation
- Replacement of imported fuel generation with locally-produced biofuels generation

- Demand management options, including time-of-use pricing and direct load control options
- Energy storage options, including electric battery, pumped hydro and compressed-air energy storage options
- Interisland cable transmission options

During the last year-and-a-half, the HECO utilities have disclosed their identifications of (1) wind curtailment mitigation options on Maui, (2) Oahu-Maui interisland cable transmission options, and (3) distribution- and system-level mitigation options for high penetration of PV on distribution circuits. We can ask the utilities to identify and disclose their identifications of *all* the plausible options for achieving 100% renewable energy for each of the islands of Hawaii.

The third step in a planning process for achieving 100% renewable energy might be evaluating plausible options one-by-one for systematic comparison of their costs and benefits. Proper evaluation of benefits might require evaluation of avoided fuel costs, avoided plant O&M costs, avoided capacity costs, avoided environmental costs and the energy security & resiliency value of each option. Energy security & resiliency might be evaluated under a baseline scenario that assumes imported fuels stop flowing to Hawaii in a time frame of about 13 years.

We can ask the utilities to disclose *all* their evaluations, including their cost-benefit evaluations. Disclosing their evaluations shows the presence of trust. Disclosing their evaluations means being able to talk them about their evaluations. Being able to talk with them about their evaluations means renewable energy plans with fewer mistakes, lower costs and greater benefits for them.

The fourth step of a 100% renewable energy planning process might be using the one-by-one evaluations of options to compose the plan itself. A goal-oriented plan might consist of a series of steps to achieve the 100% renewable energy goal. Each step might consist of one or more options that might be implemented in an order that prioritizes options evaluated to provide the greatest benefit at the lowest cost. We can ask them to prioritize the options that their own evaluations show as bringing them the greatest benefit at lowest cost.

The fifth step of a 100% renewable energy planning process might be implementing the first step of the plan. The first step of the plan might consist of one or more options that are evaluated to provide the greatest benefit at lowest cost. We can ask the utilities to implement the options that their own evaluations show as bringing them the greatest benefit at lowest cost.

The sixth step of a planning process for achieving 100% renewable energy might be using knowledge gained during implementation of the most recent step of the plan to re-evaluate the plausible options and revise the subsequent steps of the plan based on those re-evaluations. To achieve 100% renewable energy at greatest benefit and lowest cost, the options might be regularly re-evaluated and the plan might be regularly revised to reflect changing technologies and economics. We can ask the utilities to regularly re-evaluate the plans and revise the plans based on their re-evaluations.

Conclusion

Hawaii can achieve 100% renewable energy once the utilities reach consensus on a planning goal of 100% renewable energy. We can *ask* them to set a planning goal of 100% renewable energy for each of the islands of Hawaii. We can *ask* them the “What do you want?” question that gives them the opportunity *to convince themselves* that they *want* 100% renewable energy, and that they want to *plan* for 100% renewable energy, to ensure their future prosperity and business success.