Incentivizing Generation of More Renewable Energy in Residential and Commercial Sector in Hawaii

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EXECUTIVE SUMMARY

Hawaii is the nations' most oil dependent state deriving 85% of its total energy consumption from imported fossil fuel. Every year around 8% of the state's total budget is allocated towards oil imports to fulfill the energy needs in Hawaii. The high dependency on oil imports makes Hawaii a politically and economically vulnerable state in the nation. Hawaii's electricity price is the highest in the nation at about 33 cents/kwh compared to the national average of 11.3 cent/kwh. The higher electricity cost not only puts relatively higher pressures on the incomes of the residential and commercial units but in aggregate terms the state economy also has to allocate a heavy chunk of its resources to import oil and produce electricity. The residential and commercial sector consumes around 66 percent (66%) of the total electricity production in Hawaii.

Realizing the importance of the energy problem that Hawaii faces, the state developed a comprehensive plan named the "Hawaii Clean Energy Initiative" (HCEI) in 2008 to reduce Hawai'i's dependence on imported fossil fuel. Under this program the state has set the goal to achieve a 70 percent (70%) clean energy by the end of 2030 where 40 percent (40%) will be provided by renewable energy generation and 30 percent (30%) will be achieved through energy efficiency. A number of public, private and non-profit sector stakeholders have been involved in improving the generation of renewable energy in Hawaii. Renewable energy is obtained through different sources like the sun, wind, geo-thermal, and seawater. For the residential and commercial sector the focus has been mainly on photovoltaic (PV)systems (solar systems) to produce more electricity from the sun. Currently the share of solar system electricity is only around 1 percent (1%) in total renewable energy production in Hawaii.

The Hawaii electric company (HECO) runs two clean energy programs to incentivize the residential and commercial sector to generate more renewable energy. The Net Metering Program is primarily targeted at residential customers to adopt renewable energy systems while the Feed in Tariff Program is more oriented towards small to medium commercial business to produce electricity and sell it back to HECO. The current options offered to the residential and commercial sectors under both programs do not sufficiently incentivize individual units to generate more energy and sell it back to public utility. The existing framework does not have the capacity to provide economic incentive to the units to produce more energy and sell it back to HECO.

In order to incentivize the residential and commercial sector to generate more electricity a number of policy choices may prove helpful. Such incentives could be extending the duration of unutilized credits, adjusting the fixed line rent against the unutilized credit and increasing the rate of electricity. This paper looks in detail at each option and provides an analysis of the different scenarios. Keeping in view the scope and target market, the extension in duration and/or the buyback option of unutilized credits by HECO are the most efficient, economical and administratively feasible to provide the right set of incentives to the residential sector in Hawaii to produce more renewable electricity.

1. BACKGROUND

A majority of developed and developing economies rely on fossil fuel to fulfill their energy consumption needs. In the US, Hawaii has the distinction of depending very heavily on imported fossil fuel to fulfill its energy needs, more than any other state. In the year 2008, 85 percent (85%) of the total energy consumed in Hawaii was provided by petroleum which is well above the national average of 37.5 percent (37.5%)[1].Because of the state's heavy dependence on imported petroleum and rapid increase in petroleum prices in recent years, Hawaii's total primary energy expenditure reached about $5.3 billion in 2008. This value accounted for about 8.1 percent (8.1%) of Hawaii's total Gross Domestic Product (GDP) in 2008[2]. Sole dependence on imports of fossil fuels is economically and politically undesirable for Hawaii. Another prime concern for Hawaii has been the consistent rise in the petroleum prices over the last decade. A slowdown in the economy adds more severity to the prospects of absolute dependence on imported fossil fuel in Hawaii especially since the import payments are paid to other countries, moving precious dollars out of US economy. Assessing the urgency and importance of this issue, in 2008, the State of Hawaii Legislature introduced Hawaii Clean Energy Initiative (HCEI) aiming to achieve 70% clean energy of its total energy consumption; split into 30% from energy efficiency sources and 40% from renewable energy sources by year 2030[3]. In this context, energy efficiency refers to reducing the energy demand through upgrading to modern and efficient appliances and reducing energy consumption through efficient actions. For instance, installing energy efficient LED bulbs by replacing the traditional bulbs significantly helps in reducing the consumption of electricity. On the other hand, utilizing natural resources for energy production such as sun, sea, wind and geo-thermal are categorized as renewable energy resources. Generation of electricity through photovoltaic panel (solar panels) and wind turbines are examples of the renewable energy production.

- *85 percent (85%) of total energy consumed in Hawaii is provided by petroleum*
- *Hawaii spent $5.3 in 2008 on oil imports for energy*
- *HCEI aims at achieving 70 percent clean energy by 2030*
- *Main renewable energy sources are sun, sea, wind, geo-thermal*

2. THE PROBLEM AND ITS SCOPE

"Residential and commercial units have too few choices to produce renewable energy in Hawaii"

Hawaii's electricity price is 33 cents per kilowatt hour on average for residential users versus 11.3 cents per kilowatt hour for the rest of the country in 2010. Connecticut had the second highest average rate at 19.3 cents per kWh, followed by New York at 16.6 cents a kWh[4]. That means if a household in Hawaii uses 600kwh per month it will cost $169 in Hawaii while elsewhere in the country it would be only $69[5]. This clearly shows that Hawaii's average electricity prices are higher by almost 150% than the national average. This leads to a disproportionate burden of

[1] Department of Business, Economic Development and Tourism, Hawaii Economic Issues, Renewable Energy in Hawaii, June 2011
[2] Department of Business, Economic Development and Tourism, Hawaii Economic Issues, State of Hawaii Energy Data and Trends, March 2011
[3] Hawaii Clean Energy Initiative Road Map, 2011 Edition.
http://www.hawaiicleanenergyinitiative.org/storage/media/HCEI%20RoadMap_2011_40pgs.pdf
[4] Electricchoice.com, Texas based energy consultancy firm.
http://www.electricchoice.com/electricity-prices-by-state.php
[5] Honolulu Civil Beat

high electricity prices on residential and commercial consumers and, therefore, recommendations for rapid growth in renewable energy in these sectors through the introduction of new and/or amendments to the existing policy options. A look at the primary energy consumption by sector reveals that almost 50% of the total energy is being used in the transportation sector; 40% is used in electricity generation while 10% is directly used in industrial, commercial and residential buildings. From 1960 to 2008, the share of energy used in electricity generation increased from 19 to 39 percent. Furthermore, 64% of the total electricity in Hawaii is consumed by the residential and commercial sectors while both sectors account for 33% of total energy expenditures amounting to $1.73 billion of total energy expenditures in 2008. The industrial sector utilizes about 36% of the total electricity generated in Hawaii. Based on a forecast by Hawaiian Electric Company, Inc. total electricity generation was at 11,109 GWh in 2009. Currently, electricity generated from renewable sources totaled 1,243.7 GWh, accounted for 8.7% of total electricity demand[6]. The public utilities commission of Hawaii in its annual report of 2011 states that currently in Hawaii a total of 47.4 Megawatts was attributed to the current "Net Energy Metered Systems"[7] installed as of November 2011[8]. This contributes around 0.2% to total renewable energy electricity generation in Hawaii. While as of October 2011, renewable energy projects with more than 300 megawatts of generating capacity are providing power to the Hawaiian Electric companies[9].

The market size and electricity consumed by the residential and commercial sector in Hawaii indicate a broader potential for these sectors to generate excess renewable energy and sell it to the public utility. A conservative estimate of the National Renewable Energy Laborites shows that almost half of the Hawaii's houses (i.e. 500,036 as of the 2006 census), assuming a 2.5kw system per house, have rooftops suitable for photovoltaic systems. A trigger to incentivize not only the current residential units but the potential ones to produce excess renewable energy would require policy changes in the existing regulations of HECO's Net Metering and Feed in Tariff Programs. Individual units underutilize energy system because of a lack of any economic incentives for excess energy generation. Appropriate changes in the existing regulations by the Public Utilities Commission may provide an appropriate framework for customers to generate more renewable energy and sell it to the utility company.

- *In Hawaii electricity price is 33 cents compared to national average of 11.3 cents*
- *Almost half of the Hawaii's houses have the potential to have a 2.5Kw system installed*
- *The high upfront cost of installation can be hedged through private financing and/or leasing*
- *The prices of Photovoltaic system have dropped by 17 percent (17%) compared to 2010*

Generating excess electricity through renewable resources requires installations of extra photovoltaic systems. These systems have been expensive and therefore only a handful of customers have been able to take advantage of them. This naturally led to high upfront costs of renewable electricity generation systems and ultimately restricting the scope only to the units that could

[6] Department of Business, Economic Development and Tourism, Hawaii Economic Issues, Renewable Energy in Hawaii, June 2011
[7] According to Hawaii state law (Hawaii Revised Statutes (HRS) Section 269-101 - 269-111), all residential and commercial utility customers who own and operate an eligible renewable energy generation system up to a generating capacity of 100 kW and intend to connect to utility grid, must register their systems with their utility by executing a NEM agreement.
[8] Annual Report, Public Utilities Commission, State of Hawaii, November 2011
[9] HECO, http://www.heco.com/portal/site/heco/menuitem.20516707928314340b4c0610c510b1ca/?vgnextoid=c6caf2b154da9010VgnVCM10000053011bacRCRD&vgnextfmt=default

afford it. The federal & state governments have been providing incentives in the form of tax rebates to the individual units that opt to generate electricity through renewable resources. While these incentives have been around for several years, a recent development in the renewable energy sector has been promising to tackle the issue of the upfront cost of installation in residential and commercial units. To avoid the cost of upfront installation best practices have been private financing or leasing the systems to individual units. Under the private financing system the units are financed by a bank/financial institution through clean energy loans, with a nominal interest rate, to install renewable energy system. The unit still gets the tax credit which in most cases outweighs the interest paid on the clean energy loans by the units. However, under leased financing, the leasing company provides the systems to the individual unit which can be paid back monthly until the lease is due by the household or the commercial units. The household pays a nominal down payment and monthly lease while the leasing company receives federal and state tax credit instead of the units. These are two approaches that address the issue of the high upfront cost. As the financing options are becoming more common for the customers, the scope and target market is expanding accordingly.

Secondly, the average installed cost of residential and commercial PV systems completed in 2010 fell by roughly 17 percent from the year before, and by an additional 11 percent within the first six months of 2011[10]. These recent installed cost reductions are attributable, in part, to dramatic reductions in the price of PV modules. This reduction in cost is not only related to mass scale production of solar systems but also to cost efficient technology that is being used in making of PV modules. Following this trend it appears increasingly possible that in next 3-5 year the prices of the PV solar systems will reduce further. The reduction in the price would provide a better opportunity to a larger segment of the residential and commercial sector to go for excess renewable energy generation.

In the next section we analyze the different choices/incentives that are available to the residential and commercial sectors in Hawaii to produce renewable energy. In this section the paper discusses policy options that can incentivize excess generation of renewable energy in the residential and commercial sector. The Hawaii Electric Company is the main utility responsible for providing electricity to Hawaii besides supervising the two clean energy programs namely Net Metering and Feed in Tariff for the residential and commercial sectors. The focus for the policy analysis relies primarily on these two programs.

3. Policy Options

a. Existing "Net Metering Program"

Net metering (NEM) [11] of renewable electricity generation in the residential and commercial sector is under the supervision of the Hawaiian Electric Company. According to Hawaii state law (Hawaii Revised Statutes (HRS) Section 269-101 - 269-111), all residential and commercial utility customers who own and operate an eligible, renewable power generation system up to a generating capacity of 100 kW and intend to connect to the utility grid, must register their systems with their utility by executing a NEM agreement. The executed agreement allows the NEM customer to connect their renewable generator to the utility grid, allowing it to transmit surplus electricity into the grid, and to receive credits at the full retail price which can be used to offset electricity purchases over a 12-

[10] Tracking the Sun IV, A historical Summary of the installed photovoltaic in the United States from 1998 to 2010 http://eetd.lbl.gov/ea/emp/reports/lbnl-5047e.pdf

[11] Net Metering is a term used for two-way metering where surplus renewably generated electricity at homes/business is sent to the grid of the electric company. Under this system the electric company issues credit units to homes/business at full retail value that can be consumed by households in future.

month period. HECO bills NEM customers for net energy purchases, which is determined by subtracting the excess energy exported to the utility grid from the total energy supplied by the utility[12]. The formula used for NEM is:

Energy Supplied by the utility (kWh)-Excess Energy exported to the utility (kWh) = Net Energy billed to the customer (kWh)

Under this system, HECO gives credits to homes/small businesses at full retail value. The NEM agreement allows the customer to carry over unused credits (excess net generation expressed as a monetary value) to future bills within a 12 month period, starting from the date of contract execution. Unused credits left at the end of each 12-month reconciliation period are not carried over. HECO charges $18 dollar per household, per month as a fixed fee for maintaining the account and other administrative costs. The restriction of the 12 months time-frame to utilize unused renewable energy credits may encourage households to install lower capacity, renewable energy systems essentially producing less energy than their domestic demand even if they there is potential for higher capacity systems. For instance, a household/small business may have 10 kW electricity generating voltaic system installed while their total demand is fulfilled by 5kw system. In this case, the excess electricity produced goes back to the grid and the household gets credit units. Assuming that the household on average produced 600kwh/month but consumed 500kwh they would send 100kWh/month to the grid. The additional 1200kwh/year produced is channeled to HECO, which issues retail value credits available to the household for the *next 12 months* only.

The fact that unused credits expire in one year is a disincentive for households/commercial units to install a higher capacity renewable energy system. Instead both residential and commercial units tends to install systems that are either below or equivalent in capacity to their consumption level even if the unit is suitable for a higher capacity system. It is important to note that for every forgone unit of renewable energy, HECO produces a unit from fossil fuel that is a dead foreign exchange and a higher carbon footprint to the environment. More renewable energy produced by residential and commercial units reduces Hawaii's dependence on fossil fuel consumption.

- *Expand the time duration for unutilized credits*
- *Adjust the unutilized credits at the end of 12 months against the fixed line rent*
- *Increase the rate of electricity under the FIT program*
- *Reduce the contract time in FIT program from 20 years to 10 years*

b. Policy Choices in NEM Program:

Under the NEM system incremental policy measures can help to promote renewable energy in the residential and commercial sectors where almost 66% of total electricity is used. A couple of policy options could play a pivotal role in promoting the expansion of NEM systems in Hawaii:

I. Increase the length of time for credit usage from 12 months to indefinitely
II. Pay the households/commercial units for the additional energy that they produce. This could be at a rate higher than the one determined in the feed in tariff (FIT) program but lower than full retail price at which the HECO sells its electricity.
III. Adjust the unused credits at the expiration of 12 months against the fixed fee of $18 per month administration fee.

[12] Hawaiian Electric Company, Net Energy Metering
http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnextoid=12a290a2decab110VgnVCM1000005c011bacRCRD&vgnextchannel=a48df2b154da9010VgnVCM10000053011bacRCRD&vgnextfmt=default&vgnextrefresh=1&level=0&ct=article

c. Existing "Feed in Tariff Program"

Feed in Tariff (FIT) is another clean energy generation program by HECO. FIT allows customers to sell renewable energy to the Company by entering into an agreement with HECO. Under this program, one way metering is used for the power sold to HECO at a rate determined in the contract. The program is broadly divided into three tiers i.e. Tier 1, Tier 2 and Tier 3[13].

Tier	Project Size
1	0 - 20 kW on all islands
2	Greater than 20 kW and up to and including PV: 500 kW on Oahu, 250 kW on Maui and Hawaii, and 100 kW on Lanai and Molokai; CSP: 500 kW on Oahu, Maui and Hawaii, and 100 kW on Lanai and Molokai; In-line hydro: 100 kW on all islands; Onshore wind: 100 kW on all islands
3	Greater than Tier 2 but less than 5 MW on Oahu 2.72 MW on Maui and Hawaii or 1% of the system peak load from the previous year, Except that wind generation is precluded on Maui and Hawaii

The energy rates under the FIT program for Photovoltaic are as displayed on the table below:

Renewable Generator Type and Size	FIT Energy Payment Rate (¢/kWh)
Tier 1 PV < = 20 kW	21.8
Tier 2 PV > 20 kW and < = 500 kW	18.9
Tier 3 PV > 500 kW and < = the lesser of 5 MW or 1% of the system peak load	19.7
Baseline FIT Rate	12.0

Data available at the HECO website show the actual rate of electricity is 33 cents per kWh for residential customers as of March 1, 2012[14], HECO purchases the same unit for 21.8 cents under FIT program. Besides the spread that HECO makes between sale and purchase of electricity, a customer is required to enter in a 20 year contract with HECO for the sale of renewable energy under FIT program. Residential customers are provided with a one-time opportunity to convert from Net Energy Metering to Feed in Tariff if they desire to do so. Another important difference between NEM and FIT is the applicability of tax exemption. NEM is tax exempt while electricity sold under the FIT program is taxable.

d. Policy Choice under FIT program;

Similar incremental changes in the FIT program can help accelerate the adoption of renewable electricity generation in the residential and the commercial sector. We may consider the following policy options in the FIT program:

[13] Hawaiian Electric Company, Feed in Tariff Program
http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnextoid=0b0a8618ce4f7210VgnVCM1000005c011bacRCRD&vgnextfmt=default&cpsextcurrchannel=1

[14] http://www.heco.com/vcmcontent/StaticFiles/FileScan/PDF/EnergyServices/Tarrifs/HECO/EFFRATESJAN2012.pdf

I. The rate offered by HECO in the FIT program needs an upward revision especially with the ever increasing price of electricity that HECO charges from customers. Currently, for the residential sector, the price of a kwh electricity is 33 cents while in the FIT program HECO buys the same unit of energy for 21.8 cents resulting in a profit of 11 cents per unit for HECO.

II. In light of the increasing prices of electricity in Hawaii, the Public Utility Commission should clearly define the time period for revision of rates fixed in the FIT program. As per the current regulations, the PUC has the authority to revise the rates for FIT program; however, there should be an explicitly defined period time period for this process.

4. PROJECTED OUTCOMES

In case of the NEM policy option application, we assume the scenario of an average residential unit in Hawaii. The PUC in its 2011 annual report mentions that 47.4 MW of electricity is generated under NEM contracts that are mostly residential. We assume that an average residential unit consumes around 600kwh of energy every month. Keeping in view the maximum limit of 10kW of NEM for residential units we assume that average photovoltaic system installed is 5kw. Based on our calculations we assume that the potential capacity for an average home is about 7kw but since the unused credit will expire in 12 months therefore most of the units prefer to use optimum capacity renewable energy systems. The additional 2kw of power can be generated by every residential unit provided there is an incentive by HECO to do so.

Alternatives	**Number of Residential/Commercial Units[15]**	**Total Net Benefit to Residential Units[16] (Dollars/year)**	**Additional Power Generated (KW)**	**[17]Average Savings for each Residential Units(Dollars/year)**
Increase the length of time for credit or pay for the unused credits at the retail rate	9480	625680*12= 7,508,160	18960	66*12=792
Unused credits are offset against the 18$ fixed line rent	9480	216*9480= 2,047,680	0	18*12=216
Increase in rate of Feed-in-Tariff (Commercial Units)	37	6600*12=79,200	0	2140

This will roughly create a benefit of $7.5 million dollars to the customers each year while producing 18,960 kilowatts of power additionally. On average a residential/commercial units would get a benefit of $792 dollars per year by having the option either to sell or utilize the unused credits after the 12 months period.

[15] Total NEM (KW)/Average Capacity of Photovoltaic system in a residential unit(KW)
[16] Single unit residential savings*total number of units with renewable energy installations
[17] We assume that an increase of 2KW capacity fulfills almost 20% of an 800kwh electricity consumption of an average residential unit i.e. 200kwh*0.33(cents/kwh)= 66 dollars

This option is in conformity with two recent decisions of the Public Utility Commissions in California and New York. In June 2011, the California Public Utilities Commission set the compensation rate for NEG (Net Electricity Generation) 12-month average spot market price for the hours of 7 a.m. to 5 p.m. for the year in which NEG was generated. (Alternatively, net-metered customers may opt to carry forward NEG indefinitely.)

Similarly in May 2011, the New York Public Service Commission issued an order that required utilities to (1) adopt consistent NEG credit calculations that include all kWh-based customer charges and (2) allow customers eligible for an annual cash-out of unused NEG at avoided cost, such as residential solar customers, to make a one-time selection of the annual period in question.

Policy alternative II talks of offsetting the unused credits against the fixed line rent of $18 dollars/month that HECO charges from its customers. As discussed above typical residential units generates 1000kwh extra per annum that goes to the grid through NEM. Out of total $792 dollars savings residential/commercial units would be able to get only $216 (18dollars*12months) thereby resulting in a loss of $576 dollars each year. The aggregate effect of this program will be $2.1 million dollars benefit to the customers if we use this alternative.

The third alternative is changing the electricity price under the Feed in Tariff program. FIT program is mostly targeted at the commercial projects in Hawaii. There is 0.54 MW installed capacity under the feed in tariff program for the Tier 1 customers in Hawaii. Tier 1 customers can have a maximum of 20kw capacity generation systems. Under this category mostly the small commercial business and residential units are appropriated. Assuming that average capacity of FIT installed units is 15kw then there are 37 units operating in Hawaii. On average each unit produces 1500 kWh that it sells for 33 cents, full retail value, to the utility. The increase in rate from current 21cents/kwh to 33cents/kwh will generate an average net benefit of $2,014 dollars to each customer in one year. While in aggregate terms due the limited scope of the FIT program the total net benefit equals to $79,200 dollars per year to existing FIT customers

Losses to HECO under Different policy Options

Options → Losses ↓($)	Current Customer Base	A 10%** growth in the current customer base over the next five years ($ Dollars)					Cumulative Total From 2014 to 2018 ($ Dollars)
		2014	2015	2016	2017	2018	
Increase the length of time for credit or pay for the unused credits at the retail rate	0*	0	0	0	0	0	0
Unused credits are offset against the 18$ fixed line rent	2,047,680	2,252,448	2,477,693	2,725,462	2,998,008	3,297,809	13,751,420
Increase in rate of Feed-in-Tariff (Commercial Units)	79,200	87,120	95,832	105,415	115,957	127,552	531,876

*Assuming that HECO recovers its administrative and technical cost though 18$ per month from customers any revenue generated through the unused credits of the households under NEM program does not technically classify as a loss to the HECO systems.

**A conservative estimate based on the per capita solar installation of 32.9[18] in Hawaii placing the state at 2nd position in the nation.

[18] Interstate Renewable Energy Council, 2011 Trends and Updates.

5. Evaluative Criteria:

We will use the following criteria to assess the three different policy alternatives that we have discussed in detail above. Our evaluative criteria consists of three measures i.e. efficiency, effectiveness and administrative feasibility. A brief description of each criterion is below;

1. Efficiency; efficiency is a way of justifying policy action on the basis of economic principles. This criterion strongly encourages policy makers to analyze the cost and benefits of a policy option and change or substitute something different.
2. Effectiveness; this criterion primarily deals with determining the goals and objectives of policy options and how successfully are these achieved. It gives the policy analysts the leverage to gauge the success of the policy against objective measures that are set.
3. Administrative feasibility; It measures the likelihood that an agency or department can implement the policy well.

Options → **Criteria ↓**	Increase the time span for unused credits/pay the households at the full retail electricity	Adjust unused credits against Fixed line rent of 18 dollars per month	Increase the rate of electricity under the under Feed in Tariff program
Efficiency	Net benefit to the customers is significant and it will incentivize the residential sector to install higher capacity renewable energy systems.	Residential customers get partial relief; however, they might not be able to get full value for the unused credit if the value of the unused credits exceeds the annual fixed line rent.	The commercial units get into advantageous position since they will get a higher price for the electricity that they produce. This may spur the growth of FIT program in small businesses commercial ventures.
Who gains?	Residential customers are the net beneficiaries.	Residential customers gain to some extent but not fully.	Commercial units are the net beneficiaries
Who loses?	Utility companies do not necessarily lose any revenue since the unutilized credits are not produced by these companies rather by the residential units.	The utility company may lose some revenue in the form adjusting fixed line rent against unused credits; however, they may still retain some revenue if the unused credits are of higher value than the revenue lost in fixed line rent.	Utility companies lose the most.
Effectiveness	The large number of residential units makes it more effective to achieve the desired objectives of this option. It will further diversify the renewable energy initiative in Hawaii.	This will have essentially the same impact of effectiveness on the residential units.	Only a few commercial small projects exist under FIT program. Initially a rate increase would be more suitable for the big power producers under FIT program.
Administrative Feasibility	It is administratively easier to implement this option. The Public Utilities Commission can direct the utilities adopt this option for NEM residential customers.	The PUC can direct the Utilities to implement this system for residential users.	It would not be easy for utility companies to increase the rates to full retail value. A relief to Tier 1 customers may create pressure to provide the same to Tier 2 and 3 customers. In that case it would be difficult to administer this option.

6. CONCLUSION

The evaluative criteria for different alternatives shows that the best option to motivate and stimulate the use of renewable energy technology in the residential and commercial sectors is to give incentives to have the unused credits for an indefinite period or to get the full retail value price for the unused credits. Customers who have surplus unused credits at the end of 12 months would be able to carry them over indefinitely which gives them an incentive to produce more renewable energy. The upfront cost for a high capacity system is offset by tax rebates that the customer receives over the next few years. Similarly part of the high upfront cost may also be mitigated through private financing and/or leasing of photovoltaic systems coupled with decreasing prices of the PV modules in US. More importantly, customers who have installed high capacity systems will be able to produce additional energy that they can sell back to HECO while simultaneously increasing green energy production in Hawaii and decreasing depend of imported oil for electricity generation. The Public Utilities Commission can direct the utility companies to pay retail value of the credit to the customers if they do not use the credit by the end of the year.

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