Carl Freedman, Independent Entity

Hawaii Public Utilities Commission Docket No. 2012-0036
Integrated Resource Planning (IRP) For:
Hawaiian Electric Company, Inc. (HECO)
Maui Electric Company, Ltd. (MECO)
Hawaii Electric and Light Company, Inc. (HELCO)

May 10, 2013

To: IRP Advisory Group (IRPAG) Members and
Ross Sakuda, Hawaiian Electric Companies (HECO Companies)

From: Carl Freedman, IRP Independent Entity (IE)

Re: **IE Interim IRP Process Status Report and Statement of Concerns**

The IE provides this status report and statement of concerns (Interim Report) to inform the HECO Companies, the IRPAG and the Commission that, based on the information and materials provided by the HECO Companies to date and based on statements by the HECO Companies regarding what further information and analysis will be provided, unless supplemented by further analysis, the IE will not be able to certify that the IRP process is being conducted consistent with the Revised IRP Framework (Framework) and will not sufficiently or meaningfully address the Principal Issues identified for the IRP process.

CONTEXT AND SCOPE OF THE INTERIM REPORT

The Framework identifies several roles for the Independent Entity (IE) in the IRP process. These roles include, among others, responsibilities to: facilitate the meetings of the IRP advisory group(s), ensure that the process proceeds meaningfully and in timely fashion, ensure that the advisory group is provided with necessary information, report to the Commission regarding the issues and status of the process and, ultimately, certify whether the process is executed in a manner consistent with the Framework.[1]

This Interim Report is provided consistent with previously established protocols for the provision of comments, concerns, requests, reports and certifications by the IE.[2] Although the substance of this report is a critical assessment, the objectives are constructive. The statement of concerns is intended to provide constructive advance notice to the utility

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[1] The duties of the IE are described in section III.C of the Framework at pages 5 – 7 and elsewhere in context throughout the Framework.

[2] "Protocols for Comments, Concerns, Requests, Reports and Certifications from the IRP Independent Entity", September 6, 2012. As explained in the memo, the protocols were established consistent with the IE's responsibilities to "facilitate communications and communication protocols between the utility, Advisory Group, and the public…" (Framework section III.C.2.b.(6) at page 6)

regarding matters that bear on the IE's ultimate responsibility to certify that the planning process is being conducted consistent with the Framework.[3]

The Framework provides that the IE shall certify that the planning process is being conducted consistent with the provisions of the Framework at several key phases of the IRP process including: (1) establishment of the scenarios to be evaluated, (2) establishment of the planning assumptions, (3) the end of the analyses of resource plans for the scenarios, (4) development of the Action Plan, and (5) filing of the IRP Report.[4] This Interim Report addresses the anticipated IE certification of the third key phase: (3) the end of the analyses of resource plans for the scenarios.

The concerns identified in this Interim Report should not be interpreted as a comprehensive or final assessment of the scope, compliance or merits of the HECO Companies' implementation of the IRP process. First, it is recognized that the HECO Companies are in the active process of continuing analysis and the information and materials provided to date are necessarily provisional. Second, this interim report attempts to highlight certain concerns that are most prominent or have been previously identified; it is not an attempt to provide a comprehensive review.

The scope of the issues and analysis required to be addressed in the IRP process is determined by the Framework and the identified Principal Issues.[5]

Several concerns are expressed below regarding the details and merits of some analyses, but this is not the primary focus of the Interim Report. There has not been sufficient opportunity for a thorough probative assessment of the merits of the analyses. The primary focus is on determining whether the IE would be able to certify that the IRP process is being conducted consistent with the IRP Framework and addresses the Principal Issues, based on information available at the time of the review.

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[3] It is not required by the Framework, nor is it suggested here, that the IE must notify the utility regarding matters pertaining to compliance (or non-compliance) with the Framework prior to the IE making findings in a certification filed with the Commission. The protocol followed here is intended to provide a helpful context for the IE to note concerns as soon as possible (whenever this might be possible) so that the concerns may most effectively be addressed by the utility.

[4] Framework section III.C.2.b.(6) at page 6.

[5] The HECO Companies identified the Principal Issues to be addressed in the IRP process in a document in "chapter" form titled, Principal Issues, dated October 19, 2012 (Principal Issues). An update to this document was most recently provided dated April 25, 2013. The content of the companies' Principal Issues is derived primarily from the language in the Commission's Order No. 30534: IDENTIFYING ISSUES AND QUESTIONS FOR THE HAWAIIAN ELECTRIC COMPANIES' INTEGRATED RESOURCE PLANNING, dated July 19, 2012 in Docket No. 2012-0036 (Order Identifying Issues and Questions). There are no intentional differences in meaning between these documents. Where there may be incidental differences in meaning, it is understood that the meaning in the Commission's Order will be applied.

The IE notes that the Interim Report is a straight-ahead evaluation based on the specific Framework provisions and Principal Issues. This is not an assessment of what further analysis might be feasible in the time remaining in the IRP process.

Although not explicitly cited, the IE incorporates several concerns noted by the IRPAG in comments and questions posed at IRPAG meetings and submitted in writing.

The subject matter in this report is presented in three sections:

- General Observations
- Credibility of the Resource Plan Analyses
- Scope of the Resource Plan Analyses

GENERAL OBSERVATIONS

(1) FRAMING OF BREATH AND PURPOSE

In the most general terms, there seems to be a difference between how the HECO Companies interpret and implement the purpose of the IRP process and a broader purpose and scope of issues and questions framed by the Commission in its Order Identifying Issues and Questions. The issues and questions identified by the Commission encompass the development of information to inform several important over-arching policy questions, including: the affordability of utility rates; the costs of meeting the State Renewable Portfolio Standards (RPS) and Energy Efficiency Portfolio Standards (EEPS); the prudence of substantial investments in transmission and fuel supply infrastructure, assessment of the need and economics of possible inter-island transmission systems, and analysis of investments and alternatives to facilitate the incorporation of variable renewable generation technologies. The scope of the HECO Companies' analyses seems to be more narrowly focused within the bounds of a work plan and approach using a specific scenario planning approach and a specific resource analysis model (Strategist) to analyze resource planning issues.

The HECO Companies have been resistant to supplementing the work plan and approach that the Companies originally presented at the very beginning of the planning process prior to the identification of the Principal Issues. Early in the process it was pointed out to the Companies that the particular scenario planning process approach adopted by the Companies was time consuming and added problematic complexity. It was also stressed that the Strategist model would not cover the full scope of the necessary analysis of the Principal Issues and that other types of analysis would be necessary. At the an IRPAG technical session on October 30, 2012, it was agreed (but only after several hours of encouragement and argument by the IE and advisory group) that the Companies would perform some basic limited analysis of energy efficiency implementation and would do some supplementary studies in addition to and parallel with the Strategist model.

Shortcomings in the scope of the Companies' analyses became clear with the first presentation of the resource plan analyses at the April 2, 2013 IRPAG meeting. The

analyses remain fundamentally limited to the scope of what issues can be addressed using the Strategist model. The supplementary studies, as noted below, do not meaningfully address the Principal Issues.

(2) IRP PROCESS SCHEDULE

The analysis of resource plans has been running substantially behind schedule.

In the original IRP process schedule filed with the Commission by the HECO Companies on May 30, 2012, the initial presentation of preliminary results of the resource plan analysis was scheduled for a January 2013 IRPAG meeting. A second IRPAG meeting was scheduled for March 2013 to review analysis results and obtain IRPAG feedback. At the encouragement of the IE, an additional IRPAG meeting date was scheduled for February 2013 to allow additional opportunity for IRPAG review and consideration of IRPAG input.

In January 2013, the HECO Companies reported to the IE that the resource analyses had not progressed sufficiently to provide useful information. Consequently, the January 2013 IRPAG meeting was cancelled. In February 2013 it was again reported that preliminary results of the resource plan analyses were not available for presentation. The agenda of the February 25, 2013 IRPAG meeting was adjusted to include only a brief report by the HECO Companies regarding the amended schedule and the status of progress on the resource plan analyses. The bulk of the February 2013 IRPAG meeting was dedicated to discussion regarding improving the characterization of qualitative metrics. In March 2013 it was again determined that preliminary results of the resource analyses would not be ready to present by the time of the March 2013 IRPAG meeting. The IRPAG meeting was postponed and rescheduled on April 2, 2013.

At the April 2 IRPAG meeting it became clear that the analyses of resource plans were not complete and, although provided with voluminous documentation in spreadsheet format, the analyses were in “raw” form without explanatory or interpretive documentation. Additional resource plan analyses were presented by the Companies at a technical session on April 8, 2013. An additional technical session was held on April 22, 2013 to provide explanation and clarifications regarding the analyses.

At the IRPAG meeting on May 1, 2013 the HECO Companies provided a projected slide presentation explaining how the resource analyses addressed the identified Principal Issues. Several more-recent resource plan analyses were presented in the form of projected slides. The companies stated that further analysis of resource plans is underway.

One concern at this late date in the one-year IRP schedule is that the limited amount of time remaining in the process will not allow for sufficient presentation and review of the resource plans and Action Plans by the IRPAG. The initial presentation of resource plan analysis results originally scheduled in January 2013 did not occur until April 2013. The three-month period originally scheduled for review and iterative consideration of IRPAG comments has been compressed into a few weeks late in the IRP process. The Companies are now faced with a dilemma, having very limited remaining time to: complete existing analyses; perform necessary follow-up analyses; present and interpret the analyses; respond to IRPAG questions and comments; draft, present and revise Action Plans; assemble a draft IRP

Report with supporting documentation and expository text; review the draft report with the IRPAG (and any public meetings); and finalize, produce and file a final IRP Report.

A backlog of comments and questions from the IRPAG remains essentially unaddressed including several substantial issues raised early in the IRP process.[6] The Companies have recently indicated that, due to scheduling constraints, responses to outstanding IRPAG comments and questions will not be provided until and included in the filing of the IRP Report on June 28, 2013. IRPAG comments include questions posed in order to understand the analyses, suggestions and observations regarding the analyses, identification of shortcomings in the analyses and general recommendations. For example, several general recommendations made by IRPAG members early in the IRP process include recommendations to consider price volatility and utility system emergency response flexibility. Many more recent comments address the scope and merits of the recently presented resource plan analysis.

CREDIBILITY OF THE RESOURCE PLAN ANALYSES

The term "credibility" is used to describe this section of the Interim Report to acknowledge that the identified concerns may very well be matters of perception and understanding but are nevertheless currently sources of doubt about the integrity of the process and the ultimate merits of the Companies' plans. Perception and understanding are both important. It should be clear that, ultimately, the Companies bear the burden to provide clear documentation and presentation of the resource analyses.

The extended time taken to execute the analyses of the resource plans has not allowed thorough documentation or explanation of the assumptions and analysis methods. The analyses are unfinished and ongoing. In light of these circumstances, the concerns identified below should be considered provisional.

(3) THERE IS NO CLEAR, VISIBLE CONVERGENCE TOWARDS USEABLE FINDINGS.

It is not clear, overall, how the multitude of various resource plan analyses is converging on useable findings that will result in robust Action Plans. Multiple plans have been generated for each of the four identified scenarios. It is not clear which resource plans or strategies, if any, are considered reasonable candidates to serve as desirable objectives for the Action Plans or how possible candidate plans will be determined. There does not yet seem to be any assessment of how any possible candidate plans or strategies would fare when tested under the diverse conditions represented by the four scenarios. It is not clear what types of findings and conclusions the HECO Companies plan to draw from the analyses or whether these will adequately support the proposed Action Plans.

It is possible that all of these uncertainties will soon be resolved. Meanwhile, without a clearly identified path that explains how the currently presented analyses will methodically

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[6] The IE has not required explicit of formal written response to IRPAG comments due to concerns regarding the inability of the Companies to make timely progress with the resource planning analyses.

result in well-crafted, well-supported, defensible Action Plans, it is difficult to maintain faith in the trajectory of the overall planning approach.

(4) THE ANALYSIS METHODS ARE NOT WELL UNDERSTOOD

For several reasons, the analyses and the analysis methods are not well understood, even by those individuals familiar or expert with regard to utility resource planning analysis. Without adequate understanding, there is justifiable skepticism and doubt about the merits of the analyses.

The analyses of the resource plans have been presented in fairly "raw" form. There has, as yet, been no thorough or written explanation of how the model was used, how the model inputs were characterized, what constraints were used in the analyses (what was tested versus what was presumed) or how the results of the model should be interpreted. Some components of the analyses are not shown or explained, including the derivations of several types of model inputs. There has been limited time in the planning process schedule for review of the analyses due to the extended time taken to produce analysis results. Understanding is improving with responses to questions but the time available during IRPAG meetings and technical sessions to address questions is limited. There have been no written responses to IRPAG comments or questions regarding the resource plan analyses in the third key phase of the IRP process.

One substantial remaining task for the HECO Companies is a clearly written presentation of the analysis methods. It is required by the Framework that the final IRP Report must include a "full and detailed description" of the analyses and that the submission "should be simply and clearly written and, to the extent feasible and practicable, in non-technical language."[7] It would be helpful, but not explicitly required by the Framework, for this description to be provided, at least in draft form, by the time the IE must certify the completion of the analysis of the resource plans. Without adequate explanation, certification will be difficult.

(5) THERE ARE QUESTIONS REGARDING CORRECTNESS OF ANALYSIS METHODS

The correctness of several analysis methods is in question. To some extent this may be a matter of lack of understanding of the analysis methods. Some aspects of the analysis, however, as far as they have been explained, do not appear to be sound. Several examples are provided below.

METHOD OF DETERMINATION OF FIRM RESOURCES

It is not clear why the "Firm" resources step in the analyses is applied in the manner it is applied and why it is applied so "finally" without later re-visitation and re-examination. It was explained that one reason for this step was to manage the potentially preclusive complexity of re-optimizing resource plans in later steps. It is clear, however, that resources added in later steps affect the system economics, so that the firm resources selected in the initial "Firm" step may not ultimately be optimal choices in the resultant plans.

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[7] See Framework section IV.D.1.a at page 12 and section IV.D.1.c at page 14.

It is also unclear why the firm resources "permanently" selected in the initial "Firm" step are allowed to include resources selected for economic rather than strictly reliability-related system expansion criteria. This approach seems inconsistent with the described purposes and logic underpinning the sequential "stepped" analytical approach.

One specific shortcoming of the method for determining firm resource additions is the lack of any consideration of the economics of providing operating reserves necessary to accommodate the large amounts of variable renewable generation resources included in the many of the resource plans. For example, some of the firm internal combustion engine (ICE) resources identified in the uniform information forms[8] (UIF's) provide substantially more economical spinning/regulation/operating reserve capability than the combustion turbine and biomass options selected as the firm resources in most of the resource plans. These ICE resources compare favorably in capital and operating costs and have favorable operational traits that are not considered in the analysis methods used to select firm generation resources. If and when the economics of providing ancillary services necessary to support variable renewable generation resources is considered, it appears that it would be necessary to revisit the determination of the most economical firm resources.[9]

It appears that some further analysis is necessary to ensure that the firm resources that will be targeted in the Action Plans are indeed the most appropriate and economical resource types.

ANALYSES OF WIND AND "LANAI WIND" RESOURCES

Several sizes of wind resource options with several assumed wind regime profiles are evaluated as resource options for the HECO, MECO and HELCO systems. Because of the ability to produce economical renewable energy, wind resources figure prominently in the many of the resource plans considered/generated by the analyses.

One resource that appears in many of the resource plans for the HECO (Oahu) utility system resource plans is the "200 MW Lanai Wind" option. The Lanai Wind option includes a wind project on the Island of Lanai and an undersea cable to supply the produced energy to the Oahu utility system. Unlike other wind options, the price and characteristics of the Lanai Wind option are based on a "term sheet" that is the result of a prior bidding process. Other wind resource options are characterized in a series of UIF sheets that include several resource sizes and site location wind speed profiles.

One important but clearly controversial question is whether a contract to proceed with construction of the Lanai Wind project should be allowed. Because this issue is potentially

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[8] Most of the generation resources considered in the Companies' resource plan analyses are characterized according to the information provided in "Uniform Information Form" format, most recently provided dated March 26, 2013 and available posted on the IRPIE.COM web site in folder number 15: "1506 IRP 2013 - Consolidated UIFs-Rev1_032613.pdf"

[9] Although recognized as a necessary consideration, the costs and economics of providing necessary ancillary services to accommodate variable renewable generation have not yet been considered or accounted in the resource analyses.

ripe and because it is controversial, it is important to carefully examine the merit of the analyses that examine and would purport to answer this question.[10]

For several reasons, the analyses presented so far in the IRP process do not provide meaningful information regarding the comparative economics of the Lanai Wind project. In particular, the analyses comparing the economics of the Lanai Wind option to other wind options that do not include an undersea cable are not performed using consistent assumptions and are not meaningful as currently analyzed. The prices assumed in the resource analyses are not determined in a consistent manner. Inconsistent cost escalation assumptions are applied.[11] The treatment of capital costs for the Lanai Wind option is different than the other wind options (and has not yet been presented for review). The comparison of the Lanai Wind option to the other wind options is, in essence, an "apples to oranges" comparison.

One of the Principal Issues in this IRP process is whether inter-island or inter-utility system transmission connections can increase the use of renewable resources, lower costs or provide other benefits. It is therefore appropriate and necessary to evaluate the economics of on-island renewable resource strategies compared to "other-island" resource strategies that utilize an undersea cable. This analysis, however, should be performed carefully using consistent assumptions and methods to ensure meaningful results.

The pertinent question regarding wind and cable options is whether it is worthwhile to incurr the capital expenditures for an undersea cable system in order to obtain more economical or additionally available wind resources on another island that has more ample sites and/or superior wind speed regimes.[12] It might be possible to perform a more consistent "apples to

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[10] Responses by the HECO Companies to questions exploring the intended or appropriate conclusions to be deduced from the "inclusion" of the Lanai Wind in the various resource plans have not been consistent or decisive. Although it remains somewhat unclear, it seems that the HECO Companies do maintain that the presented analyses support a finding that the Lanai Wind project is favorable to other wind options economically.

[11] The Lanai Wind option costs, including the costs of an undersea transmission system, were characterized as a fixed per-kWh-price that were not escalated during the planning period or study periods. The costs of other wind options were characterized as separately calculated and differently modeled capital costs, fixed O&M and variable O&M charges. O&M costs were escalated at 3% per annum (or 2% for one scenario) throughout the planning and study periods. Costs for the Lanai Wind option were set as of the date of the term sheet several years prior to in-service date. Construction costs for the other wind options were assumed to escalate annually until the in-service date and then again through the study period for assessment of replacement costs.

[12] One seemingly-essential consideration that is not discussed or investigated is whether inter-island transmission is necessary for the HECO Companies to meet the RPS. Several resource plans are identified that meet the RPS without inter-island transmission that feature large amounts of wind generation sited on Oahu. There has been no discussion or presentation of information that would address the feasibility or issues associated with siting wind or other renewable generation resources on the Island of Oahu versus siting on other islands.

apples" analysis using the wind resources characterized in the existing set of comparable UIF sheets, differentiated according to the wind speed regimes characteristic of each island, but using otherwise consistent assumptions regarding cost escalation and capital financing.

If the costs indicated in the Lanai Wind term sheet are substantially less than the costs for comparable wind generation options characterized in the UIF sheets (with similar technology and similar wind speed profile), this disparity is perhaps relevant as a basis to question and/or inform the accuracy and appropriate magnitude of the costs in the UIF sheets. If there are sound reasons to conclude that the Lanai Wind option costs should, in fact, cost less than the other wind options with similar wind profiles (i.e., they are not comparable), these reasons should be explicitly identified and examined since they would be important underpinnings for any findings. In any case, in light of the uncertainties and importance of this issue, it would be reasonable to conduct sensitivity analyses to verify that any asserted conclusions are accurately characterized and well founded.

SCOPE OF THE RESOURCE PLAN ANALYSES:

A primary focus of the IE's certification is determination whether the IRP process is being conducted consistent with the Framework and addresses the identified Principal Issues. This section of the Interim Report provides a forward-looking evaluation based on the specific wording of the Framework provisions and Principal Issues based on information that is available at the time of review.

(6) FINDINGS IDENTIFIED IN THE CERTICATION OF KEY PHASES I & II

The IE provided a *Certification of Phases I & II of the HECO/MECO/HELCO IRP Process* on December 31, 2012 (prior Certification). In the prior Certification the IE identified several findings regarding compliance with the Framework and Principal Issues. Two findings that remain unchanged are reiterated below as summarized in the prior Certification:

- *One aspect of the planning process to date is clearly non-compliant with specific Framework provisions:*

  The scope of resource options considered and analyzed in the process does not include "all appropriate, available, and feasible resource options". Several resource options, including resource options identified in previous IRP plans, by advisory group members and/or listed in the Framework are not explicitly included in the resource options characterized for analysis.

  Resource options were not screened based on any of the specific screening criteria identified in the Framework or according to other criteria established with input of the advisory group.

- *The IRP process, as currently being implemented, will not evaluate customer-sited distributed generation strategies. It appears that an important question identified by the Commission will not be squarely addressed by the planned resource analysis: What investments in utility system infrastructure or expenditures towards mitigating*

system operating protocols are sufficient and justified to accommodate additional variable renewable distributed generation resources.

- *Customer-sited distributed generation is being considered in the planned analyses only as an assumption, as a subtractive component in the demand forecasts in the planning scenarios. This approach will not produce meaningful evaluation of the merits of this potential resource strategy.*
- *Costs of customer-sited distributed generation resources are not being identified or counted in the analysis of resource plans.*
- *The economics and potential for providing ancillary services to accommodate additional variable generation resources will not be evaluated, either in absolute terms or in terms of comparing alternate means to provide necessary ancillary services.*

These findings are discussed in the prior Certification and in the section below that addresses compliance with the Framework provisions.

(7) THE ANALYSES DO NOT FULLY ADDRESS SEVERAL PRINCIPAL ISSUES

Evaluation of the extent to which the HECO Companies IRP planning analyses address several of the Principal Issues is provided below. Only those issues for which concerns are noted are listed. The title and text of the Principal Issues is in bold italic type. The text of the Principal Issues below reflects the Companies' October 19, 2012 version rather than the recently revised version provided on April 25, 2013.

4. Energy Storage.

Consider hydrogen and other available energy storage technologies to stabilize the grid when necessary.

The HECO Companies have characterized and performed some analysis of a lead-acid battery energy storage system. There are no hydrogen storage or pumped hydroelectric storage technologies currently identified or characterized for analysis in the planning process. The Companies have announced that energy storage technologies will be considered conjunctively using battery energy storage options as a proxy for all storage options in the analysis of resource plans.

At the May 1, 2013 IRPAG meeting, the Companies presented an analysis of battery energy storage economics documented in several projected slides. The analysis compares two resource plans for the MECO system that are identical except that one plan does and one plan does not include a battery energy storage system installed starting in the year 2020. The conclusions derived from this analysis are that adding battery storage reduces curtailment of variable renewable generation but increases total resource costs. It was clarified that, although the analysis considers at least some of the effects of the battery energy resource on the dispatch of generation resources, the analysis does not consider or measure the ability or impacts of the battery resource to stabilize the grid.

The focus and scope of this analysis seems to be determined more by the nature and capabilities of the Strategist model than by the nature of the pertinent question. Batteries have not been considered for the Hawaii utility systems for purposes of reducing curtailment in the manner simulated in the model. Batteries are being considered and added to serve other system objectives such as providing ancillary services that are not considered in the analysis presented.

In response to a question by the IE, the HECO Companies stated that this analysis is intended to be full scope of resource analysis regarding battery storage in the IRP process. Further analysis of battery energy storage systems is not included in the analyses performed regarding the Principal Issue: Essential Grid Ancillary Services.

While the Companies' battery-storage-proxy approach might be reasonable as an initial exploration of energy storage options, it is not compliant with the specific directive in this Principal Issue to "[c]onsider hydrogen and other available storage technologies". The single analysis that was presented also does not serve to consider the ability of storage technologies "to stabilize the grid when necessary". There is further discussion below regarding the Principal Issue: Essential Grid Ancillary Services.

Battery and other storage technologies may be important resources for Hawaii's island energy systems. The information and analyses presented so far, however, do not consider or explain the nature, costs or potential magnitude of the benefits that could be provided.

5. Waste-to-Energy Facilities.

Consider generating electricity from waste-to-energy facilities to serve as an untapped fuel source.

Waste-to-energy resource options were assessed in analyses performed for the MECO (Maui) and HELCO systems. A summary of the results of some analyses was presented at the May 1, 2013 IRPAG meeting in several projected slides but these analyses have not been presented in detail. The summary concluded that the waste-to-energy resources were not cost competitive against other renewable options based on the analysis assumptions but that the projects might actually prove cost competitive considering factors not included in the analysis.

Tipping fees that could provide an actual revenue stream and other benefits to the affected Counties (i.e., avoided landfill impacts and investments) were not analyzed.[13] One reason for not including tipping fees in the analysis seemed to be the Companies' perception that this was not possible to accomplish using the analysis model. Based on some further

[13] Tipping fees for Oahu, Hawaii and Maui islands were identified in the UIF forms as 91, 85 and 63 dollars per ton respectively. These fees would approximately equal or exceed (depending upon which county) the fixed O&M costs stated in the UIF sheets for the waste-to-energy option. Several components of the capital costs included in the UIF sheets might, in fact, be avoided in conjunction with embedded or reduced land, citing and planning costs associated with ongoing or avoided county landfill operations.

discussion at the May 1, 2013 IRPAG meeting it has been credibly asserted that there are several possible ways to incorporate tipping fees and other benefits in the analysis.

The analysis and consideration of waste-to-energy resources in the IRP Analyses and Action Plans may have exceptional importance. Unlike many other firm resource options, these facilities would not be effectively bid directly into any later "all-source" utility-sponsored competitive bidding process. Although the counties would likely be the project developers, the counties would probably have to contract for construction of any waste-to-energy facilities by a county-sponsored competitive procurement process. If there does prove to be substantial value in waste-to-energy resources, it may be necessary to identify specific steps to enable consideration of effective procurement.[14] Sufficient analysis to provide meaningful assessment of the merits of waste-to-energy facilities in the IRP process could establish whether any necessary exceptional procurement considerations are warranted.

The HECO Companies have performed and presented a basic, inconclusive analysis of waste-to-energy resources for one utility system.[15] Several factors have been identified that could improve the merits of the analysis. If determined to have promising value, the means to allow for possible effective procurement should be considered.

8. Best Use of HECO CIP CT-1 Generating Facility.

The IRP must ascertain whether the current exclusive use of biofuel in CIP CT-1 reflects the highest or best use of the unit. For example, can greater efficiencies, and/or overall system benefits be gained if CIP CT-1 is used to support the maximum integration of renewables through the use of more efficient and/or cheaper fuels, rather than limiting CIP CT-1 use as a biofuel peaking unit with a negligible contribution to the Renewable Portfolio Standard?

The HECO Companies have performed and presented analysis specifically addressing this Principal Issue. Although subject to further review, the findings of the analysis appear to be meaningful: (a) operating the CT-1 unit using USLD or LNG fuels would be less expensive than continued operation using currently-priced biofuels and (b) a utility-scale PV resource would be a less expensive alternative to provide renewable generation penetration for the HECO system than continued operation of the CT-1 unit on currently priced biofuels.

These findings answer at least part of the Principal Issue. It is not yet discussed or analyzed whether benefits would be gained by using the CT-1 unit to "support the maximum integration of renewables". This objective suggests that the unit might be used in other ways, for example: at higher levels of dispatch to provide both up and down regulation/operating reserves (rather than the existing dispatch of the unit at minimum loads

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[14] The Framework provides that the Action Plan shall identify the intended means of procurement or implementation of the included resources. (Framework, V.C.10.f at page 20).

[15] It may also be the case that waste-to-energy resources were included in the preliminary, screening and/or "firm" resource analysis steps of the resource analyses but no such analyses have been identified, documented or presented.

to provide system spinning reserves). If, perhaps, this utilization of the CT-1 is so obviously uneconomic or impractical that it does not merit more explicit analysis, this should at least be explicitly discussed and justified.

One clear question begged by the rather extreme dis-economies of running the CT-1 unit is whether it would be beneficial to add a heat-recuperating steam generation addition to CT-1. Would the increased efficiencies of combined-cycle operation be cost effective, either generally as a system resource or more specifically as a means to provide "more efficient" fuel use and/or to "support maximum integration of renewable"?

The HECO Companies have performed apparently meaningful analysis addressing this Principal Issue. A complete and compliant response would require at least some discussion and, as necessary, supplementary analysis to address the specific issues identified above.

9. Reasonable Cost and Rate Impacts.

The Companies, with input from the Advisory Group, must consider whether the IRP report and Action Plan result in affordable electric utility service. Reasonable cost is an important objective for resource planning identified in the statement of the goal of Integrated Resource Planning. The affordability of utility-provided energy services is a primary concern and objective of the Commission, especially in light of the need for timely implementation of statutory standards and goals and the need to maintain reliable energy service. Among any other possible measures of the achievement of this objective, the Companies' planning analysis shall include meaningful measures of the rate impacts of the Resource Plans and Action Plan evaluated in accordance with the planning scenarios, forecasts, and sensitivity analyses. The Companies shall determine meaningful methods to measure rate impacts with input from the Advisory Group.

Costs and rate impacts are identified for many of the resource plans presented in the analyses.[16] The quantification of these costs and rate impacts is not comprehensive, excluding several components of overall costs that have not yet been determined or included. As clarified several times by the IE, the objective required by this Principal Issue is a complete, "all-in" assessment of the costs of providing electric utility service. This requires a careful and comprehensive analysis of utility costs and rate impacts. Several cost components that may not be fully expressed in the cost and rate estimates presented so far include: costs of smart grid measures, costs of ancillary services necessary to accommodate the amounts of variable renewable generation resources in some resource plans, several components of transmission costs associated with some specific resource plans, transmission and distribution costs generally (to the extent these exceed any assumed corresponding depreciation), reasonable estimates of expected increases in utility

[16] Some of the more recently presented analyses have not yet been accompanied by documentation identifying detailed quantitative metrics such as rate and bill impacts.

base expenses, and costs for life extension and increased maintenance costs for older generation units.[17]

Affordability has been emphasized by the Commission as a primary concern and objective. The HECO Companies are directed to consider this objective "with input from the Advisory Group" and specifically to "determine meaningful methods to measure rate impacts with input from the Advisory Group." These directives to incorporate IRPAG input have not yet been executed by any explicit deliberate process. The IE has on several occasions expressed the need and willingness to accommodate this process. Now that some cost and rate impact statistics are available, at least in provisional form, the time seems ripe to comply with the directives in this Principal Issue.

In order to meaningfully interpret the magnitude of the costs and rate impacts reported by the resource analyses it is necessary to clarify the rate of inflation assumed in the analyses. The costs in the analyses are stated as nominal costs over the life of the planning and study periods. Several cost escalation rates are identified for operating and construction costs. Capital costs are characterized using specific cost rates for several elements of the cost of capital. Discount rates are used to state planning and study period costs in terms of net present values. It is presumed that all of these escalation, capital cost and discount rates are expressed in nominal terms. The rate of inflation assumed in these rates, however, has not yet been explicitly identified. It would be reasonable to interpret and express meaningful assessments of future costs and affordability in "real" terms, accounting for the effects of inflation. There should be some discussion to ensure that the various assumptions regarding escalation and discount rates are consistent and appropriately applied.[18] Any implicit assumptions regarding inflation (nominal versus real dollars) should be explicitly indentified.

The consideration of cost and rate impacts seems to be an ongoing effort by the HECO Companies that is not yet complete. Final determinations regarding compliance with this Principal Issue are therefore premature. A complete and compliant response to this Principal Issue should address the concerns identified above.

10. RPS Rate Impact.

The Companies shall consider in its analysis the cost and rate impacts that result from fully attaining, various levels of partially attaining, as well as exceeding the current RPS law.

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[17] The increasing costs of maintaining older units figures prominently in the capital budgets and recent decoupling rate adjustments for the HECO Companies. These substantial costs should be realistically accounted for in the assessments of rates and affordability as well as in economic comparisons of strategies and resource plans that maintain versus retire older generation units.

[18] The Framework requires that "The utility shall fully explain the rationale for its choice of discount rates, assumptions and procedures." (Framework, V.C.8.e at page 20).

The HECO Companies have analyzed the attainment of the RPS by including several alternate assumed levels of RPS requirements in the differing scenarios and by including several levels of attainment of the assumed RPS requirements as alternate resource plans/strategies. These analyses include at least preliminary statements of costs and estimates of rate impacts. It is not clear, however, how the analyses will be interpreted to formulate an answer the questions posed in this Principal Issue.

It should be noted that the Companies' statement of this issue above is different that the Commission's wording:

> What costs and rate impacts result from full attainment of the RPS. This evaluation shall include comparison of full attainment of the RPS with various levels of partial attainment as well as exceeding the RPS. [footnote omitted][19]

The HECO Companies' statement of this Principal Issue would require the Companies to consider costs and rate impacts. The Commission's wording further requires a determination and statement of the costs and rate impacts. This is a question that requires an answer, not just a requirement that a factor should be considered. As previously clarified and agreed, the Commission's wording is dispositive regarding compliance with the Principal Issues.

So far, there have been no conclusions or concise statement of the costs or rate impacts resulting from various levels of implementation of the RPS. As an underlying concern, there seems to be some wanting clarity and understanding regarding the procedures used to assess RPS attainment in the resource plan analyses.

Does implementation of the RPS result in increased costs? If so, what are the costs? What about alternative levels of RPS attainment? These questions have not yet been answered in any discernable way.

One concern has been noted by several IRPAG members and reiterated by the IE. The companies plan to characterize partially attaining, attaining and exceeding the RPS by assuming 75% attainment, 100% attainment and 100% renewable generation saturation respectively. The increment characterizing exceeding the RPS (100% renewable generation) is very large, equivalent to over 200% attainment of the RPS. Depending upon the outcome of the currently planned analysis, it may be necessary to also analyze a smaller increment of exceeding the RPS in order to provide the information sought by this Principal Issue.

11. EEPS Rate Impact.

The Companies shall consider in its analysis the cost and rate impacts that result from fully attaining, various levels of partially attaining, as well as exceeding the current EEPS law.

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[19] Order Identifying Issues and Questions at page 7.

The HECO Companies have performed several analyses to consider the costs and rate impacts of various levels of attainment of the EEPS. The analyses consider attainment of the EEPS by including several assumed levels of EEPS requirements in the scenarios and by including several alternate intensities of energy efficiency measure implementation as alternate resource options in several specific resource plans and scenarios.

The analysis of energy efficiency as a resource option performed so far is rudimentary in at least two fundamental respects:

First, the characterization of alternate levels of energy efficiency implementation intensity are relatively simplistic, presuming proportionally extrapolated and interpolated costs and impacts of the existing PBFA program portfolio to represent expanded or reduced energy efficiency implementation respectively. No specific energy efficiency measures or programs are being identified or tested.

Second, the analysis of various assumed intensities of energy efficiency program implementation have, so far, been performed only on generic resource plans assuming only ICE and SCCT generation resources as possible resource additions. This method makes some sense as a preliminary or screening approach.[20] Ultimately, however, a more meaningful test of the costs and rate impacts that result from various levels of energy efficiency implementation should be based on resource plans or strategies that more closely resemble the expected economics and mix of resources targeted in the Action Plans.

Other simplifying assumptions regarding the characterization of energy efficiency resources should be reviewed in light of the results of the analysis of resource plans. Since no characteristic hourly profiles of energy efficiency measure impacts are being used in the analyses, the analysis results should be examined to determine whether modeling assumptions result in overestimating energy efficiency impacts that reduce system minimum loads thereby overestimating resulting curtailment of renewable generation resources.

The results of the initial analyses presented by the Companies indicate that higher levels of investment in energy efficiency result in lower total resource costs. Exceeding the EEPS by 10%, the maximum amount tested, is the least-cost case in all cases tested. Pending verification by more meaningful analysis, this result suggests that higher amounts of energy efficiency than what was tested may be a preferred option. An existing ongoing study of technical and economic potential of energy efficiency will indicate the potential magnitude and costs of the available energy efficiency more accurately than the rudimentary characterization in the Companies' IRP analyses. It would be valuable, meanwhile, to further explore the potential benefits of higher levels of energy efficiency program implementation in the IRP analyses. This analysis should help scope and consider potential measures in the Companies' Action Plans and inform the Commission regarding the extent

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[20] In order to measure the capacity-deferral value of energy efficiency measures it is most precise to use generation resource expansion plans that include deliberately small increments of deferrable generation. Ultimate accuracy requires consideration of the energy efficiency measures in the context of more realistic circumstances.

to which energy efficiency investments, if verified by ongoing studies, can best meet customers' energy needs.

As noted above regarding the evaluation of RPS impacts, the Companies statement of this Principal Issue above is different than the Commission's wording:

> What costs and rate impacts result from full attainment of the EEPS. This evaluation shall include comparison of full attainment of the EEPS with various levels of partial attainment as well as exceeding the RPS. [footnote omitted][21]

The HECO Companies' statement of this Principal Issue would require the Companies to consider costs and rate impacts. The Commission's wording further requires a determination and statement of the costs and rate impacts. As previously clarified and agreed, the Commission's wording is dispositive regarding compliance with the Principal Issues.

At the May 1, 2013 IRPAG meeting, the representative of the Public Benefits Fee Administrator (PBFA) clarified that energy efficiency measures can be targeted to specific geographic areas and can target specific load management objectives. This is a potentially valuable option that could be applied as a means to avoid or defer transmission or distribution system investments. In formulating Action Plans the HECO Companies should consider actions to investigate and utilize feasible and cost-effective geographically targeted energy efficiency and load management opportunities.

Further analysis is required to provide a fully compliant response to this Principal Issue.

12. Captive Customer Rate Impact.

The Companies must consider whether and to what extent utility customers who do not have a renewable energy device or have implemented energy efficiency measures could face high cost and rate impacts if utility sales decrease for any of several possible causes. The planning process should consider circumstances that could compound to result in high utility fixed costs and/or low utility system sales and evaluate the extent to which these circumstances could lead to high rate impacts and possible customer exit or self-generation.

At several times during IRPAG meetings and in prior quarterly and certification reports the IE has expressed concern that the HECO Companies' approach to addressing this issue may be deficient. Until announced otherwise at the May 1, 2013 IRPAG meeting, the companies have maintained that they did not intend to characterize customer exit opportunities or electricity rate thresholds that could result in increased customer exit or self-generation. At the May 1 IRPAG meeting it was announced that analysis of this Principal Issue is now a work in progress. The HECO Companies plan to determine the cost of LNG that would encourage customer use of fuel cells to self generate and will measure the rate impacts of a sudden decrease in utility sales. Several questions were asked regarding the reasons and

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[21] Order Identifying Issues and Questions at page 7.

justification for using a relatively expensive fuel cell resource to characterize the economics of potential customer exit or self-generation. The HECO Companies responded that the fuel cell option was selected because it was suggested and because there was an existing UIF sheet that characterized the fuel cell resource. Previous suggestions on this matter by the IE and the IRPAG actually suggested CHP or solar photovoltaic resources as possible options to characterize opportunities for customers to self-generate. Unless there is further justification for using the more expensive LNG fuel cell option, it is likely that customer exit and self-generation opportunities will be underestimated.

It should be clear that the question posed in this Principal Issue has broad implications that should be part of the consideration risks and uncertainty required by several specific Framework provisions.[22] Investments in renewable energy resources are characteristically capital intensive. Several specific large projects under consideration would entail substantial long-term fixed financial obligations that must ultimately be borne by future utility customers. These include possible inter-island transmission systems, LNG infrastructure development, environmental compliance investments and replacement of older generation units. All of these capital investments represent risks that need to be soberly considered in light of uncertainties regarding the magnitude and continuity of the utilities' future sales base.

It should also be clear that the question posed by this Principal Issue is relevant not just to determine overall potential costs and risks but also pertains to evaluation of differences between resource plans and strategies. For example, it may (or may not) be cost effective to replace existing older generation units with new more-efficient units but this would entail encumbrance of financial risks to the utility and future ratepayers (i.e., if sales decrease more than expected for any of various reasons including possible customer exit).

Similar to what is noted above regarding the assessment of RPS and EEPS costs and rate impacts, the Commission's wording of this Principal Issue more specifically requires quantification of possible captive customer cost and rate impacts whereas the HECO Company wording cited above requires "consideration." It should be expected that analysis of this issue should include some discussion and quantitative analysis of realistic customer exit opportunities and potential.

13. Resource Plans and Strategies.

The Companies must consider whether the Resource Plans effectively ensure affordable electric rates, maintain service reliability, and accommodate expected increasing proportions of variable and/or intermittent renewable generation resources.

This Principal Issue restates a general preamble in the Commission's Order Identifying Questions and Issues that pertains to several issues expressed more specifically in other Principal Issues. As clarified in discussion of the other issues, the HECO Companies analyses are not yet in full compliance with addressing this generally stated directive.

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[22] Framework: section IV.D.1.a.(4) at page 13; section V.C.6.f at page 18; and section V.C.8.d at page 20.

14. Inter-Island and Inter-Utility System Transmission.

The Companies must analyze the comparative costs and benefits of whether possible alternate inter-island and inter-utility system transmission connections across multiple islands can be used to increase use of renewable energy resources, lower costs of existing fossil-fuel resources, or provide other net benefits across multiple islands.

As discussed above, a Lanai Wind resource option that includes costs of an inter-island transmission system was analyzed as a resource option for the Oahu utility system. Several analyses were performed that evaluate cost and benefits of inter-connecting the Oahu and Maui utility systems or the Oahu and Hawaii Island systems.

One analysis presented at the April 8, 2013 IRPAG meeting considered the costs of an Oahu to Maui inter-utility transmission system and the conjunctive system operating cost savings resulting from the utilization and re-dispatch of generation resources on the interconnected systems.

At the May 1, 2013 IRPAG meeting two additional inter-utility transmission analyses were presented: one for the Oahu/Maui systems and one for the Oahu/Hawaii Island systems. These analyses included some changes in resource mix (and, in one case, unit cycling operation) as well as re-dispatch and energy transfers between interconnected island systems. The HECO Companies have not provided any written explanation of what conclusions are to be drawn from these analyses. The May 1 IRPAG meeting presentation slides show a lower cost for the inter-connected systems in both cases. It was stated that the analyses depict one case where the inter-connection is less expensive.

There has not been sufficient time to examine the assumptions and details of these analyses. Additional explanatory documentation needs to be provided regarding the analysis assumptions, including the specific characterization of transmission system capital, financing and operating costs.

The underlying question of whether the Companies can meet the RPS without inter-island transmission of energy has not been explicitly addressed. Several resource plans have been presented that meet the RPS including extensive wind generation installations on the Island of Oahu and that do not include inter-island transmission. There is no investigation or analysis presented, however, that examines the feasibility or issues associated with "on-island" versus "other-island" siting of wind or other renewable generation resources.

One clarification, based on the presentation materials and statements at the May 1 IRPAG meeting, is that the presented analyses measure the benefits of inter-connecting the Oahu system with another island that has additional economical renewable resources. The analyses do not measure whether it is more economical to provide renewable resources on Oahu versus providing the renewable resources on another island utilizing a cable. The specific analyses presented also do not assess whether there is value in interconnection to allow economical generation using low-priced LNG fuels on Oahu to flow to the connected neighbor island systems.

Further clarification and further analysis will be necessary to fully address the questions posed in this Principal Issue.

15. Smart Grid Implementation.

The Companies must analyze the comparative costs and benefits of whether adoption and utilization of a smart grid, including smart meters, should be completed by the Companies. The Companies shall analyze how these technologies could:

**** Enable the electrical grid to be operated more efficiently and reliably.***

**** Enhance customer service.***

**** Accommodate additional renewable energy resources by remotely controlling customers' loads.***

**** Increase energy efficiency and conservation through real-time transparency of energy usage and costs.***

To what extent can modifying existing and future distribution system design criteria and operation practices enable greater interconnection of distributed renewable energy resources?

The HECO Companies have identified several demand response programs that are continuations or expansions of the companies' existing programs. These programs appear to be characterized, at this stage in the planning process, only for analysis of the capacity deferral benefits of the programs. Other potential system benefits of the demand response programs have been identified in discussion and slides presented to the IRPAG but have not been quantified.

The Companies provided a report in "chapter" format to the IRPAG titled "Smart Grid", dated March 26, 2013. The report explains actions the HECO Companies are currently taking regarding smart grid measures. The report states that cost benefit analysis has been performed and includes a summary table from a recent filing with the Commission. The report identifies cost / benefit analyses conducted for other utilities.

Other than the limited analysis of the demand response program resource options noted above, and considering the limited information in the Smart Grid report cited above, the Companies have not yet quantified the magnitude of potential benefits or costs of the smart grid resource, smart meters, remote control of customer loads, real-time rate transparency, distribution system design criteria or operating practices. Costs or ranges of costs for these measures have not been identified. It is not discussed, quantified or analyzed which specific benefits or characteristics of Smart Grid measures would be targeted for each of the Hawaii utility system or to what extent the measures could or would attain the objectives identified in the Principal Issue. A meaningful determination has not been made or attempted regarding the costs or extent that the identified resources or system operation practices will be able to accommodate greater interconnection of renewable distributed generation.

This Principal Issue has not been addressed.

16. Strategies for Handling Environmental Regulations.

The Companies must analyze the comparative costs and benefits of strategies to comply with expected and possible changes in environmental regulations. One of the strategies to be analyzed is whether fuel switching will result in the net reduction in capital and operating costs when complying with new environmental regulations.

The HECO Companies have conducted meaningful analyses to address this Principal Issue. Indeed this seems to be the principal discernable logical focus of the initially presented resource analysis procedures.

Several aspects of the analyses need further development. For example, the economics of unit retirement need to be further explained and justified. The costs of life extension and any increased costs of maintaining older generation units should be included and excluded appropriately in resource plans that exclude or include unit retirements respectively. Feasible timing and logistics associated with unit retirements should be considered. Consideration of retiring an intermediate number of units should be considered in addition to the existing strategies that retire either few or most existing units.

Appropriate sensitivity analysis could be used to examine the extent to which results are determined by several uncertain estimates of alternative fuel costs.

17. Fuel Supply and Infrastructure.

The Companies must analyze the comparative costs and benefits of:

**** Modifying the fuel supply portfolio and delivery infrastructure—for existing utility and non-utility fossil generation resources—to reduce system fuel costs and/or reduce environmental compliance costs.***

**** Assessing the total cost (capital, fuel, and operating expenses) and merits of fuel supply strategies to utilize alternate fuels, supply procurement methods, and delivery options.***

One specific question concerns the fuel supply infrastructure requirements, including costs, necessary to provide diverse fuel sourcing, procurement, and delivery options. Will significant changes in fuel output by refineries operating in Hawaii affect the Companies' fuel supply options?

Beyond provision of the January 31, 2013 *Hawaiian Electric Company Fuels Master Plan*, analysis of the comparative costs and benefits of strategies to utilize alternate supply procurement methods and delivery options has not been presented.

Information or discussion has not yet been provided regarding effects of significant changes in output of Hawaii's fuel refineries. Will possible and/or anticipated changes in refinery infrastructure affect fuel supply price or reliability in future years?

It is not clear what actions are being considered regarding the HECO Companies' role in providing LNG infrastructure in Hawaii versus obtaining contracts for fuel delivery.

18. Fossil Fuel Generation Resources.

The Companies must analyze the comparative costs and benefits of:

**** Modernizing or adapting existing utility and non-utility fossil generation resources to achieve greater efficiency, reliability, and flexibility to reduce renewable energy curtailment.***

**** Assessing the costs and merits of retiring units (with or without replacement), minimizing the amount of must-run fossil generation, and enhancing the operational flexibility of generating units to reduce costs and increase renewable energy penetration.***

Some analysis of unit deactivation was performed in the analysis of environmental compliance strategies. There has not be discussion or analysis focused on the costs and merits of retiring units, minimizing the amount of must-run generation or enhancing generation unit flexibility to enable increased renewable generation. As noted above regarding analysis of CT-1 operation, there has not been consideration of increasing the efficiency and flexibility of the CT-1 unit by addition of a steam recuperating unit. More generally, measures to accommodate increased renewable energy penetration have not been substantially addressed, quantified or analyzed.

19. Essential Grid Ancillary Services.

The Companies must analyze the comparative costs and benefits of:

**** Implementing new technologies, measures, and strategies to decrease reliance on fossil-fuel generation resources, provide essential grid ancillary services, and accommodate expected increasing proportions of variable and/or intermittent renewable generation resources.***

**** Assessing the costs and merits of possible non-fossil fuel resources, technologies, or programs to provide quick-response capacity and other ancillary services—including modifying existing fossil and renewable energy generating units, customer demand response programs, and energy storage resources.***

One important planning and policy question is: What measures and investments are necessary and reasonable to enable higher levels of variable renewable distributed generation on each island system? Another important related question is: What are the best measures and costs of providing the ancillary services needed to accommodate increasing amounts of variable renewable generation on each island system?

The first question is important to effectively mitigate existing and future constraints in the amounts of variable distributed generation that can be accommodated on the island grids. This question is entirely ignored in the resource planning analyses.

The second question is important in properly determining the costs and rate impacts of the resource plans that are considered in the analyses. The costs of providing necessary ancillary services have not yet been incorporated in the analyses of resource plans.

The HECO Companies provided a report to the IRPAG in “chapter” format titled “Essential Grid Ancillary Services”, dated March 26, 2013. The report explains an existing effort to investigate the value of alternative ancillary services and determine a least-cost portfolio of

resources. The effort is described as similar to an earlier "EPS-cycling" study performed for the HELCO and MECO systems in the RSWG proceedings. No results of the ongoing or earlier studies are reported.

There has not yet been any discussion or analysis that would meaningfully address this Principal Issue or inform the two corollary questions identified above. No information, estimates or discussion is provided regarding the nature and magnitude of the need for ancillary services required to accommodate variable renewable distributed or transmission-level generation resources. Nor is information or discussion provided regarding the costs or obstacles in providing sufficient necessary ancillary services. There is no discussion or analysis of the relative costs and benefits of various methods of providing ancillary services.

Except for the identification of several instances of conversion of existing generation units to cycling service, any specific assumptions regarding provision of ancillary services that may be included in the resource analyses have not been identified. It is not clear what, if any, measures identified in the RSWG process have been considered or included in the analyses. It is not identified, for example, which units are designated as must run versus cycling service or whether the analysis assumptions reflect related options or policies discussed in the RSWG process.

In addition to examination of necessary ancillary services to address this Principal Issue, it is clear that some assumptions or estimates regarding the costs and impacts of necessary ancillary services will be required in order to meaningfully analyze increasing proportions of variable or intermittent renewable generation resources in the resource plan analyses. Zero is not the most appropriate estimate of expected costs for providing ancillary services for resource plans with substantial amounts of variable renewable generation additions.

This Principal Issue has not been meaningfully addressed.

(8) COMPLIANCE WITH SPECIFIC FRAMEWORK PROVISIONS

Compliance with specific Framework provisions is discussed for a subset of the Framework provisions below. Framework sections that do not pertain to certification of the third key phase of the IRP process and sections that do not have prominent compliance issues are omitted.

Although some concerns regarding the merits of the analyses are noted, the concerns do not attempt any comprehensive assessment of the merits. The primary focus is on whether the IRP process to date, particularly the third key phase of the process, complies with the Framework.

Framework provisions are in bold italic type.

V. Planning Guidelines

B. General Planning Guidelines.

2. Analysis supporting the Integrated Resource Planning Report shall:

a. provide meaningful support for the reasonableness of the Action Plan; and

The HECO Companies have not identified a draft Action Plan and have not disclosed the methods that will be used to develop and determine the Action Plan. In light of the other concerns expressed in this Interim Report, one primary general concern is whether the Action Plan will be sufficiently supported by meaningful analysis.

C. Specific Planning Guidelines

The process for developing utility Scenarios, Resource Plans and Action Plan, to the extent applicable, shall include the following.

3. Identification of uncertainties and factors that affect utility planning.

Uncertainties and factors that affect utility planning have been identified for the forecasts and scenario assumptions. Uncertainties regarding other aspects of utility planning, including characterization of resources, programs, measures and resource plan analysis assumptions have not been explicitly identified and discussed.

This Framework provision has not been explicitly addressed with respect to uncertainties associated with the resource options or analyses of resource options.

6. Identification of resource options.

a. The utility shall consider all appropriate, available, and feasible resource options in the development of the reasonable range of Scenarios and associated possible futures. Options may include: energy efficiency demand-side management programs; demand response and load management programs; distributed generation resources; smart grid measures; measures to mitigate constraints to the incorporation of as available or variable renewable generation resources; alternative renewable fuels; energy storage resources; alternative measures to provide ancillary services; and retirement or protective storage of existing generation units and related facilities.

According to a strict interpretation, the scope of resource options considered and analyzed in the process does not include "all appropriate, available, and feasible resource options." Several resource options, including resource options identified in previous IRP plans, options suggested by advisory group members, options identified in the Principal Issues and options listed in this Framework provision are not explicitly included in the resource options characterized for analysis. Currently omitted or excluded options include but are not limited to:

- any specifically identified energy efficiency measures or programs
- sea water air conditioning options
- customer-sited combined heat and power options
- hydrogen storage (explicitly identified in the Principal Issues)
- pumped hydroelectric storage

- o demand response programs beyond those already planned by the HECO Companies,
- o measures to mitigate constraints to the incorporation of as available or variable generation resources (other than battery storage options)
- o alternative measures to provide ancillary services and retirement or protective storage of existing generation and related facilities
- o coal-fueled resources[23]

Some logical reasons were offered by the HECO Companies regarding why some of these options are not being explicitly included in the analyses but the options were not "screened out" based on the provisions in section d. below.

The IRP process is not being conducted consistent with this Framework provision.

> ***c. The utility shall also include among the resource options to be considered in Section V. C. 6. a. above, the resource options that are or may be supplied by persons or entities other than the utility.***

Customer-sited distributed generation options are not being considered in the analyses except as components of the forecasted demand projections in the characterization of the scenarios. These resource options are not being characterized in accordance with Sections V.C.6.e. or V.C.6.f or V.C.6.g below.[24] No costs, benefits, underlying assumptions, uncertainties, limitations or infrastructure constraints have been identified. It does not appear that the HECO Companies currently have any intention of characterizing or analyzing the costs or benefits of implementing or accommodating additional customer-sited distributed generation.

The IRP process is not being conducted consistent with this Framework provision.

> ***d. The utility shall, upon review of the range of Scenarios to be analyzed, screen out those options that are not reasonably appropriate to Hawaii, are not reasonably expected to be available to address the identified range of Scenarios, or are clearly infeasible. The utility, with the input of***

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[23] Coal resources were discussed briefly as a potential "missing" resource option at one IRPAG meeting (in the context of omission of any projection of coal fuel prices) but there did not seem to be any support stated by any IRPAG members in attendance to include this option in the IRP analyses. Although this option was not "screened out" by any methodical process, its omission was supported by at least some minimal discussion by the IRPAG.

[24] An Oahu small rooftop solar photovoltaic resource option is characterized as a utility-owned resource in the *Supply-side Resource Unit Information Forms, IRP 2013*, dated October 15, 2012, provided most recently as part of Attachment 6 of the Notice of Completion. Much of the information regarding this utility-owned resource could be used as a basis to characterize customer-sited distributed generation options.

the Advisory Group(s), may establish such other criteria for screening out clearly infeasible options.

The utility has not conducted any screening process that is discernable or consistent with this Framework provision. No screening criteria have been discussed or established with input from the Advisory Group.

The IRP process is not being conducted consistent with this Framework provision.

e. The utility shall identify the assumptions underlying any resource option or the cost or benefit of any option or any analysis performed.

f. The utility shall also identify risks and uncertainties associated with resource options.

g. The utility shall further identify any technological limitations, infrastructural constraints, legal and governmental policies or requirements, and other constraints that impact any option or the utility's analysis.

Except for estimates of cost uncertainty identified for some resource options, the risks and uncertainties, underlying assumptions, technological limitations, infrastructural constraints and other information required in the three provisions above have not yet been identified.

h. The utility shall consider measures, strategies, and programs to address limitations and constraints that may negatively impact its ability to achieve the objectives identified.

As noted in several places above, measures, strategies and programs have not been sufficiently considered or analyzed to address the ability of the HECO Company utility systems to facilitate increasing amounts of variable renewable generation.

7. Models.

b. Each model used shall be fully described and documented.

Accept for some brief general discussions at IRPAG meetings, the models used in the IRP planning process have not yet been described or documented.

8. Analyses.

b. The utility, with input from its Advisory Group(s), shall develop a reasonable scope and number of Resource Plans for the Scenarios developed. One or more Resource Plans may be developed for each Scenario. A sufficient number of Resource Plans will be developed and analyzed to ensure that the results of the utility planning process are meaningful and will address the scope of the identified issues. However, the number and scope of Resource Plans developed and analyzed will consider the limitations of utility planning resources and the planning process schedule.

The HECO Companies have analyzed numerous resource plans for the identified scenarios. It is not clear that the scope or particular of resource options will be sufficient to meaningfully address the identified Principal Issues. Analyses of resource plans is continuing. As noted in several sections of this Interim Report, several Framework provisions and Principal Issues have not been addressed by analysis.

c. The utility shall analyze all options in the Resource Plans on a consistent and comparable basis. The utility may use any reasonable and appropriate means to assure that such equal consideration is given.

Several concerns have been noted above regarding the wind and Lanai Wind resource analyses regarding analysis of these options on a consistent and comparable basis.

d. In addition to addressing risks and planning uncertainties through consideration of Scenarios, the utility may utilize sensitivity analysis to determine the extent to which uncertainties affect analysis results and conclusions.

Several aspects of the resource analyses should be tested by sensitivity analyses to determine whether results are sensitive to uncertain assumptions.

e. Notwithstanding the above, the utility shall compare the options on a present value basis. For this purpose, the utility shall discount the estimated annual costs (and benefits, as appropriate) using reasonable and appropriate discount rates, assumptions and procedures. The utility shall fully explain the rationale for its choice of discount rates, assumptions and procedures.

The Companies have not fully explained the rationale for the choice of discount rates, assumptions and procedures. Assumptions regarding inflation have not been discussed or identified in any respect, including clarifications regarding assumed discount rates.

f. The analyses shall identify the resources to be acquired through available procurement mechanisms. The analyses shall consider and identify, to the extent feasible, those resources which the utility proposes to acquire through its available resource procurement mechanisms, including any competitive bidding, feed-in tariff, bilateral contract negotiation, net energy metering, demand response tariffs, or other approved, applicable, or proposed procurement mechanisms.

This section refers to analyses that pertain to remaining steps in the determination of Action Plans. Except for identifying and characterizing the scope of resources being considered in the resource plan analyses, none of the considerations in this section have yet been discussed or addressed regarding procurement.

9. Determination of Resource Plans.

The utility shall rank or descriptively prioritize the final Resource Plans (i.e. , preferred plan, secondary plan, parallel plan, contingency plan)

based upon such criteria as it may establish with the advice of its Advisory Group.

There has not yet been any ranking or descriptive prioritization of resource plans. It has not been discussed and is not clear how the process will comply with this Framework provision.

CONCLUSION

This Interim Report is a critical evaluation that is intended to serve constructive ends. Hopefully the shortcomings identified at this stage will help focus further analysis in the third key phase of the IRP process. The concerns expressed in the Interim Report are provisional, recognizing that the Companies have not completed the third phase of the process.

In light of the short time remaining in the process schedule, the scope and nature of the concerns identified in this Interim Report seem substantial and challenging. In several important respects, unless further analyses are provided, the IE will not be able to certify that analyses of resource plans in the third key phase of the IRP process is compliant with Framework requirements and meaningfully addresses the Principal Issues.