Hawaiian Electric Company, Inc.
INTEGRATED RESOURCE PLAN
2006–2025

Docket No. 03-0253

October 28, 2005

Hawaiian Electric Company, Inc.

Executive Summary

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1 EXECUTIVE SUMMARY

1.1 Introduction

Integrated Resource Planning (IRP) is the process required of each energy utility in the State of Hawaii to systematically and thoroughly develop long-range plans for meeting Hawaii's future energy needs. IRP evaluates, integrates, and balances both resources that *supply* electricity and resources that reduce or better manage the *demand* for electricity. The purpose of achieving this balance is to ensure reliability and affordability of electric power for residential and business customers, to support the State's growing economy, and to protect our unique island environment. Because the planning process must proceed in a context of uncertainty, the proposed balance of resources needs to be diverse and flexible, and to reflect community preferences. In response, the IRP-3 Final Preferred Plan provided in this report contains a strong commitment to increase the use of distillate fuels like naphtha, and indigenous renewable resources including biofuels, and in general to decrease the use of imported oil.

Hawaiian Electric Company (HECO) would like to thank the members of its Advisory Group and the co-chairs of each Technical Committee for their valuable time and input.

1.2 Background

HECO submits this report in compliance with the Hawaii Public Utilities Commission's (the Commission, or PUC) IRP Framework, Decision and Order No. 11630 in Docket No. 6617, as revised May 22, 1992.

Two previous IRP review reports, each containing a preferred plan, have been filed to date: the first in 1993 (IRP-1) and the second in 1998 (IRP-2). A 2002 Evaluation Report was filed in December 2002 to update the IRP-2 resource plan.

This submittal is the third integrated resource planning review report and preferred plan (IRP-3); it complies with the Commission's Order No. 20430, filed September 11, 2003, in Docket No. 03-0253, which ordered the third IRP cycle for HECO to commence.

1.3 Major Changes Since IRP-2

HECO submitted its IRP-2 preferred plan and action plans on January 30, 1998. On January 29, 2001, the PUC issued Order No. 18340, which closed the docket for IRP-2,

finding that the process and Preferred Plan satisfactorily met IRP Framework criteria. HECO filed on December 31, 2002 an Evaluation Report of IRP-2, which assessed the then-current validity of the forecasts and assumptions used in IRP-2, and ultimately the IRP-2 plan itself, in the planning context at that time.

Since the filing of the IRP-2 2002 Evaluation Report, significant changes have occurred in the planning context. These changes, which have been reflected in HECO's IRP-3 Final Preferred Plan include:

- In 2004, Hawaii's legislature passed Act 95, increasing and extending the State renewable portfolio standard (RPS) to 20% by 2020.
- Since 2002, the condition of Hawaii's economy has improved as measured by most economic indicators, leading to higher than expected demand for electricity.
- The 2004 Adequacy of Supply letter projects possible reserve capacity shortfalls as early as 2006.
- The 2005 Adequacy of Supply letter anticipates reserve capacity shortfalls in 2005 and projects these shortfalls to continue at least until 2009, which is the earliest that HECO expects to be able to permit, acquire, install, and place into commercial operation its next central station generating unit.

1.4 Public Participation

In an effort to seek early public involvement in an IRP process that would promote transparency and broad participation by the community, HECO invited representatives from government, business, environmental and community organizations to provide input to help improve and develop an even stronger IRP process than those of past IRPs (IRP-1 in 1993 and IRP-2 in 1998). Two process improvement meetings were held at the start of the IRP-3 cycle in July and August of 2003. Out of this effort, many of the suggestions and comments were incorporated in the structure and design of the IRP-3 Advisory Group and process (see Appendix E for description and list of comments received).

Building on these process improvement meetings, HECO invited key representatives from government agencies, the business community, and environmental and cultural interest groups to participate as part of the IRP-3 Advisory Group, providing input at a procedural or policy level.

In addition to the Advisory Group, five technical committees were formed for specific IRP process elements:

- Load Forecasting Technical Committee (LFTC);
- Demand-Side Technical Committee (DSTC);
- Supply-Side Technical Committee (SSTC);
- Distributed Generation/Combined Heat and Power Technical Committee (DG/CHPTC); and
- Integration Technical Committee (ITC).

HECO invited Advisory Group members to co-chair each technical committee. Other Advisory Group members who wished to participate at this more detailed level were invited to participate in one or more of the technical committees. Appendix F provides a list of the Advisory Group and Technical Committee members.

Public meetings were held to share information, obtain input on the IRP process and receive comments on the finalist plans.

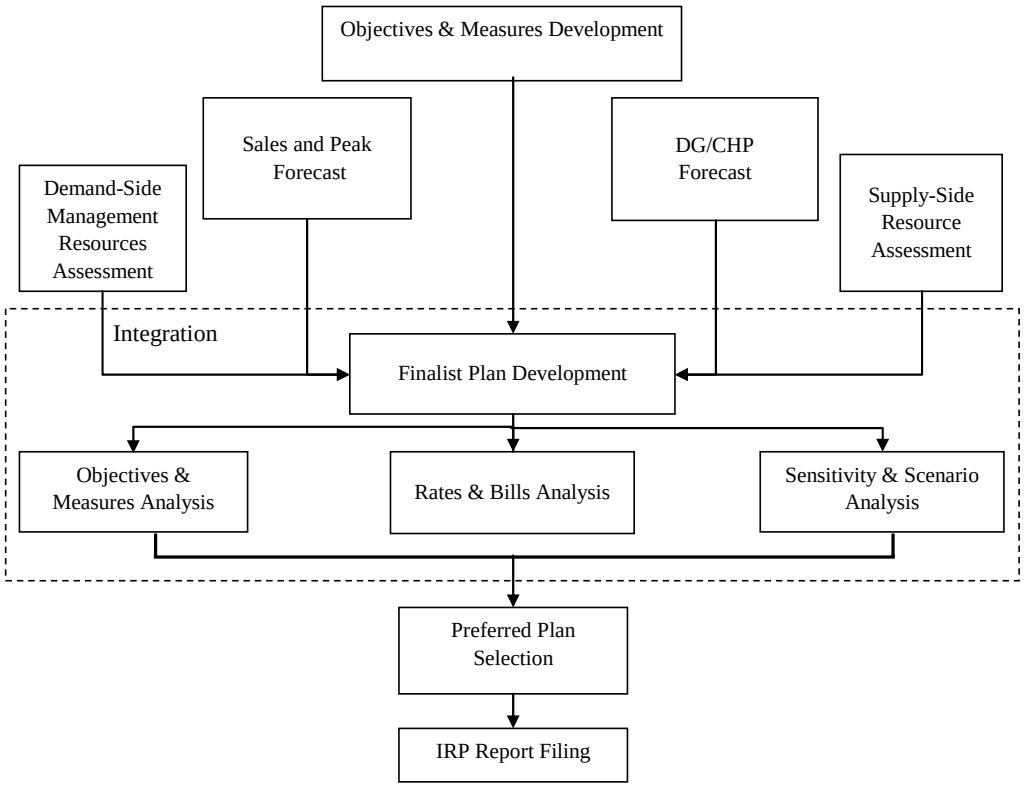
Meetings of the Advisory Group and Technical Committees were open to the public. Meeting notices, reference materials and minutes were posted on the HECO website (www.heco.com) for public information. The meeting minutes, presentations and comments from the Advisory Group and Technical Committee meetings are provided in Appendix G. The initial orientation meetings for the Advisory Group were publicized and broadcast on public television to provide information to the general public, encourage dialogue and understanding, and promote involvement and transparency in the IRP planning process.

The IRP process and the IRP website address were publicized in HECO's *Consumer Lines* newsletter, which is sent to all customers with their electric bill. Newspaper ads were placed to publicize public meetings. Separate full-page newspaper ads were placed to share information on the candidate plans in advance of the public meeting. Throughout the IRP process, efforts were made to invite public input and participation, respond to questions and requests for information, and incorporate suggestions, which are reflected in HECO's Final Preferred Plan. In addition, HECO identified key issues that were raised by the members of the Advisory Group, Technical Committees and general public, and has provided a discussion and analysis of these issues in Appendix I.

1.5 IRP-3 Process

The IRP-3 process elements and workflow include objectives development, sales and peak forecast development, DSM and Supply-Side characterization, plan development, and integration and preferred plan selection. The general workflow for IRP-3 is shown in Figure 1.5-1.

Figure 1.5-1 IRP-3 Process



The IRP-3 process began with development of the objectives that guided the formulation of the integrated resource plans that were analyzed. As a part of this development procedure, the detailed measures that were used to assess the attainment of the objectives were determined. Next, the respective Technical Committees developed the data required for the analysis, including sales and peak forecasts, and Demand-Side Management (DSM) and Supply-Side resource characterizations. Combined heat and power (CHP) and distributed generation (DG) resource assessments, new to IRP-3, were also included. The Advisory Group recommended finalist plan concepts based on

the objectives and measures defined earlier. HECO worked closely with the Advisory Group to structure a series of plans for detailed evaluation. These finalist plans were analyzed using the objectives and measures analysis, rates and bills analysis, and sensitivity and scenario analysis. The six finalist plans were presented to the Advisory Group and at a public meeting to obtain input and comments. HECO then selected the Combination Plan (Plan 6) as a foundation for the IRP Draft Preferred Plan reflecting many of their suggestions.

The Combination Plan was subjected to additional analyses of various DSM, CHP and DG penetration levels. After considering the guidance from the Advisory Group and updating assumptions that had changed during the process, HECO developed its Draft Preferred Plan. Action plans covering the first five years of the IRP planning period were developed for DSM resources, Supply-Side resources (including renewable energy technologies), CHP resources, and risk mitigation measures.

HECO shared its Draft Preferred Plan and Action Plan with the Advisory Group. After further review of the Draft Preferred Plan based on additional Advisory Group comments and a decision by HECO to terminate its Kahe wind farm project in response to community concerns, HECO revised its Draft Preferred Plan by replacing the 50 MW Kahe Wind Farm in 2007 with a 50 MW wind farm in 2009 at an unspecified site. This revised Draft Preferred Plan is HECO's IRP-3 Final Preferred Plan.

1.6 Objectives and Measures

The IRP Framework requires a description of the objectives to be attained by the Preferred Plan and the measures by which achievement of these objectives is to be assessed. The objectives developed with the Advisory Group input for IRP-3 include:

- Protect the environment;
- Economical electricity;
- Power quality and reliability;
- Energy security and sustainable future;
- Minimize potential negative societal and cultural impacts;
- Increase plan flexibility; and
- Utility financial integrity and competitiveness.

It is important to note that these objectives sometimes compete with each other and that tradeoffs between objectives must be considered. One of the biggest challenges in

integrated resource planning is developing a plan that reasonably balances the competing objectives.

1.7 Long-Term Planning Assumptions

Long-term planning assumptions for IRP-3 were based on forecasts of DSM acquisition, supply-side resource cost and performance, existing unit performance and maintenance, unit retirements, and CHP market size, as well as the following key variables (see Table 1.7-1):

- Electricity sales (February 2004 forecast);
- Peak demand (February 2004 forecast);
- Fuel prices (July 2002 forecast);
- Financial assumptions (cost of capital, inflation rate, tax rates etc.); and
- Externality costs.

Table 1.7-1 IRP-3 Key Assumptions

Item	Assumption
Analysis Period	2006-2025 (specified by IRP Framework)
Transmission & Distribution Losses and Company Use	4.864% of net generation (1998-2002 historical average)
Sales & Peak Load Forecast	HECO February 2004 Long-Term Sales & Peak Forecast
Fuel Forecast	2002 Fuel Price Forecast dated September 11, 2003 (Appendix M)
DSM Cost & Performance Data	Data shown in Sections 6.3 and 6.4
Future Supply-Side Resource Cost & Performance Data	Data shown in Section 8.3 and Appendix O
Existing HECO-owned generating unit performance and maintenance data	Data shown in Section 8.2.1
Existing unit retirements	Data shown in Section 8.2.1
Purchase Power Agreements	Data shown in Section 8.2.2
Cost of Capital	Short-term debt: Weight 3%, Rate 6.0% Long-term debt: Weight 38%, Rate 6.5% Preferred Stock: Weight 7%, Rate 8.0% Common Equity: Weight 52%, Rate 12.0% Composite Weighted Average: 9.45% After-Tax Weighted Average: 8.42%
Inflation Rate (used to escalate O&M)	2006-2010: 2.5% 2011-2016: 2.7% 2017-2025: 3.2% (Source: 2002 fuel price forecast)
Composite Income Tax Rate	38.91%
Revenue Taxes	8.89%
Externality Costs	See Section 5.5.1

1.8 Assessment of Demand-Side Resources

The DSM resource portfolio presented in IRP-3 is the result of a comprehensive and wide-ranging assessment of DSM potential conducted by HECO over the past two years. To assist in the development of this assessment, HECO retained Global Energy Partners (Global) in July 2003. Global developed two studies that assessed Hawaii's energy efficiency and demand response potential.

As a result of this assessment, HECO plans to expand its five existing energy and efficiency programs and continue its two load management programs, which were approved by the Commission in October 2004:

- Five existing energy efficiency programs:
  - Commercial and Industrial Energy Efficiency (CIEE). This program offers cash rebates to non-residential customers who purchase high-efficiency

electric equipment, and provides incentives to dealers who sell high-efficiency electric equipment.

- Commercial and Industrial New Construction (CINC). This program offers design assistance and customer rebates that covers both new buildings/facilities and buildings/facilities undergoing major renovation.
- Commercial and Industrial Customized Rebate (CICR). This program provides targeted customers with a full range of products and services within their facilities that will be aimed at achieving total energy efficiency improvements rather than individual measure energy efficiency.
- Residential Efficient Water Heating (REWH). This program promotes solar water heating and high-efficiency electric water heaters to customers in existing residential dwellings.
- Residential New Construction (RNC). This program promotes solar water heating, high-efficiency electric water heaters, and packages of other energy efficiency measures (such as wall and ceiling insulation, high performance windows, high-efficiency cooling equipment and EnergyStar® appliances) to customers in new residential dwellings.

- Two load management programs:
  - Residential Direct Load Control (RDLC). This program provides ongoing incentives to participating customers in return for allowing HECO to control their electric water heaters and/or air conditioning equipment during system peak hours through the use of load control devices attached to the customers' equipment.
  - Commercial and Industrial Direct Load Control (CIDLC). This program provides ongoing incentives to participating commercial and industrial customers in return for HECO being allowed to interrupt some or all of their electrical service during peak hours.

In addition, HECO plans to propose two new DSM programs[1]:

- Energy Solutions for the Home (ESH). This program provides a comprehensive range of energy efficiency options suitable for several major end-use applications.
- Residential Low Income (RLI). This program enables qualified low-income customers to receive high-efficiency equipment (i.e., compact fluorescent lamps and low-cost water heating measures, such as faucet aerators and low-flow showerheads) for little or no cost.

[1] HECO previously proposed a third DSM program, the Residential Customer Energy Awareness (RCEA) program. In response to a PUC decision on this program, HECO has proposed in its 2005 rate case to include in base rates the costs of similar consumer conservation and energy efficiency awareness informational advertising with the objective of helping to achieve energy savings, reduction of peak load and additional reductions during emergencies. (see Section 6.4.4 for additional information)

1.9 Assessment of Distributed Generation, and Combined Heat and Power Resources

Distributed generation (DG) involves the use of small-scale electric generating technologies installed at, or in close proximity to, the end-user's location. Combined heat and power (CHP) is a type of DG in which heat energy from a conventional electric generating unit is captured for use in a heat exchanger or absorption chiller to provide hot water for domestic hot water uses or chilled water for air conditioning, respectively.

In October 2003, HECO, together with MECO and HELCO, filed an application in Docket No. 03-0366 for approval of a utility-owned CHP Program and Schedule CHP tariff, under which these companies would provide CHP services to eligible commercial customers. In October 2003, the PUC opened an investigative docket (Docket No. 03-0371) to determine the potential benefits and impact of DG on Hawaii's electric distribution systems and markets, and to develop policies and a framework for DG projects deployed in Hawaii. In Order No. 20831, issued on March 2, 2004, the PUC suspended HECO, MECO, and HELCO's application for their CHP program until, at a minimum, the PUC concludes its generic DG docket. Pending approval of the CHP program, the electric utilities planned to request PUC approval for individual CHP projects in accordance with Rule 4 of the Companies' tariffs. It was under these conditions that HECO's 2004 CHP forecast for IRP-3 was developed.

HELCO and HECO filed applications for approval of individual CHP Agreements with the Commission in accordance with Rule 4 in the fourth quarter of 2004. However, by Order Nos. 21554 and 21555, issued on January 21, 2005, the PUC suspended these applications, noting that such CHP agreements would more appropriately be evaluated after its separate generic DG docket (Docket No. 03-0371) has been concluded.[2] With the continued suspension of HECO's CHP Program application and the subsequent suspension of applications for individual CHP projects, there is a considerable amount of uncertainty as to when or if the benefits of utility CHP can begin to be realized. Therefore, the most recent HECO forecast projects no utility CHP projects to be installed in 2005. The impact of this revised forecast is discussed in Section 14.1.4.

[2] HECO then withdrew its Rule 4 application for approval of a CHP agreement with Pacific Allied Products, Limited ("Pacific Allied"), as a result of Pacific Allied's termination of the agreement after the suspension of the application by the PUC.

HECO is also in the process of installing nine 1.64 MW portable, leased DG units at utility-controlled substations or other utility sites as a short-term mitigation measure to bolster HECO's reserve capacity. Installation of these DG units is scheduled to be completed in October 2005.

1.10 Assessment of Supply-Side Resources

A comprehensive list of candidate resource options was first developed in IRP-1. For IRP-2, the list of candidate resource options was updated after assessing developments in technology, performance, and cost characteristics. For IRP-3, the list of candidate resource options was based on the lists of technologies previously developed and updated by HECO and the consulting firm of Black & Veatch, with input from the SSTC. The candidate resources were then evaluated and screened using criteria developed and used in previous IRPs. Based on this analysis, the following resource options were selected for further consideration:

Renewable Resources

- Wind energy – 10, 25, and 50 MW wind farms
- Biomass combustion – 25 MW
- Municipal waste mass burn – 16 MW
- Central-station photovoltaics
    - 100 kW (Fixed)
    - 100 kW (Single-axis tracking)
- Distributed (residential) photovoltaics
    - 2 kW (Fixed)
    - 2 kW (Fixed with battery storage and back-up charging system)

Fossil Fuel Resources

- Simple-Cycle Combustion Turbine – 76 MW (Naphtha/No. 2 Fuel Oil)
- Steam Injected Gas Turbine (STIG) – 81 MW (Naphtha/No. 2 Fuel Oil)
- 1-on-1 Combined-Cycle Combustion Turbine – 120 MW (Naphtha/No. 2 Fuel Oil)
    - Phase 1 of 2 Simple-Cycle (1 x 76.3 MW)
    - Phase 2 of 2 Thermal-Cycle (120.2 MW)
- 2-on-1 Combined-Cycle Combustion Turbine – 242 MW (Naphtha/No. 2 Fuel Oil)
    - Phase 1 of 3 Simple-Cycle (1 x 76.3 MW)
    - Phase 2 of 3 Simple-Cycle (2 x 76.3 MW)
    - Phase 3 of 3 Thermal-Cycle (242.1 MW)

- Atmospheric Fluidized Bed Combustion (AFBC)
    - 180 MW (Sub-bituminous coal)
    - HECO/AES AFBC – 180 MW (Sub-bituminous coal).

Unit information forms were developed for each of these resource options. The specifics of each of these options were used for the IRP-3 analysis. Each of the above resource options represents a class of resources. For example, a simple-cycle combustion turbine from GE generates 76.3 MW and represents a 100 MW class of generators, of which the 107 MW Alstom and 107 MW Siemens-Westinghouse units are also members.

1.11 Integration Considerations and Assumptions

Before performing the integration analysis, a number of operating parameters and assumptions had to be understood by the ITC. These operating parameters and assumptions include (1) maintaining an adequate level of system reliability (e.g., capacity planning criteria and spinning reserve), (2) understanding the mix of generation resources (i.e., baseload, cycling and peaking) and the minimum load constraints of baseloaded units, (3) as-available curtailment issues, (4) application of the recently introduced Renewable Portfolio Standards (RPS), (5) ownership consideration of supply-side resources to be considered in this IRP process, (6) competitive bidding, and (7) the near-term need for additional capacity. These issues are discussed further in Chapter 9.

The Strategist optimization model (Appendix W) was used to perform the integration of demand-side and supply-side resources, in combination with plan concepts developed by HECO and the Advisory Group. A range of candidate integrated resource plans were developed.

HECO anticipates reserve capacity shortfalls in 2005 (even after adding 28 MW of firm capacity from Kalaeloa Partners, L.P., at the end of September 2005) and projects these shortfalls to continue at least until 2009, which is the earliest that HECO expects to be able to permit, acquire, install, and place into commercial operation its next central-station generating unit (the planned generating unit addition is a combustion turbine (CT) unit) to be located at a site in Campbell Industrial Park as described in Section 15.2.4. The reserve capacity shortfalls are due to a number of factors, including (1) the continued strong economic outlook and resulting peak load growth, (2) a decrease in the availability of HECO generating units, (3) the delayed start of the load management

DSM programs, and (4) the continued delay in the start of HECO's proposed CHP program. HECO is taking a number of interim mitigation measures to reduce the amount of the anticipated shortfall, including the addition of nine 1.6 MW portable leased DG units at three HECO substations in October 2005. At the same time, this shortfall could increase significantly if DSM program participation is lower than originally anticipated, if HECO is not able to achieve the CHP penetration now forecasted after delays in starting the CHP program, or if electricity sales are higher than forecasted. (See Sections 2.5.6, 9.10, 11.8 and 11.9 for more discussion). The degree to which these measures can address the reserve capacity shortfall in the 2006-2010 period will depend on (1) the time required to obtain the permits and/or approvals that may be necessary to implement the measures, and to obtain and install the measures, (2) the cost to install, operate and maintain the measures, and (3) the extent to which the customers agree to participate in the demand-side measures. Thus HECO projects that there will continue to be some reserve capacity shortfall, even after implementation of mitigation measures, at least until 2009.

Because the power generated by resources considered in the IRP analysis must be delivered by the transmission system, the potential impacts of transmission system capital improvements and energy losses were calculated for each of the finalist plans. The transmission analyses include estimates of the cost and timing of load driven transmission additions and of generation related interconnection requirements. The capital costs for all transmission additions were then incorporated into each finalist plan's capital cost. The transmission analyses also included a calculation of system energy losses in each year of the 20-year planning period for each of the finalist plans. These losses were inputs to the generation model to incorporate system loss impact upon generation energy costs.

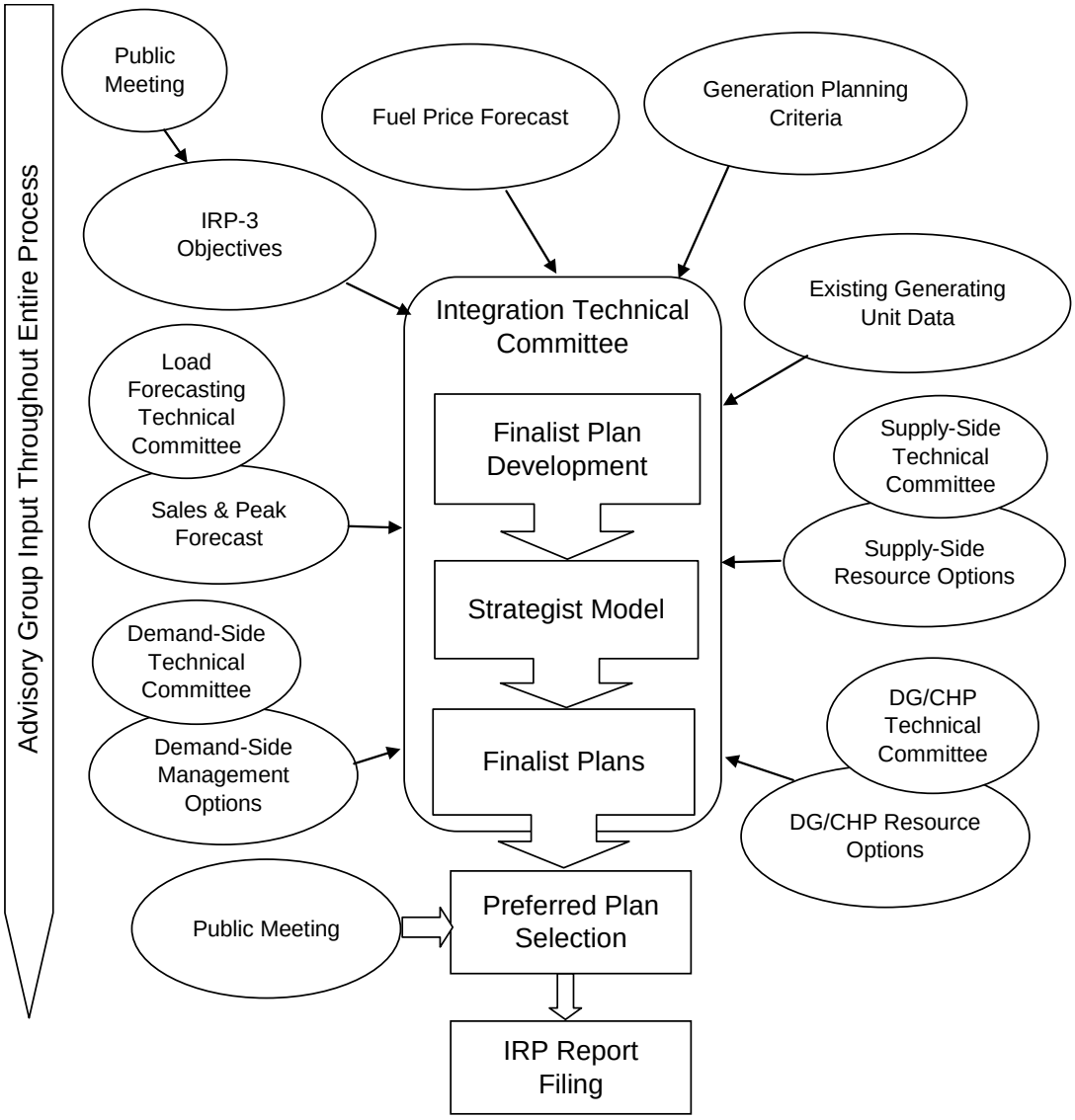
The impact of alternative resource plans on the State's economy was provided by macroeconomic analysis performed by the University of Hawaii Economic Research Organization (UHERO), as detailed in Appendix S.

1.12 Finalist Plans Development and Integration Analysis

The considerations and assumptions described above were used to perform an integration analysis on a variety of finalist plan concepts developed by HECO and the Advisory Group. They were based on the objectives and measures defined earlier in the

process. This analysis first helped provide a set of finalist plans through a process illustrated in Figure 1.12-1.

Figure 1.12-1 Integration Resource Process



The integration analysis considered each finalist plan's ability to meet the IRP-3 objectives described in Section 1.6. For purposes of this analysis, each objective was characterized in terms of specific attributes, for which corresponding measures were applied. The finalist plans, described below, result from tradeoffs made in the integration analysis among competing objectives and always produce the lowest total resource cost

while best meeting the applicable objectives and satisfying HECO's generation criteria and reliability guidelines.

- Least-cost plan – provides the lowest total resource cost without any requirement to meet RPS;
- Meet 20% RPS on Oahu – enables HECO to meet the RPS set by Act 95 of 2004 (Senate Bill 2474) without contributions from its subsidiary utilities;
- Maximize renewable energy – adds as much energy from renewable resources as would be feasible regardless of cost;
- Meet State RPS law – enables HECO to meet the RPS set by Act 95 of 2004 (Senate Bill 2474) with contributions from its subsidiary utilities;
- Maximize fuel diversity – diversifies the sources of fuel to minimize the consumption of petroleum fuel with the intent of reducing Hawaii's dependence on imported oil; and
- Combination plan – represents a hybrid of the other plans, developed to incorporate some of the best features from several plan concepts.

A summary of the finalist plans is shown in Table 10.8.1 of Chapter 10 of the report.

After input from a public meeting and much discussion with the Advisory Group on potential impacts, key factors and uncertainties, the finalist plans were then subjected to scenario analysis to determine their sensitivity under changing conditions. The following scenarios were considered:

- No future energy efficiency DSM impacts – assumes DSM is no longer pursued by the utility;
- Moderate level of energy efficiency DSM and CHP market;
- High and low sales and peak demand – reflects changing economic conditions;
- Honolulu Power Plant retirement – considers the possibility of plant retirement due to the state's interest in redevelopment of the waterfront;
- Alternate combustion turbine size – from 76MW to roughly 100MW; and
- High and low fuel prices.

A major conclusion of the scenario analysis was that additional firm capacity, beyond that contemplated in the finalist plans, may be needed between 2009 and 2013 under certain conditions.

As part of the IRP Framework, HECO analyzed the macroeconomic impacts of all plans on the Hawaiian economy. This analysis revealed that there was little difference among the plans: The projections of Hawaii's Gross State Product and average household income differed by about 0.2% across the plans.

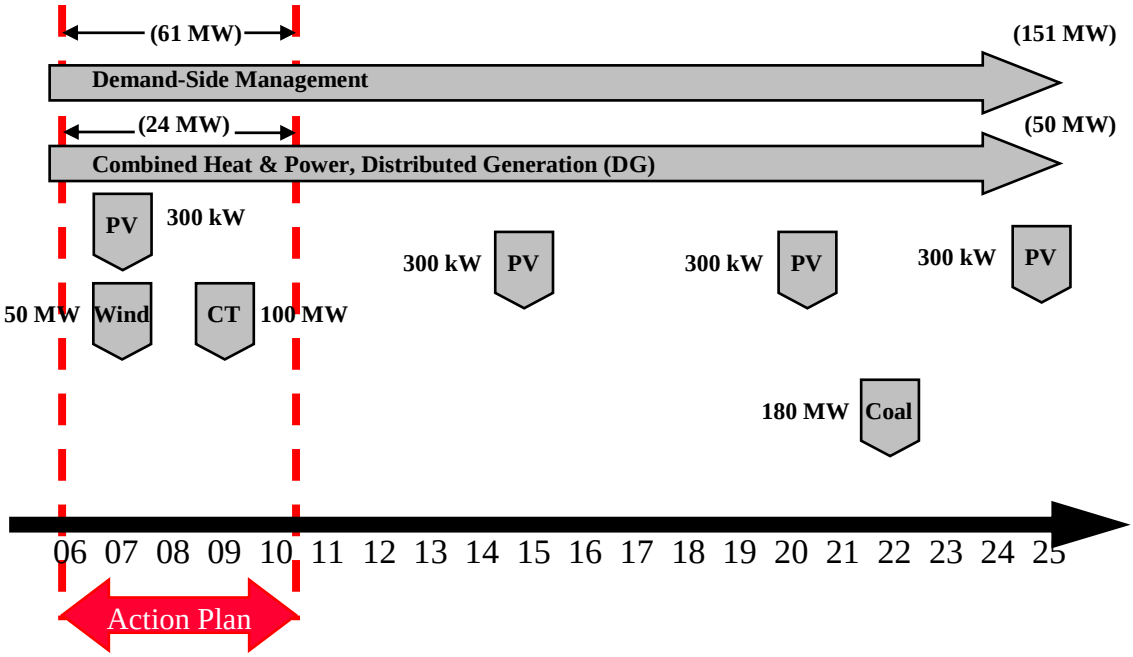
1.13 Draft Preferred Plan Selection

After evaluating the finalist plans listed in Section 1.12 on the basis of their attributes and response to the different scenarios, and on comments from the public and Advisory Group that tended to favor more DSM, more renewable energy (especially solar photovoltaics), more CHP, and quicker implementation of renewable energy resources (see Section 11.4). HECO selected the Combination Plan as a foundation for its IRP-3 Draft Preferred Plan. The Resulting Draft Preferred Plan is a modification of the Combination Plan (Plan 6). The modifications to the Combination Plan included the addition of PV in 2007 and the acceleration of the wind farm installation from 2009 to 2007. The resulting Draft Preferred Plan comprised the following elements:

- Enhanced level of energy efficiency DSM programs
- Load management DSM programs
- Large CHP market
- A 50 MW wind farm in 2007 (Actual size of the wind farm is dependent on project development analyses and activities.)
- 300 kW of commercial rooftop PV in 2007
- A simple-cycle combustion turbine in 2009 that is capable of utilizing a range of fuel sources such as naphtha, diesel, and biofuels (e.g., ethanol).
- 300 kW of commercial rooftop PV in 2015
- 300 kW of commercial rooftop PV in 2020
- A coal unit in 2022
- 300 kW of commercial rooftop PV in 2025

In addition, as discussed in Chapter 14, HECO reviewed updated information since the development of the finalist plans and its impact on the plan analyses. The Draft Preferred Plan reflected updated forecast levels of CHP and DSM as of the February 2005 and March 2005 forecasts, respectively. For CHP, the February 2005 forecast reduced the CHP/Distributed Generation impact in the five-year Action Plan period from 38 MW to 24 MW and from 61MW to 50 MW for the twenty-year Plan period. For DSM, the March 2005 forecast reduced the impact of the proposed DSM programs in the five-year Action Plan period from 69 MW to 61 MW, resulting from later program approval, while not impacting the 151 MW impact during the twenty-year Plan period. The resulting Draft Preferred Plan is shown in Figure 1.13-1.

Figure 1.13-1 Draft Preferred Plan



DSM Programs Include:		Supply-Side Resources Include:
REWH - Residential Efficient Water Heating	CICR - Commercial & Industrial Custom Rebate	Coal - Atmospheric Fluidized Bed Combustion
RNC - Residential New Construction	CFL - Interim Compact Flourescent Light	CT - Simple-Cycle Combustion Turbine
CIEE - Commercial & Industrial Energy Efficiency	RDLC - Residential Direct Load Control	PV - Photovoltaic
CINC - Commercial & Industrial New Construction	CIDLC - Commercial & Industrial Direct Load Control	Wind - Wind Farm
Note: Actual size of supply-side resources will depend on project development activities and siting considerations.		

This Draft Preferred Plan incorporated near-term implementation of renewable supply-side resources, a diversity of fuels, aggressive DSM, CHP/DG, and conventional supply-side resources that meet the IRP objective of meeting near- and long-term consumer energy needs in an efficient, reliable manner at the lowest reasonable cost. Flexibility has been designed into the Draft Preferred Plan, in the event that planning forecasts and assumptions change.

1.14 Key Issues from the IRP Advisory Group

To promote transparency and understanding of the key issues in the IRP-3 planning process, HECO shared its Draft Preferred Plan and Action Plan with the IRP Advisory Group. HECO invited members of the IRP Advisory Group to submit written statements of position or comments on the IRP process, Draft Preferred Plan and Action Plan to be

included in the final report (see Chapter 12). Ten members of the Advisory Group, and one individual of another organization who attended the IRP meetings (which were open to the public), submitted their written comments. Their statements reflected a broad spectrum that ranged from statewide policy and planning issues to specific programmatic and implementation concerns. HECO tried to respond meaningfully to them in this report.

HECO received acknowledgement for conducting a more open, transparent and inclusive IRP process from a number of the members of the Advisory Group. Participants noted that their comments were heard and that changes were made to incorporate their feedback throughout the planning process. Members stated that the level of public involvement was greatly enhanced and, overall public input was much improved over previous IRP cycles.

On a policy level, issues were identified which dealt with reliability, the structure of the planning process and the IRP framework. For example, a recommendation was made to modify the framework to incorporate multi-company, statewide planning, as an umbrella for individual plans, to be able to better maximize the use of indigenous and renewable energy resources, address possible subsidies between affiliate companies in the provision of renewable resources, and reduce Hawaii's dependence upon imported oil. Reliability was consistently mentioned in various statements of position as critical for our economic growth and security.

The credibility of the fuel oil price forecast was one of the primary and most recurring issues brought up by the IRP Advisory Group. In response to their concerns about the rising costs of fuel oil, an additional higher fuel price forecast was developed and analyzed. In considering the comments received on future fuel prices, HECO tried to assess the implications of the higher prices on future supply-side resource options and decisions. The additional higher fuel price analysis was done to be able to build a better understanding of the impacts and choices HECO might face under those conditions.

To provide additional information, responses to many of the comments received from Advisory Group members are also included in a registry of key issues brought up throughout the IRP cycle, with brief explanations giving more detail about the topic and summarizing how the issues were addressed in the IRP process (see Chapter 13 and Appendix I).

1.15 Fuel Price Forecast Scenarios

Forecasting fuel oil prices was one of the most difficult and controversial parts of this IRP-3 process. HECO's fuel price forecast methodology relies on the research and analytical capabilities of the U.S. Department of Energy's Energy Information Administration (EIA). However, the world energy market has recently experienced rapidly escalating oil prices, which make reliance solely on the original forecasts developed for this IRP-3 questionable. Therefore, this IRP-3 relies primarily on three sets of forecasted fuel prices; a base case developed using the traditional forecasting methodologies (2002 Fuel Price Forecast) and two scenario analyses (Integration Technical Committee High Oil Price Forecast and Additional High Fuel Price Forecast) to evaluate the impact of higher fuel prices.

The original forecasts for IRP-3 included a base case Fuel Oil Price Forecast developed in 2002, and high and low scenarios reflecting higher and lower fuel oil price escalation rates. HECO's 2002 Fuel Price Forecast was its latest available forecast at the start of the IRP process in September 2003. This fuel price forecast for No. 6 low sulfur fuel oil (LSFO), No. 2 diesel and coal, which is described further in Section 5.2, relied on future annual escalations based on projections in 2002 by EIA. The starting point for this initial forecast of fuel oil prices was in the $20 to $30 range. As fuel oil prices began to rise in 2004, HECO reviewed the 2002 Fuel Price Forecast and determined it was still valid for IRP-3 planning purposes.

As fuel oil prices continued to rise in 2004, the Integration Technical Committee discussed and developed a high oil price forecast (ITC High Oil Price Forecast) in its September 27, 2004 meeting to more accurately reflect current fuel price conditions. This ITC High Oil Price Forecast was based on current oil prices at that time, with a starting point for oil price in the $40 to $50 range. The IRP-3 finalist plans were re-evaluated through a scenario analysis using this high forecast. Strategist optimization modeling showed that wind, biomass and MSW resources were not cost effective at these higher fuel prices. However, as a result of Advisory Group input, wind and photovoltaic energy resources were included in the Preferred Plan. A coal unit was cost-effective and would be added to the plan at the earliest date feasible, even before firm capacity was required by HECO's capacity planning criteria. The larger difference between oil and coal prices makes a coal unit appear more economically attractive and the fuel savings from the coal unit would more than offset the incremental capital cost of

installing the coal unit earlier. It should be noted, however, that a revised coal price forecast was not developed that would correspond to the ITC High Oil Price Forecast. Section 10.9.7 provides a more detailed discussion of the scenario analysis performed using this high fuel oil price forecast.

HECO also developed another EIA-based forecast in 2005 (based on EIA's 2005 Annual Energy Outlook), which reflected higher fuel oil prices in the short-term than the 2002 forecast, but similar fuel oil prices in the longer term. Since these prices fell within the range of fuel oil prices already analyzed in the HECO IRP-3 integration analyses, including the higher ITC High Oil Price Forecast, it was not necessary to introduce the updated 2005 EIA-based forecast into the IRP-3 process and redo the integration analysis (see Section 14.1.8).

Fuel oil prices continued to climb through September 2005. HECO Advisory Group members continued to share their concerns about the validity of the fuel price forecast. A key concern was that HECO's 2002 Fuel Price Forecast might bias the Draft Preferred Plan toward fossil-fueled resources and away from renewable resources. Although EIA's 2005 Annual Energy Outlook projected similar oil prices in the long-term as previous forecasts, higher near-term oil prices would have a larger present value and improve the economics of renewable resources. To better understand the potential implications and respond to the concerns of the Advisory Group, HECO developed an additional high fuel price scenario (Additional High Fuel Price Forecast) that used the same fuel price escalations from the 2002 Fuel Price Forecast, but changed the starting price to correspond to the LSFO and diesel price equivalent of the West Texas Intermediate (WTI) crude oil price of $70/bbl (the price that WTU crude oil was approaching in early September 2005). WTI is a benchmark that is commonly quoted in the media.

Strategist optimization modeling again showed that the addition of a coal unit would be cost-effective under this high oil price scenario for the same reasons stated earlier – although it should be noted again that a corresponding coal price forecast was not developed. In addition, the analysis showed that with this higher assumed level of oil prices, wind resources become economically attractive. Strategist optimization modeling showed that an additional wind farm (in addition to the wind farm in the Draft Preferred Plan) should be installed as early as feasible under this high oil price scenario. Other

renewable resources, however, were still not cost-effective with this higher fuel price forecast.

This “Additional High Fuel Price” forecast was developed as a scenario to illuminate possible options and impacts under the higher fuel price conditions. It was intended to provide additional information to manage uncertainties and develop a plan that is responsive to high fuel prices. A further description of the scenario analysis and results for this Additional High Fuel Price Forecast is provided in Section 13.2.

As discussed above, as a result of the unexpected rise in fuel oil prices and concerns expressed by the Advisory Group and its Integration Technical Committee, HECO has analyzed several fuel price forecast scenarios to determine the least-cost resources for the scenarios to understand the changes that may be required should fuel price continue to rise. The scenario analyses performed for the ITC High Fuel Oil Price and Additional High Fuel Price forecasts have not resulted in dramatic changes in the Action Plan elements for 2006-2010. There are three principle reasons for that result: 1) the demand-side and CHP programs which reduce use of fuel oil are as aggressive as possible; 2) siting and construction of any sizable additional power generation facility (renewable or fossil fuel) within the Action Plan period beyond that already identified is unlikely; and 3) the resource most favored under high fuel price scenarios which is coal, faces particular challenges.

The more significant changes to the IRP-3 plan that would be required for higher fuel prices occur in the later period of the 20-year plan, with the acceleration of the proposed coal unit and potential wind farms. The Action Plan contains items relating to coal and wind farms. Other possible resources that could come into play are: 1) expanded MSW facilities (to be installed for municipal solid waste reduction purposes rather than least cost); 2) increased photovoltaic projects, particularly if significant increased tax credits become available; and 3) seawater air conditioning projects, such as that being proposed for downtown Honolulu.

As discussed in Chapters 11, 13 and 15, HECO’s Final Preferred Plan, Action Plan and risk mitigation measures provide a high degree of flexibility and robustness that will allow HECO to modify its plans to respond to changing market conditions, including high fuel prices.

On a fundamental level, oil prices are now expected by many experts to be higher in the long-term than those reflected in the January 2005 EIA Annual Energy Outlook (AEO), upon which HECO's updated 2005 forecast was based. The 2006 AEO which should be available in January 2006, should better take into account the higher prices actually experienced in 2005, and the fundamentals underlying those prices. HECO will continue to monitor fuel prices, what experts in the market predict for the future fuel prices, and any changes in the EIA fuel price forecasts (resulting from the recent fuel oil price increases) which HECO believes may in fact occur in the near future. HECO will provide updates to the Commission on fuel prices and reflect these updates in its IRP Evaluation Reports.

1.16 Updated Information and Its Effect on the Analyses

Since the time the original data for IRP-3 was collected and the base analysis was performed, updated information became available in the following areas:

- Sales and peak forecasts – modestly lower in near-term years because of delays in large construction projects;
- Load management DSM programs – reduced impact on load through 2007 because of later-than-forecast program approval:
  - In October 2004, the PUC approved HECO's two DSM load management programs, the Residential Direct Load Control (RDLC) and Commercial and Industrial Direct Load Control (CIDLC) Programs.
- Energy efficiency DSM programs – reduced impact on load because of uncertainty over program approval. In November 2004, HECO filed its current rate case in which it requested PUC approval for the DSM energy efficiency programs included in this IRP Draft Preferred Plan. These programs will end as part of this rate case, and any new DSM programs to be in place after the rate case were to have been determined as part of that case.
  - A subsequent PUC order placed the DSM programs in the new Energy Efficiency Docket (Docket No. 05-0069), which is separate from the original rate request. Subsequent PUC orders allowed HECO to continue the five existing energy efficiency programs and two load management programs until the outcome of the new docket. In addition, the PUC approved the continuation of the existing DSM cost recovery mechanism for the same period.
- Proposed CHP projects – reduced impact because of uncertainty over program approval:
  - In January, 2005, the PUC suspended HECO's and HELCO's existing applications requesting approval of Combined Heat and Power agreements with individual customers; noting such a program would more appropriately be evaluated after its separate generic DG docket (Docket No. 03-0371) has been concluded.

- Equivalent forced outage rates (EFORs) – greater negative impact on peak load because of somewhat higher outage rates, which occur as generating units age and are run under more demanding operating conditions.
- Challenging maintenance schedule issues for generating units – greater negative impact on reserve capacity because, as reserve capacity decreases, the flexibility to adjust maintenance schedules also decreases, which can adversely affect system reliability.
- Kahe wind farm project – Termination of the 50 MW Kahe wind farm project in 2007 due to community and governmental concerns. Replaced with a 50 MW wind farm in 2009 at an unspecified location.
- Fuel price forecasts – higher fuel price forecast in 2005 than 2002 Fuel Price Forecast.

HECO's review of the updated information indicated that the analyses and conclusions conducted earlier still remain valid. Specifically, the proposed mix of resources remained the same in the Draft Preferred Plan, but there is increased urgency to pursue risk mitigation measures. As a result, specific risk mitigation measures were developed.

1.17 Final Preferred Plan, Action Plan and Risk Mitigation Measures

With the additional scenarios completed, assumptions updated, Advisory Group comments considered, and risk mitigation measures identified, HECO reviewed its Draft Preferred Plan to determine its Final Preferred Plan.

In its Draft Preferred Plan, HECO included the addition of a wind farm from in 2007, located on the ridges above the HECO Kahe Generating Facility. HECO held public meetings in July 2005 to provide the community with information on the proposed wind farm project. At the public meetings, many strong concerns were expressed about archeological and cultural sites in the area of the proposed wind farm, as well as the potential loss of the panoramic view of the coastline. Although the City Administration expressed general support for wind energy as a resource, on September 19, 2005, it announced that it would not issue related government permits for the Kahe wind site based on community concerns. As a result of this opposition, HECO has determined that it is not practical to proceed with the Kahe site and is exploring other alternatives. HECO has revised its Draft Preferred Plan by replacing the 50 MW Kahe wind farm in 2007 with a 50 MW wind farm in 2009 at an unspecified site. HECO has determined this revised Draft Preferred Plan to be its Final Preferred Plan.

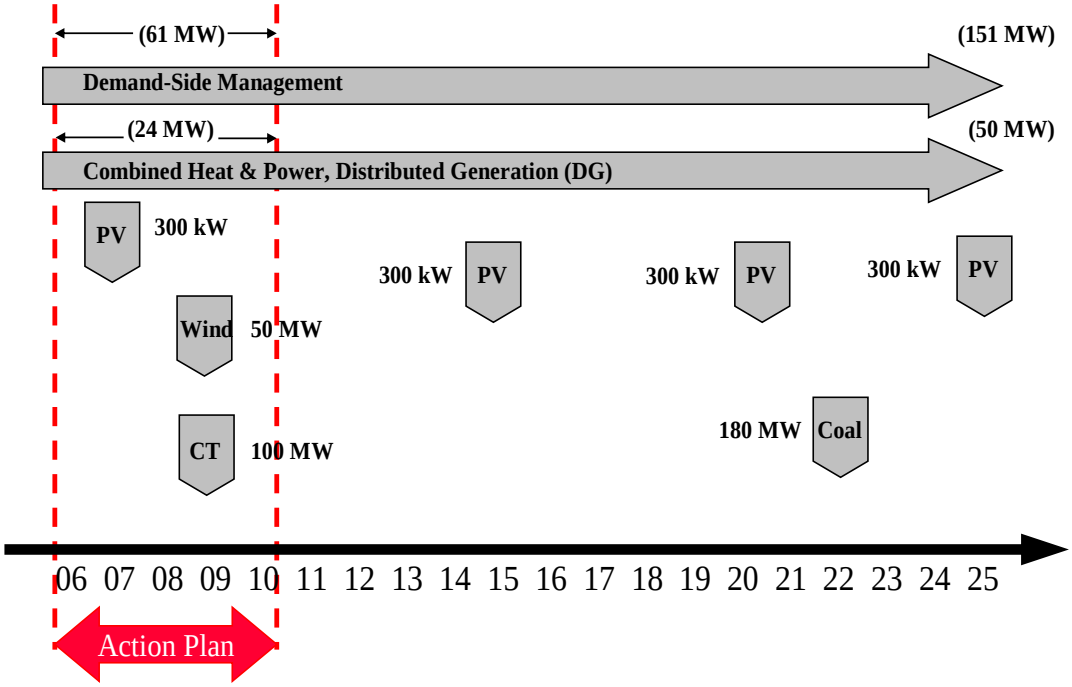
HECO believes that its Final Preferred Plan best fulfills the IRP Framework's goal of identifying a mix of energy resources that will meet both near- and long-term customer

needs in an efficient, reliable manner at the lowest reasonable cost. The IRP-3 Final Preferred Plan, shown in Figure 1.17-1, contains a strong commitment to increase the use of distillate fuels like naphtha, and indigenous renewable resources including biofuels and, in general, to decrease the use of imported oil. It is responsive to the near-term need for generation brought about by the strong economy, and it reduces near-term risks of reserve capacity shortfalls by implementing mitigation measures such as expanding load management programs and installing distributed generation at selected HECO substations.

The Final Preferred Plan includes approximately 151MW of energy efficiency, conservation, and other DSM programs, 50MW of CHP and DG resources, 1.2MW of solar photovoltaic resources of which 300kW is to be accelerated into the 5-year action plan period, and 50MW of wind power. Fuel diversity is further enhanced with the installation of a coal unit later in the planning period.

Given the uncertainties facing the electric utility industry, HECO's Final Preferred Plan provides a high degree of flexibility and robustness that will allow HECO to modify its plan in response to changing market conditions. It should be considered as a planning strategy rather than as a fixed course of action.

Figure 1.17-1 Final Preferred Plan



DSM Programs Include:		Supply-Side Resources Include:
REWH - Residential Efficient Water Heating	CICR - Commercial & Industrial Custom Rebate	Coal - Atmospheric Fluidized Bed Combustion
RNC - Residential New Construction	CFL - Interim Compact Flourescent Light	CT - Simple-Cycle Combustion Turbine
CIEE - Commercial & Industrial Energy Efficiency	RDLC - Residential Direct Load Control	PV - Photovoltaic
CINC - Commercial & Industrial New Construction	CIDLC - Commercial & Industrial Direct Load Control	Wind - Wind Farm
Note: Actual size of supply-side resources will depend on project development activities and siting considerations.		

For the objectives of IRP-3 to be achieved over the 20-year planning horizon, several major actions must be undertaken during the next five years. The purpose of the 2006-2010 Action Plan is to establish the specific tasks that need to be considered in three major areas:

- DSM Action Plan.
  - Continue the five existing energy efficiency programs and two new load management programs, with modifications, and add an interim compact fluorescent lamp (CFL) program.
  - Pursue approval of the ESH and RLI programs in the Energy Efficiency Docket (Docket No. 05-0069).

- Supply-Side Action Plan.
    - Activities to support the installation of a wind farm in 2009. The actual size of the wind farm will depend upon wind resource and siting considerations.
    - Activities to support installation of three 100 KW photovoltaic systems in 2007.
    - Activities to support installation of a 100 MW class simple-cycle combustion turbine generating unit in 2009.
    - HECO and its subsidiary Renewable Hawaii, Inc., (RHI) are actively pursuing additional renewable energy projects through separate requests for project proposals.
    - Preliminary activities are being undertaken to support installation of a future 180 MW AFBC coal unit.
- CHP Action Plan.
    - HECO will continue to pursue PUC approval of the proposed Utility CHP Program, in addition to individual CHP projects under Rule 4 of HECO's tariff.

Risk mitigation measures are being undertaken or developed in three major areas:

- DSM Risk Mitigation Measures.
    - HECO plans to submit modifications to its existing DSM programs and request a decision from the PUC to proceed with the modified DSM programs.
    - HECO will also develop and implement programs to expand the use of direct load control.
- DG/CHP Risk Mitigation Measures.
    - HECO is proceeding with installation of nine 1.64 MW portable, leased DG units at selected utility-controlled substations or other utility sites in 2005. Installation of the units is scheduled to be completed in October 2005. Additional units may be installed in 2006 and beyond. Initial evaluation has identified the potential for installing an order-of-magnitude 20-40 MW capacity, using portable diesel generators with roughly 9-10 month installation lead times. HECO is also evaluating mainland utility models for dispatchable standby generation.
- Supply-Side Risk Mitigation Measures.
    - HECO is considering ways to accelerate the installation of the next combustion turbine generating unit, currently scheduled for 2009.
    - In addition, because of long lead-times, preliminary activities to preserve the option, if needed, of installing additional firm capacity such as a second combustion-turbine generating unit need to take place during the Action Plan period. HECO will also continue to work with the City and County of Honolulu to facilitate municipal solid waste generating units.

In addition, three short-term mitigation measures are ongoing that could help reduce the potential impact of a reserve capacity shortfall:

- Improve the availability of HECO generating units.
- Maintain or improve the availability of independent power producer generating units.
- Implement a public notification program to inform customers of potential generation-related outages and to ask for voluntary conservation.