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Energy Efficiency and Renewable Energy

An Evaluation of Alternative Commercial Approaches to Distributed Energy Resources and Combined Heat and Power in Hawaii

Prepared for the
State of Hawaii
Department of Business, Economic Development,
and Tourism
Strategic Industries Division
and the US Department of Energy
by
Competitive Energy Insight, Inc.

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Executive Summary

This report, entitled, Alternative Approaches to Distributed Energy Resources / Combined Heat and Power (DER) in Hawaii, was prepared under a contract with the State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT), Strategic Industries Division. The results of the evaluation were presented at a Workshop on Distributed Energy Resources and Combined Heat and Power in Regulated and Competitive Markets, held on August 24, 2004 at the Japanese Cultural Center in Honolulu. The workshop was hosted by DBEDT with funding from the Western Regional Office of the U.S. Department of Energy (USDOE). USDOE funds were also used to support this work. The results presented were excerpted from the presentation made at the workshop. This report is provided bullet and outline format, reflective of the presentation that was made at the DEBDT workshop.

There are a number of challenges to achieving a greater and successful penetration of DER. This project seeks to encourage deployment of DER in Hawaii by providing the State of Hawaii and Hawaii stakeholders with:

- An objective analysis of the costs and benefits of DER.
- An independent comparison of the economic benefits and risks associated with the application of DER under regulated or unregulated scenarios.

Key findings of the analysis included:

- Hawaii is an exciting and economically attractive market opportunity for DER,
- The economics of DER are island and site specific,
- The economics of Third Party Ownership are stronger on the Neighbor Islands where electricity costs are higher than on Oahu.
    - On Oahu there is a strong preference for sites with substantial thermal uses.
    - On Maui and The Island of Hawaii the economics appear to be very attractive subject to optimization, efficient design and risk management,
    - On Kauai the economics appear to be compelling driven by high cost of electric energy on this island.
- In many instances diesel appears to be the most economic fuel for DER on the islands. This conclusion is subject to the important considerations of transportation, storage, permitting and environmental benefits offered by gas fuels such as SNG or propane which for many sites may prevail over the fuel cost difference. It is important to note that both diesel and gas fuels can exhibit attractive returns for host, Third Party, or utility investment, especially on the Neighbor Islands.
- Utility-Owned DER, as proposed by HECO and placed in Docket 03-0366, provides an economically attractive alternative option for hosts, especially on Oahu where electric rates are lower. Under the docket site owners would be provided with guaranteed savings and with capital and risk management by the utility.
- In many circumstances host or Third Party ownership can offer additional savings and benefits compared to Utility-Owned DER projects.

It is important to note that each site will have its own unique features that must be addressed to maximize value. In order for third parties and hosts to successfully and profitability benefit from the economics of non-regulated DER applications they must:

- Carefully consider pertinent site specifics,
- Select the optimum configuration of equipment & operations to match the site needs,
- Design a system that operates reliably, especially during peak energy pricing periods,
- Properly manage fuel pricing risk,
- Make efficient use of waste heat,
- <u>Perform proper and thorough up-front engineering and financial analysis to ensure that right things are done right the first time and every time.</u>

1. Background and Overview

This report, entitled, Alternative Approaches to Distributed Energy Resources / Combined Heat and Power (DER) in Hawaii, was prepared under a contract with the State of Hawaii Department of Business, Economic Development, and Tourism (DBEDT), Strategic Industries Division. The results of the evaluation were presented at a Workshop on Distributed Energy Resources and Combined Heat and Power in Regulated and Competitive Markets, held on August 24, 2004 at the Japanese Cultural Center in Honolulu. The workshop was hosted by DBEDT with funding from the Western Regional Office of the U.S. Department of Energy (USDOE). USDOE funds were also used to support this work. This report is provided bullet and outline format, reflective of the presentation that was made at the DEBDT workshop.

1.1. Benefits of DER

DER offers a number of potential benefits to energy stakeholders in Hawaii. These include:

Grid Benefits

- Improved grid reliability;
- Higher energy conversion efficiencies than central generation;
- Faster permitting than transmission line upgrades; and
- Ancillary benefits—including voltage support and stability, contingency reserves, and black start capability;
- Reduced upstream congestion on transmission lines;
- Reduced or deferred infrastructure (line and substation) upgrades;
- Optimal utilization of existing grid assets—including potential to free up transmission assets for increased wheeling capacity;
- Less capital tied up in unproductive assets by more closely matching capacity additions with demand.

Customer / Host Benefits

- Better power reliability and quality;
- Lower energy costs;
- More choice in energy supply options;
- Greater predictability of energy costs (lower financial risk) with renewable energy systems;
- Energy and load management;
- Combined heat and power capabilities;
- Environmental benefits—including cleaner, quieter operation, and reduced emissions.

Opposing the benefits there are a number of challenges to achieving a greater and successful penetration of DER. These challenges include factors such as:

- A lack of familiarity of site owners with the design and operating principles of on-site electric generation.
- Fuel price uncertainty.
- Complexity of tariff structures and uncertainties regarding future regulatory requirements.
- Design optimization.
- A lack of tools to facilitate independent and unbiased analysis of private or third party ownership.

This project seeks to encourage deployment of DER in Hawaii. The goals include providing the State of Hawaii and Hawaiian stakeholders with:

- Faster response to new power demands—as capacity additions can be made more quickly.
- An objective analysis of the costs and benefits of DER, and
- An independent comparison of the economic benefits and risks associated with the application of DER under regulated or unregulated scenarios.

1.2. The Problem Statement

The economics of DER are highly dependent on the following factors:

- The host's time-related energy use profiles including electric, chiller and thermal use.
- The pricing signals imposed by the utilities' electric energy and gas tariffs.
- The operating characteristics and operating costs of the DER facilities as a function of load and hours of service.
- Investment costs and financing alternatives.
- Operations and maintenance costs.
- Depreciation and income taxes.
- The timing of cash flows and savings.

These factors, when properly evaluated, will determine what energy use will cost as a function of usage profiles and tariff, to what extent it is economic to self-generate using DER, and under what circumstances the investment in DER presents an attractive opportunity. With this information the building owner or third party investor can independently gain a valuable understanding of:

- The costs paid under current tariffs without DER.
- The potential economic benefits of DER.
- The economic tradeoffs of alternative DER technologies and facility sizes.
- The optimum economic equipment sizing and operating profile of the DER facility.
- The impacts of alternate Hawaii utility tariffs and changes in tariffs on DER economics.
- The impacts of private ownership or third party ownership.
- The benefits of ownership of DER projects by HECO and its affiliates under regulated ownership

- Alternative financing approaches that can be applied to optimize the return on investment of DER applications.

1.3. Objectives

There are a number of challenges to achieving a greater and successful penetration of DER. This project seeks to encourage deployment of DER in Hawaii by providing the State of Hawaii and Hawaii stakeholders with:

- An objective analysis of the costs and benefits of DER.
- An independent comparison of the economic benefits and risks associated with the application of DER under regulated or unregulated scenarios.

Applying Competitive Economic Insight's (CEI) unique software products, site specific or typical building configurations selected by DBEDT (complemented by CEI's database of building electric and thermal load profiles), and publicly available information on DG equipment and Hawaii utility tariffs, the evaluation produced under this project will allow the State and other stakeholders to more fully understand the cost/benefit tradeoffs and risk allocation associated with alternative DER rollout scenarios. It is anticipated this will encourage DER in Hawaii and better inform development of appropriate policies and regulations.

This evaluation includes a detailed discussion of the analysis that was performed describing:

- The objectives of the evaluation of alternative commercial approaches to DER in Hawaii,
- An overview of the current applicable tariffs on Oahu, Maui, the Island of Hawaii and Kauai,
- An overview of the DER tariff for customer cited utility-owned DER proposed by the Hawaiian Electric Company (HECO) filed October 10, 2003 and assigned Docket No. 03-366 by the Hawaii Public Utilities Commission (PUC),
- The assumptions used in the evaluation,
- The results of the evaluation identifying the economic considerations associated with applying site specific DER at a typical hospital, hotel or office building located on the islands of Oahu, Kauai or Maui.

An introduction to Competitive Energy Insight, Inc. and an overview discussion of the *EconExpert*™ computerized modeling tools developed by CEI and used in the study is provided in the appendix. This study will evaluate the impacts of key factors on the economic attractiveness of DER investment by site owners, third party owners or under regulated electric utility ownership scenarios. Supported by interviews with key stakeholders on the Islands including HECO, The Gas Company, and facility owners, the evaluation is intended to allow the State and other stakeholders to more fully understand the cost/benefit tradeoffs and risk allocation associated with alternative DER rollout scenarios. It is anticipated that this will encourage DER in Hawaii and will better inform development of appropriate policies and regulations.

The stakeholder perspectives evaluated in the analysis were:

- **Utility Own and Operate**. Under this scenario HECO or an affiliate utility would design, build, own and operate the facility providing guaranteed savings (through a credit on their electric rates) to the facility owner. Those savings would be architected and limited under the terms approved by the PUC. For this analysis the rates proposed by HECO's filing were used.
- **Host Own and Operate**. Under this scenario the host would independently own and operate the facility, providing or borrowing all of the capital necessary to install the facility, keeping all of the applicable net benefits and assuming all of the associated risks.
- **Private Third Party Own and Operate**. Under this scenario a third party would design, install, own and operate the facility under a set of structured agreements and would share some percentage (typically 10 – 25%) of the resulting savings with the host. In this situation, the Third Party Investor would also take responsibility for installation and operations.

A range of sensitivity analyses were performed using the automated sensitivity features in the EconExpert model. Tornado Diagrams were generated by the model to illustrate the relative impacts of a range of variables on DER economics under the various scenarios that were addressed.

Sensitivities included:

- Fuel types – Diesel, SNG and Propane
- Fuel price
- Equipment configuration and redundancy
    - Number of generators
    - Size of absorption chillers
- Demand Charges, Standby Charges and System reliability
    - Differences in first year savings
    - Impacts of outages on savings

1.4. Recognition of Inputs by Others

Included in the analysis were discussions with an array of DER stakeholders in Hawaii. Stakeholders who were interviewed included:

- HECO. HECO provided overview and valuable insight into the mechanisms of their respective tariffs including current tariffs and the proposed tariffs for DER applications filed October 10, 2003.
- Kauai Island Utility Cooperative (KIUC). Like HECO, KIUC was very helpful in providing assistance to understand and interpret their respective tariffs. KIUC also provided feedback which was used to adjust the proxy load profiles.

- The Gas Company provided substantial assistance with the review and adjustment of the proxy load profiles as well has providing pricing information on propane and SNG based on a world oil price level of about $41/bbl.
- CEI held confidential discussions with certain hotel and building property owners of facilities on Oahu. Specific building load profile information was provided to assist to normalizing the proxy profiles developed by CEI to ensure that they were reasonably representative of load shapes for similar facilities on the Islands. These building owners requested that their identity not be revealed and the specific data provided was required to be kept confidential and to be used for guidance purposes only.
- Equipment Suppliers. Hawthorne Power Systems, the registered distributor of Caterpillar Engines and Equipment on the Hawaiian Islands and Blue Point Energy the developer and manufacturer of the Blue Point Lean One Engine each provided detailed engine performance data for use in the study and consultation on the application of that data for uses and fuels in Hawaii.

DBEDT and CEI would like to provide their thanks to these parties for providing inputs and support of the analysis.

2. DER Forecasts for Hawaii

Figure 1 provides the HECO Companies’ recent forecasts for DER in their three service territories. HECO serves Oahu, Maui Electric Company serves Maui, Molokai, and Lanai, and the Hawaii Electric Light Company serves the Island of Hawaii. The combined forecast for Oahu, Maui and the Island of Hawaii also presented. The charts were developed from data provided by HECO in their October 10, 2003 filing to the Public Utilities Commission. Forecasts for the Kauai Island Utility Cooperative (KIUC) were not available.

As shown on the charts, the pink bars illustrate HECO’s projections of for utility owned facilities, purple depicts Third Party owned systems (in cooperation with the utility), and light blue indicates third party independently owned systems. In total, HECO forecasts over 80 MW of DER applications on these three islands over a 10 year period with Oahu installations peaking at 6000 kW/yr in 2008, Maui peaking at 5000 kW/yr in 2006, and the Island of Hawaii peaking at just under 4000 kW/yr in 2005.

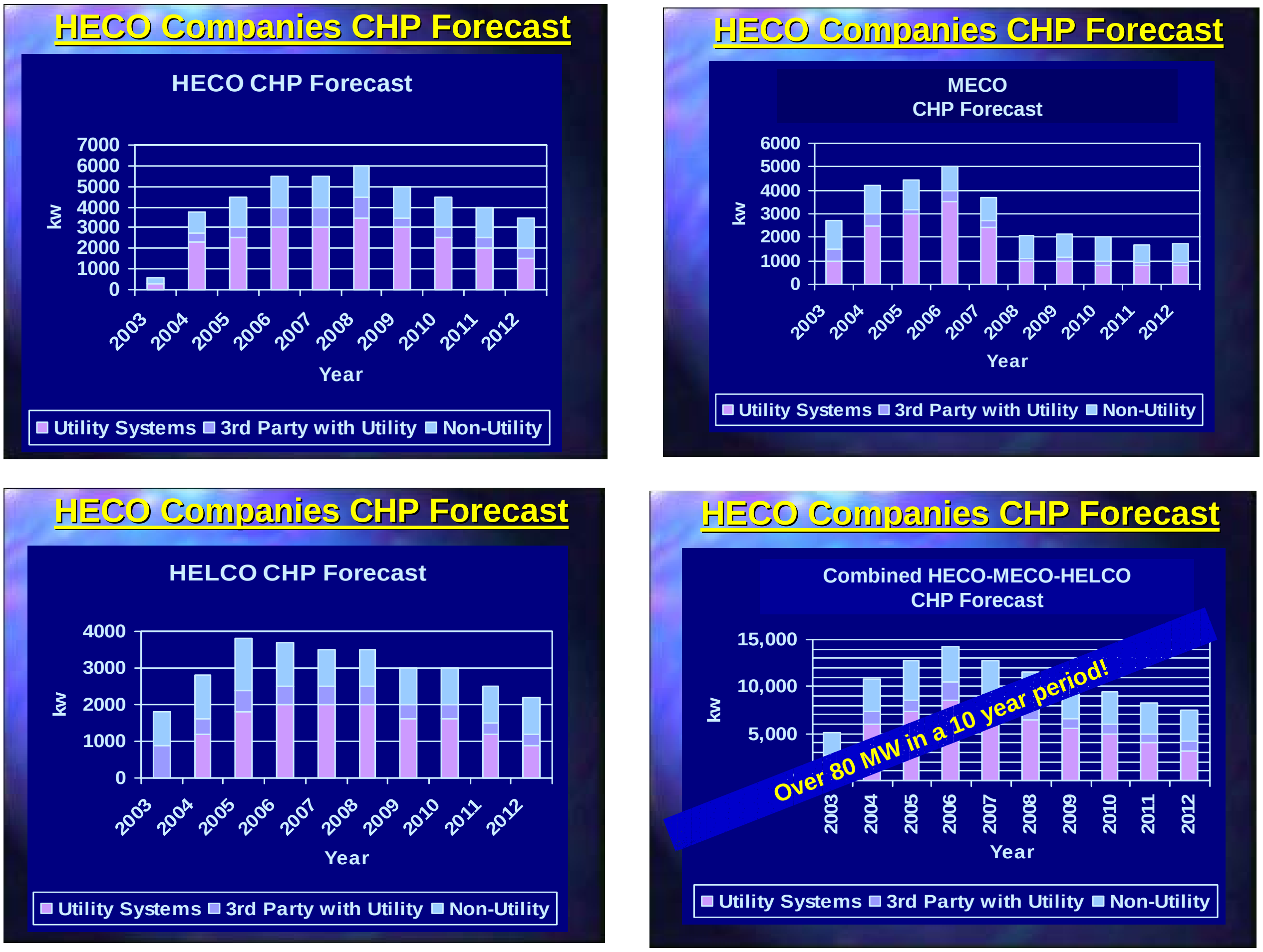


Figure 1 - DER Forecasts for HECO's Service Territory

3. Study Assumptions

3.1. Tariffs

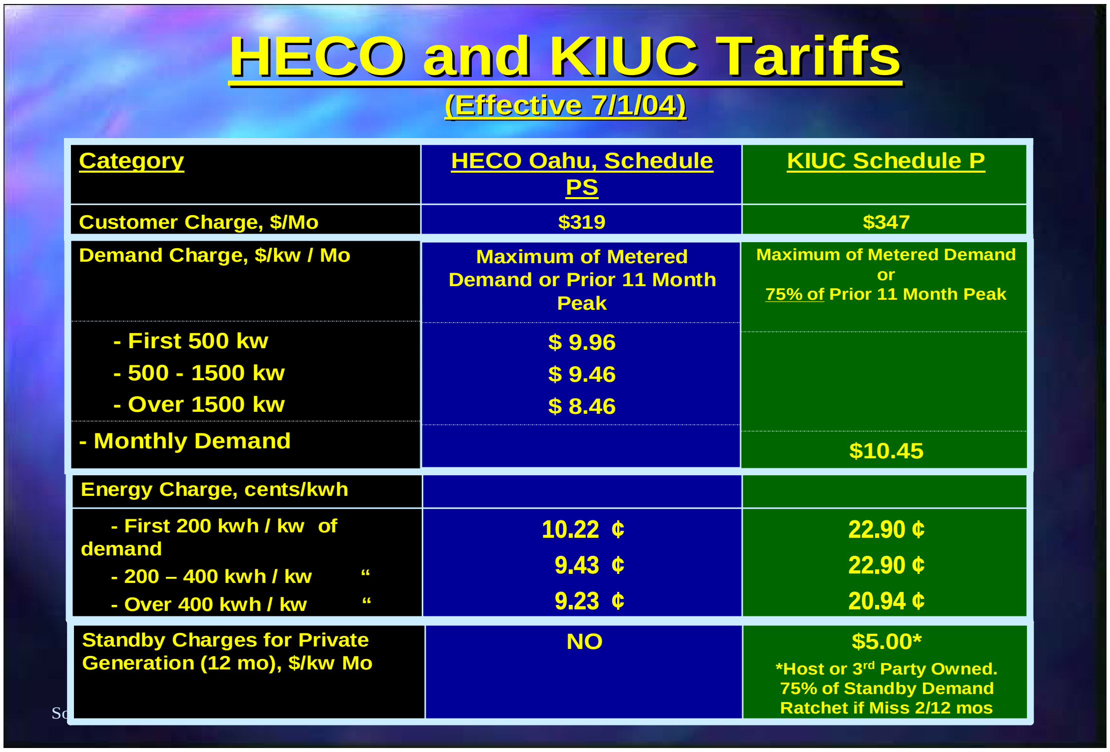
Analyses were performed for DER facilities sited on Oahu, Kauai and Maui. Because of the relative similarity of tariffs on Maui and The Island of Hawaii, analysis for Maui was assumed to provide a representative case for The Island of Hawaii.

3.1.1. Tariffs on Oahu and Kauai

Figure 2 illustrates comparative electric rates on Oahu and Kauai in July of 2004. All rates quoted include applicable fuel adjustments, surcharges and taxes, and so are representative of as-billed rates. Both schedules represent rates applicable to Large Power Commercial Facilities, and, in the case of HECO at secondary voltage levels. Notable are:

- Both electric rates apply a tiered tariff structure whereby the energy rate in cents/kwh is adjusted as a function of the peak demand during the billing cycle. Reducing peak demand will affect both demand charges and the band over which a specific energy rate applies.
- Demand charges are only slightly (10 – 15%) higher on Kauai than Oahu but energy rates are substantially higher (more than double).
- KIUC currently assesses a $5.00 / kW mo standby charge to privately owned generating facilities. The charge is calculated based on a demand level equal to 75% of the peak demand achieved over the past 12 months. The standby charge is ratcheted if outages occur that affect peak demand twice during any 12 month period. There are currently no standby charges on Oahu.

Figure 2 - Tariffs on Oahu and Kauai



HECO and KIUC Tariffs

(Effective 7/1/04)

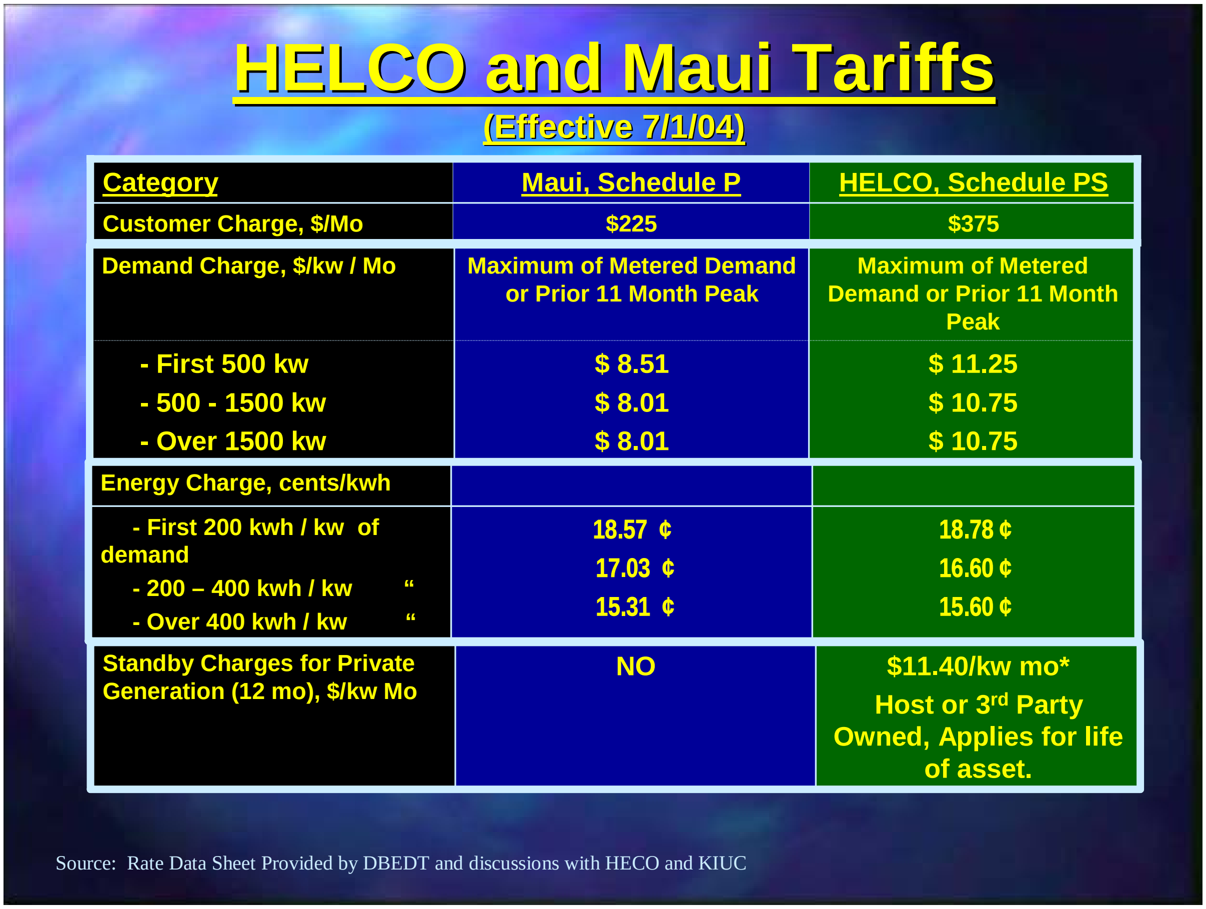
Category	HECO Oahu, Schedule PS	KIUC Schedule P
Customer Charge, $/Mo	$319	$347
Demand Charge, $/kw / Mo	Maximum of Metered Demand or Prior 11 Month Peak	Maximum of Metered Demand or 75% of Prior 11 Month Peak
- First 500 kw	$ 9.96	
- 500 - 1500 kw	$ 9.46	
- Over 1500 kw	$ 8.46	
- Monthly Demand		$10.45
Energy Charge, cents/kwh		
- First 200 kwh / kw of demand	10.22 ¢	22.90 ¢
- 200 – 400 kwh / kw “	9.43 ¢	22.90 ¢
- Over 400 kwh / kw “	9.23 ¢	20.94 ¢
Standby Charges for Private Generation (12 mo), $/kw Mo	NO	$5.00* *Host or 3rd Party Owned. 75% of Standby Demand Ratchet if Miss 2/12 mos

3.1.2. Tariffs on Maui and the Island of Hawaii

Figure 3 shows comparative electricity rates on Maui and the Island of Hawaii in July of 2004. All rates quoted include applicable fuel adjustments, surcharges and taxes, and so are representative of as-billed rates. Both schedules represent rates applicable to Large Power Commercial Facilities. Notable are:

- These rates also apply a tiered tariff structure whereby the energy rate in cents/kwh is adjusted as a function of the peak demand during the billing cycle. Reducing peak demand will affect both demand charges and the band over which a specific energy rate applies.
- Demand charges on Maui are comparable to Oahu but demand charge rates are moderately (over 20%) higher on the Island of Hawaii.
- Energy rates on both of these islands are about 70% higher than that of Oahu.
- HELCO currently assesses an $11.40 / kW mo standby charge to privately owned generating facilities. There are currently no standby charges on Maui.

Figure 3 - Maui and HELCO Tariffs



HELCO and Maui Tariffs

(Effective 7/1/04)

Category	Maui, Schedule P	HELCO, Schedule PS
Customer Charge, $/Mo	$225	$375
Demand Charge, $/kw / Mo	Maximum of Metered Demand or Prior 11 Month Peak	Maximum of Metered Demand or Prior 11 Month Peak
- First 500 kw	$ 8.51	$ 11.25
- 500 - 1500 kw	$ 8.01	$ 10.75
- Over 1500 kw	$ 8.01	$ 10.75
Energy Charge, cents/kwh		
- First 200 kwh / kw of demand	18.57 ¢	18.78 ¢
- 200 – 400 kwh / kw “	17.03 ¢	16.60 ¢
- Over 400 kwh / kw “	15.31 ¢	15.60 ¢
Standby Charges for Private Generation (12 mo), $/kw Mo	NO	$11.40/kw mo* Host or 3rd Party Owned, Applies for life of asset.

Source: Rate Data Sheet Provided by DBEDT and discussions with HECO and KIUC

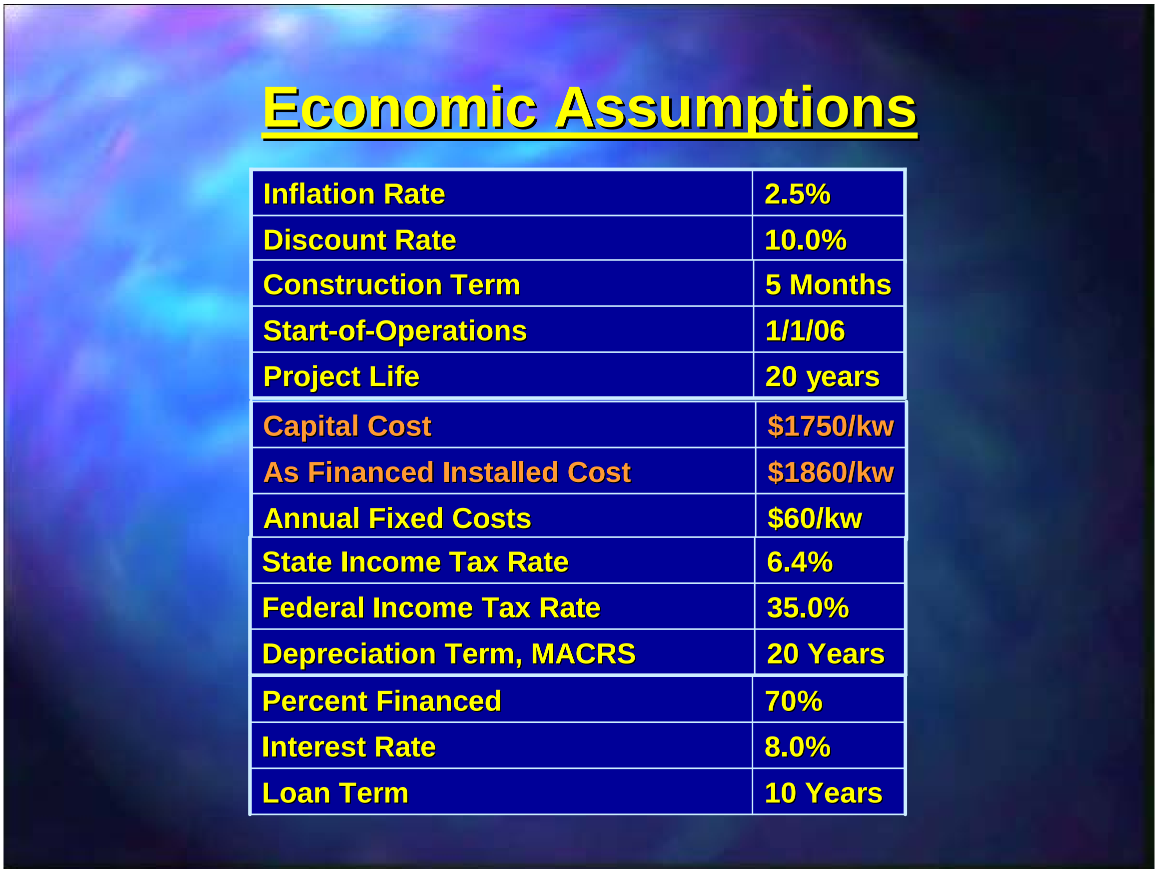
4. Assumptions

Provided below is a discussion of the assumptions used in the analysis.

4.1. Economic Assumptions

Figure 4 illustrates economic, schedule, tax and financing assumptions used in the analysis. A proxy capital cost of $1750/kw was assumed and an as financed cost of $1860/kw was assumed for all cases (except for the optimum sized chiller case where a credit of $100/kw was applied). No application or site specific cost estimating was included as part of the scope of the analysis. It should be noted that costs for installation and financing for specific sites and applications could deviate substantially from these assumptions. Sensitivities were performed to evaluate how project economics would be impacted by higher or lower capital costs.

Figure 4 - Economic Assumptions



Economic Assumptions

Inflation Rate	2.5%
Discount Rate	10.0%
Construction Term	5 Months
Start-of-Operations	1/1/06
Project Life	20 years
Capital Cost	$1750/kw
As Financed Installed Cost	$1860/kw
Annual Fixed Costs	$60/kw
State Income Tax Rate	6.4%
Federal Income Tax Rate	35.0%
Depreciation Term, MACRS	20 Years
Percent Financed	70%
Interest Rate	8.0%
Loan Term	10 Years

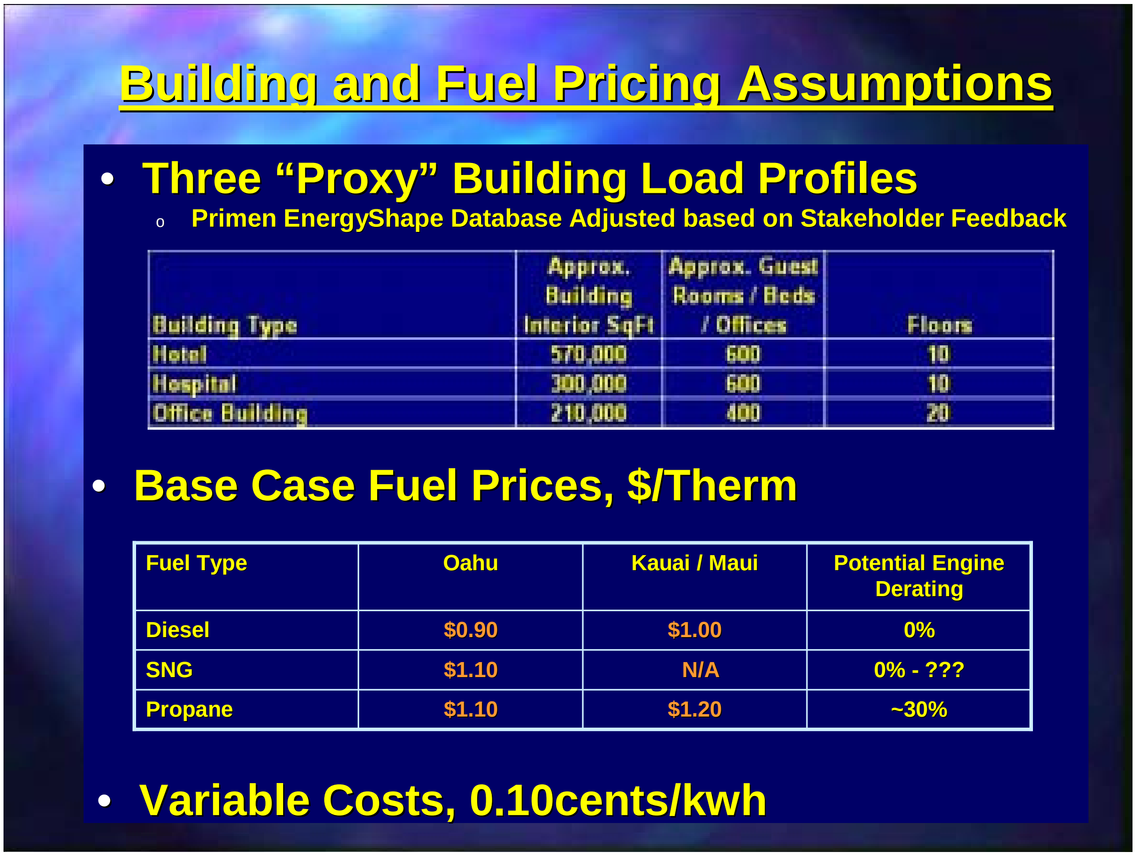
4.2. Building and Fuel Pricing Assumptions

Figure 5 shows the approximate building sizes and types represented by the three proxy load profiles used in the evaluation. Data was derived from the EnergyShape® database that has been licensed by CEI, EnergyShape was developed by Primen, an affiliate of the Electric Power Research Institute. The load profiles were derived from profiles for the southeastern US mainland, adjusted based on feedback from Hawaii stakeholders including HECO, The Gas Company, KIUC, and Oahu facility owners with the goal of most fairly representing profiles on the Islands.

Case studies were performed for proxy sites located on Oahu, Kauai and Maui. Economics for the Island of Hawaii are expected to be similar to Maui as the HELCO tariff structure on the Island of Hawaii is somewhat higher than MECO's on Maui, but standby charges imposed by HELCO will offset much of that difference. A slightly higher fuel cost was assumed on Kauai and Maui to account for the added costs of transportation and storage of fuel on those islands relative to Oahu.

A variable cost adder of 0.10 cents/kwh was added to fuel costs to account for operating costs such as lubricants and water. Fixed costs were also added as illustrated in Assumptions Table 1 and annual property tax and insurance costs of 1% of capital were assumed.

Figure 5 - Building and Fuel Pricing Assumptions



Building and Fuel Pricing Assumptions

- Three "Proxy" Building Load Profiles
  - Primen EnergyShape Database Adjusted based on Stakeholder Feedback

Building Type	Approx. Building Interior SqFt	Approx. Guest Rooms / Beds / Offices	Floors
Hotel	570,000	600	10
Hospital	300,000	600	10
Office Building	210,000	400	20

- Base Case Fuel Prices, $/Therm

Fuel Type	Oahu	Kauai / Maui	Potential Engine Derating
Diesel	$0.90	$1.00	0%
SNG	$1.10	N/A	0% - ???
Propane	$1.10	$1.20	~30%

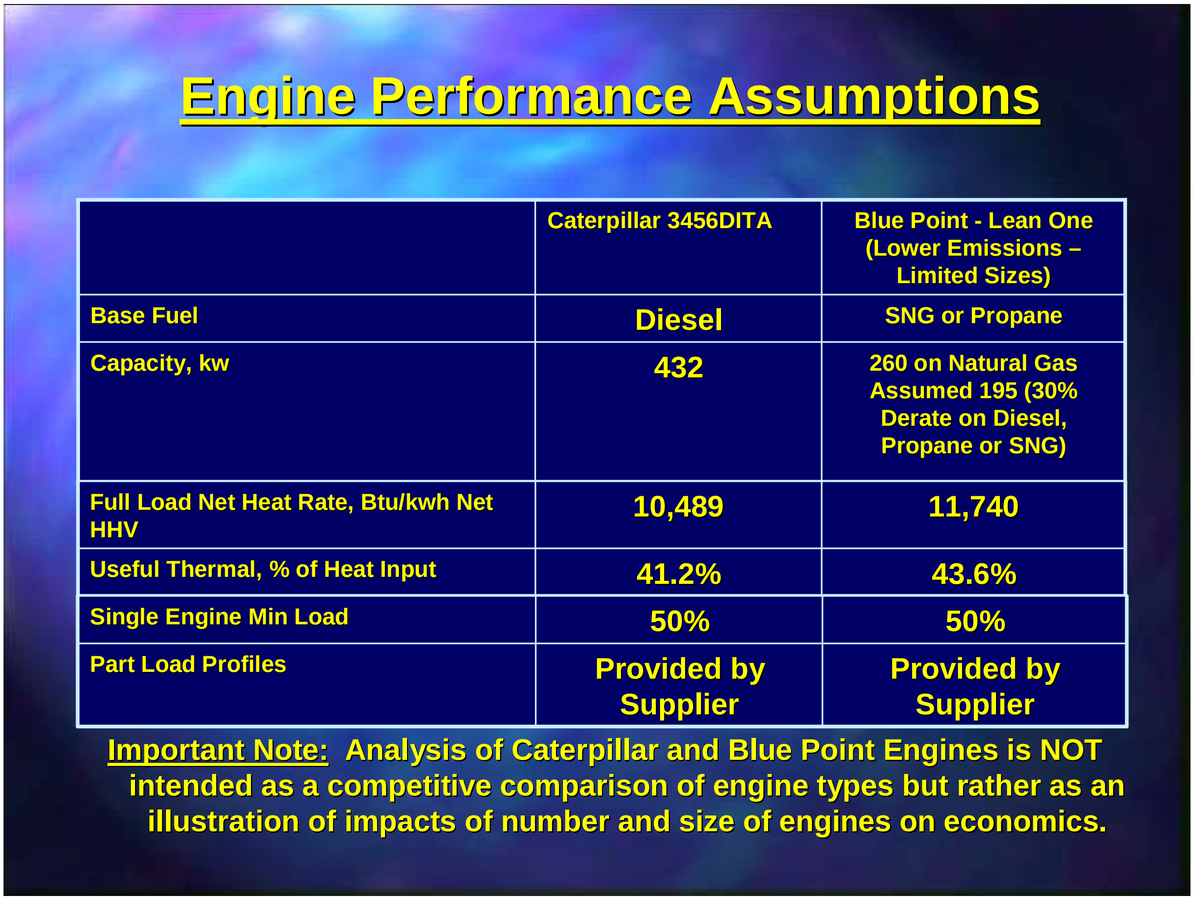
- Variable Costs, 0.10cents/kwh

4.3. Engine Performance Assumptions

Figure 6 illustrates equipment performance assumptions used in the analysis. The data was provided by Hawthorne Power Systems (for the indicated Caterpillar Engine) and from Blue Point Energy (for the Lean One Engine). The Caterpillar Engine is primarily designated for diesel fuel applications and the Blue Point Engine is primarily designated for gaseous fuels such as natural gas with a derating assumption when fired on Propane. Part load performance information used in the analysis was also provided by the respective suppliers and used in the analysis

Also note that due to the difference in fuel types (and respective emissions levels) achieved by the respective engines the information provided is NOT intended for use in a comparison of the two technologies.

Figure 6 - Engine Performance Assumptions



Engine Performance Assumptions

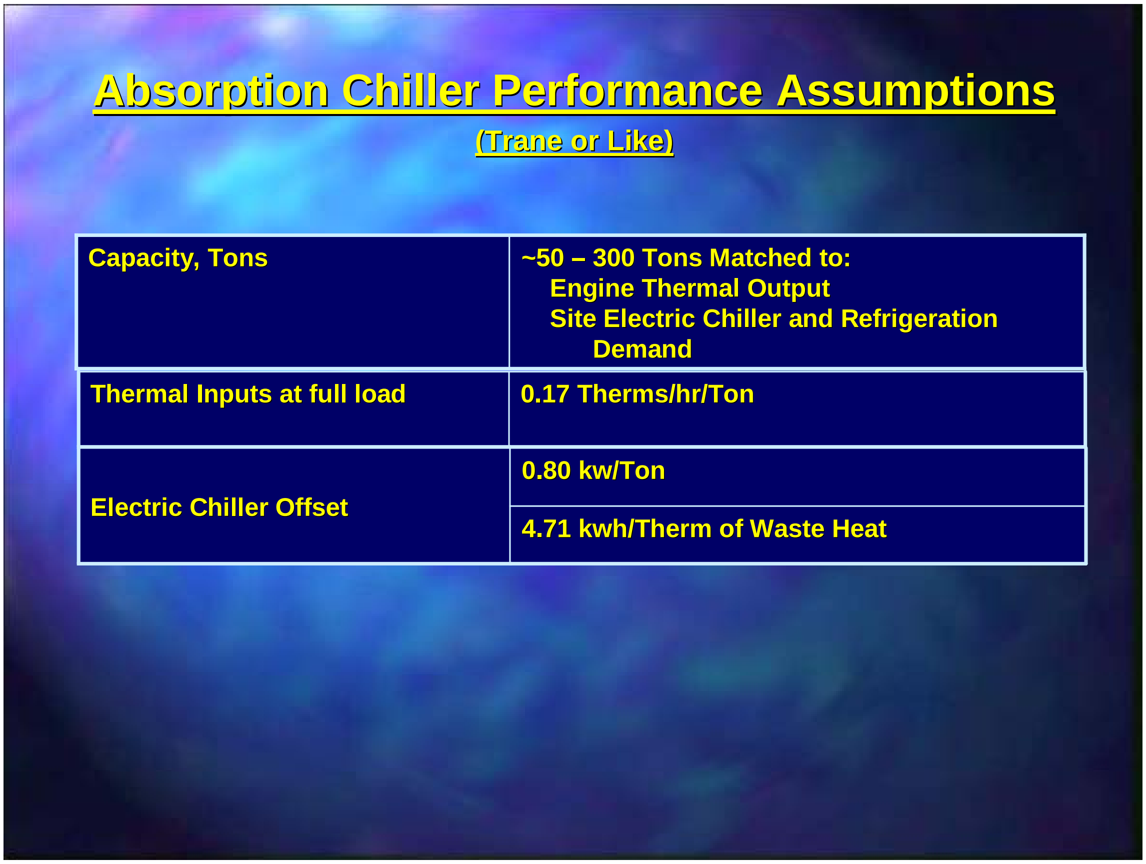
	Caterpillar 3456DITA	Blue Point - Lean One (Lower Emissions – Limited Sizes)
Base Fuel	Diesel	SNG or Propane
Capacity, kw	432	260 on Natural Gas Assumed 195 (30% Derate on Diesel, Propane or SNG)
Full Load Net Heat Rate, Btu/kwh Net HHV	10,489	11,740
Useful Thermal, % of Heat Input	41.2%	43.6%
Single Engine Min Load	50%	50%
Part Load Profiles	Provided by Supplier	Provided by Supplier

Important Note: Analysis of Caterpillar and Blue Point Engines is NOT intended as a competitive comparison of engine types but rather as an illustration of impacts of number and size of engines on economics.

4.4. Absorption Chiller Performance Assumptions

Figure 7 illustrates assumptions based on Trane or like equipment used for absorption chiller evaluations for the various proxy sites.

Figure 7 - Absorption Chiller Assumptions



Absorption Chiller Performance Assumptions

(Trane or Like)

Capacity, Tons	~50 – 300 Tons Matched to: Engine Thermal Output Site Electric Chiller and Refrigeration Demand
Thermal Inputs at full load	0.17 Therms/hr/Ton
Electric Chiller Offset	0.80 kw/Ton
	4.71 kwh/Therm of Waste Heat

4.5. Proxy Load Profiles and Base Case System Sizing

The charts provided on Figure 8 illustrate the hourly proxy load profiles over the course of a 12-month calendar year used in the study for the Hotel, Office Building and Hospital scenarios, respectively. These hourly profiles were derived from the 30-day profiles in the EnergyShape database and adjusted based on actual load profile data provided by island building owners and on feedback by various stakeholders who were interviewed. Total electric loads (including chillers), displaceable thermal load (thermal uses that can be offset by waste heat from the DER facility) and the breakout of electric chiller loads are illustrated. An expanded view of the hotel electric profile is included in the appendix.

Note the relatively consistent annual profile associated with the moderate climate in Hawaii, with about a 20% higher energy consumption assumed during the hottest months of July – October. Also note the relatively low thermal load anticipated for the Office Building configuration, a factor that had a dramatic negative impact on the predicted economics of DER for office building applications, especially on Oahu.

Figure 8 - Proxy Load Profiles

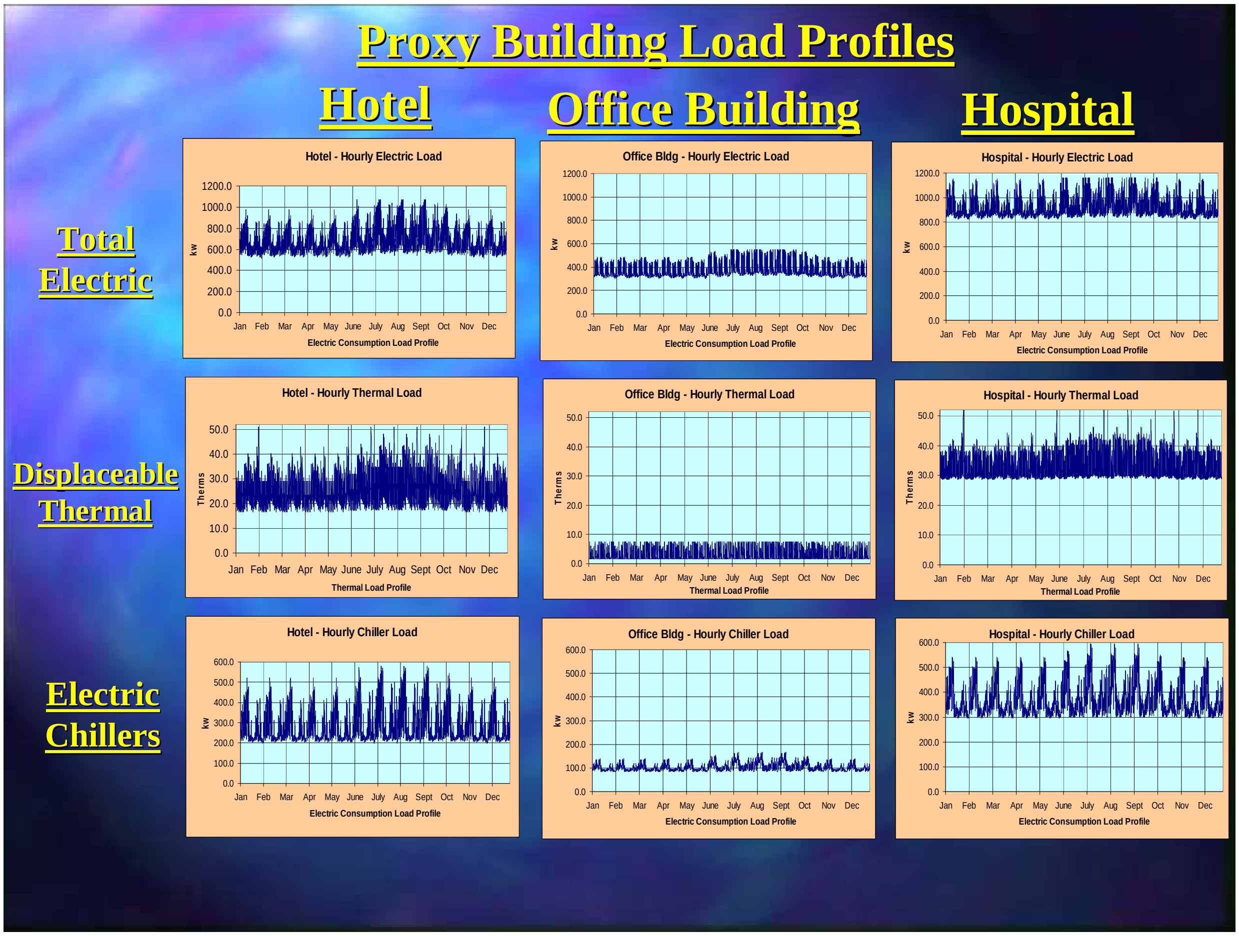
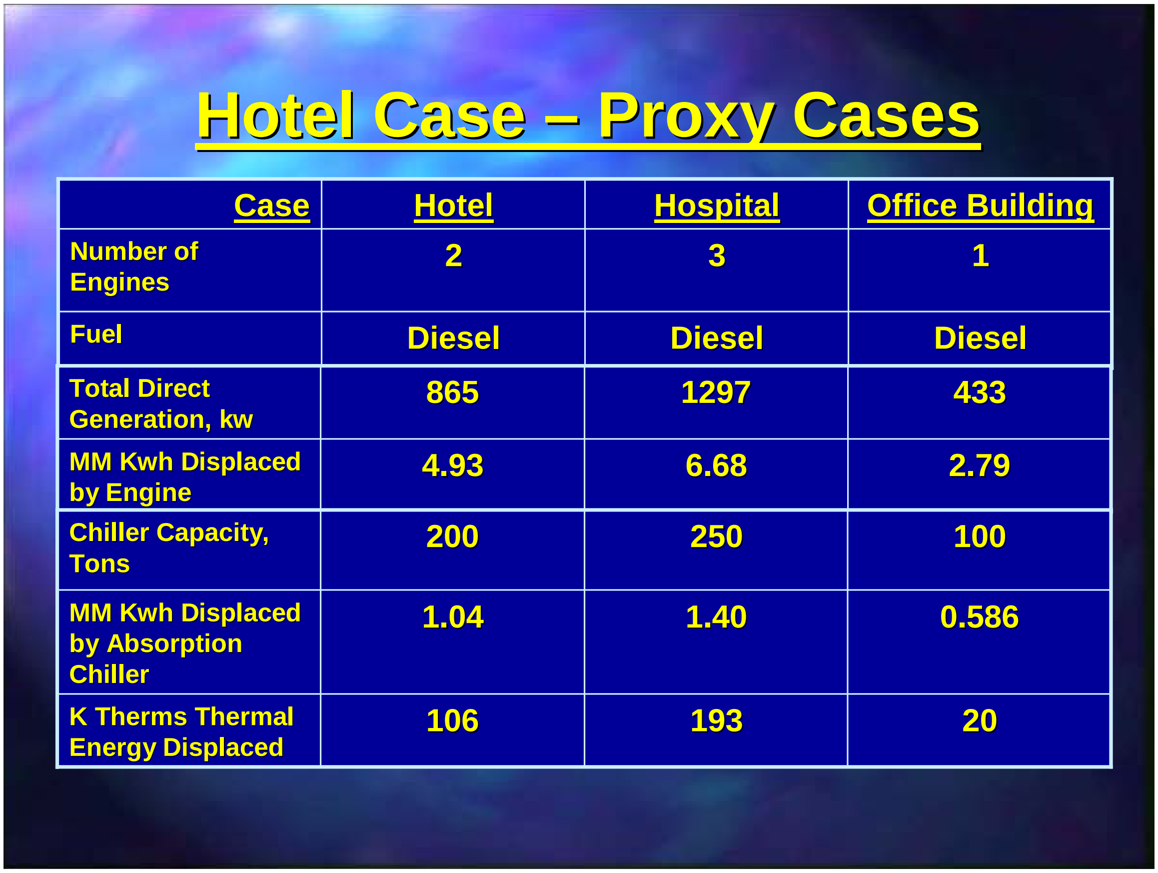


Figure 9 illustrates typical annual the thermal and electric offsets predicted by the EconExpert-IAT model for the three proxy building configurations evaluated on Oahu. Contributions of direct generation, chiller offsets and thermal offsets are identified.

These configurations represent the base case used in the analysis (as is typical on the US Mainland) where absorption chillers are often sized to maximize the use of thermal energy for chiller offsets. Sensitivity analyses performed later in the study revealed that it may be more economic on Oahu to first dedicate thermal energy to thermal offsets and then to use residual thermal energy for chillers where as the more common engineering practice of maximizing absorption chiller sizing appears to apply on the Neighbor Islands.

Figure 9 - Base Case System Sizing (Chillers Sized to Engine Capacity, not Optimized)



Hotel Case – Proxy Cases

Case	Hotel	Hospital	Office Building
Number of Engines	2	3	1
Fuel	Diesel	Diesel	Diesel
Total Direct Generation, kw	865	1297	433
MM Kwh Displaced by Engine	4.93	6.68	2.79
Chiller Capacity, Tons	200	250	100
MM Kwh Displaced by Absorption Chiller	1.04	1.40	0.586
K Therms Thermal Energy Displaced	106	193	20

5 Alternative Ownership Scenarios

The stakeholder perspectives evaluated in the analysis were:

- **Utility Ownership and Operations**. Under this scenario HECO or an affiliate utility would design, build, own and operate the facility providing guaranteed savings to the facility owner through credits in their electric rates. Those savings would be architected and limited under the terms approved by the PUC. For this analysis the rates proposed in HECO's October 10, 2003 filing were used.
- **Host Ownership and Operations**. Under this scenario the host would independently own and operate the facility, providing or borrowing all of the capital necessary to install the facility, keeping all of the applicable net benefits and assuming all of the associated risks.
- **Private Third Party Ownership and Operations**. Under this scenario a third party would design, install, own and operate the facility under a set of structured agreements and would share some percentage (typically 10 – 25%) of the resulting savings with the host. In this situation, the Third Party Investor who would also take responsibility for installation and operations.

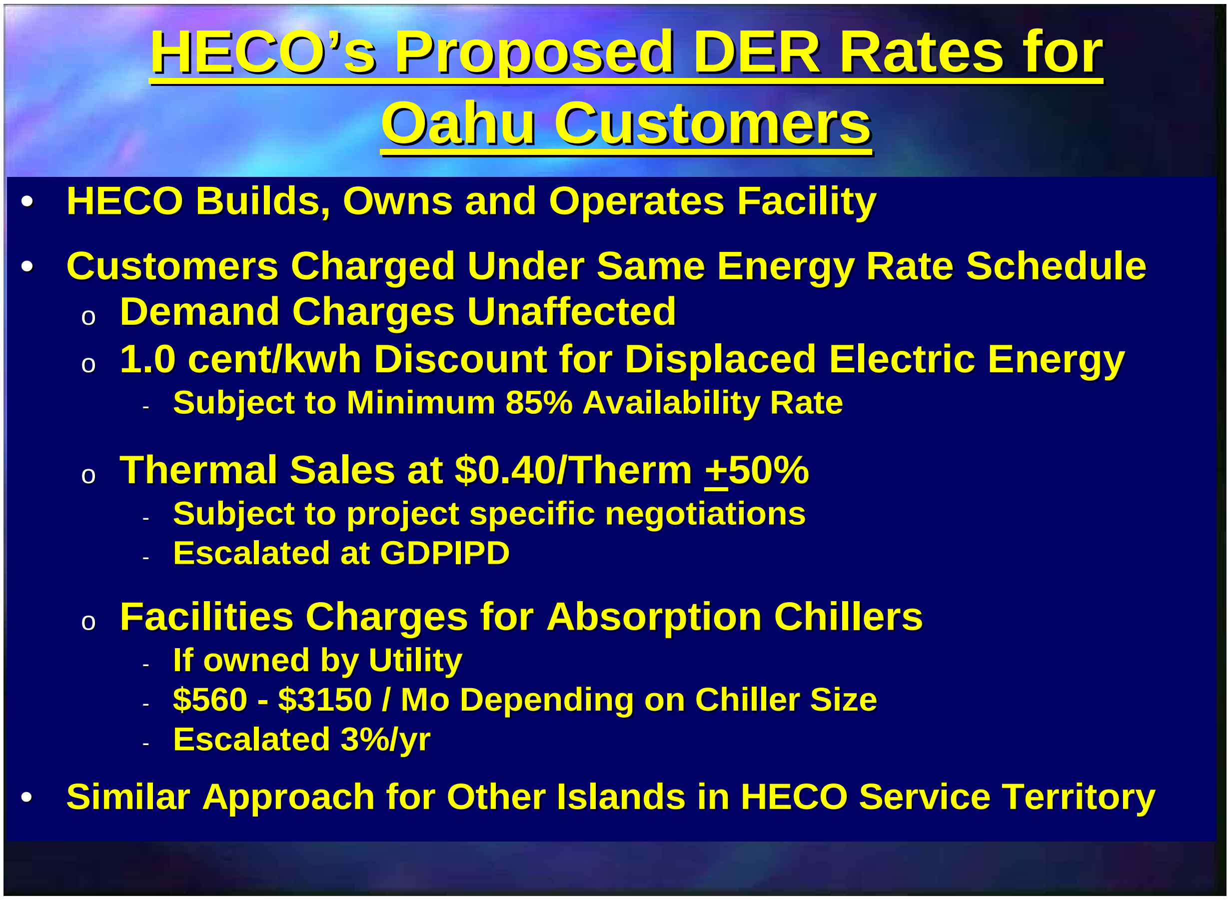
5.1. Utility Ownership

Figure 10 provides a summary of the Utility Ownership scenario proposed by HECO in its October 10, 2003 filing with the PUC. If approved as proposed to the Commission, HECO and its subsidiaries would be allowed to design, build, own and operate DER facilities and to include the capital and operating costs of those facilities in their Rate Base. For customers/hosts with whom HECO negotiates to site such facilities, those customers would receive a 1.0 cent per kWh discount in their electric energy rates for the energy supplied by the DER facility over a 20 year committed contract period. The energy savings provided to the customer would be guaranteed to be 85% or greater of the facilities design operating rate. In addition, any thermal energy sold by HECO to the host would be a guaranteed rate somewhere between $0.40 and $0.60/Therm. The actual rate would be finalized during specific negotiations for each site. It does not appear that HECO would be allowed to deviate from these rates to provide greater or lesser savings to the host.

If utility owned absorption chillers are sited at the installation, a lease payment of $560 - $3150/month would be charged to the owner, based on the capacity of the installed chillers

While not evaluated in this analysis, similar rate structures were proposed for Maui and The Island of Hawaii. No similar rate structure has yet been proposed by KIUC.

Figure 10 - HECO Proposed DER Rates



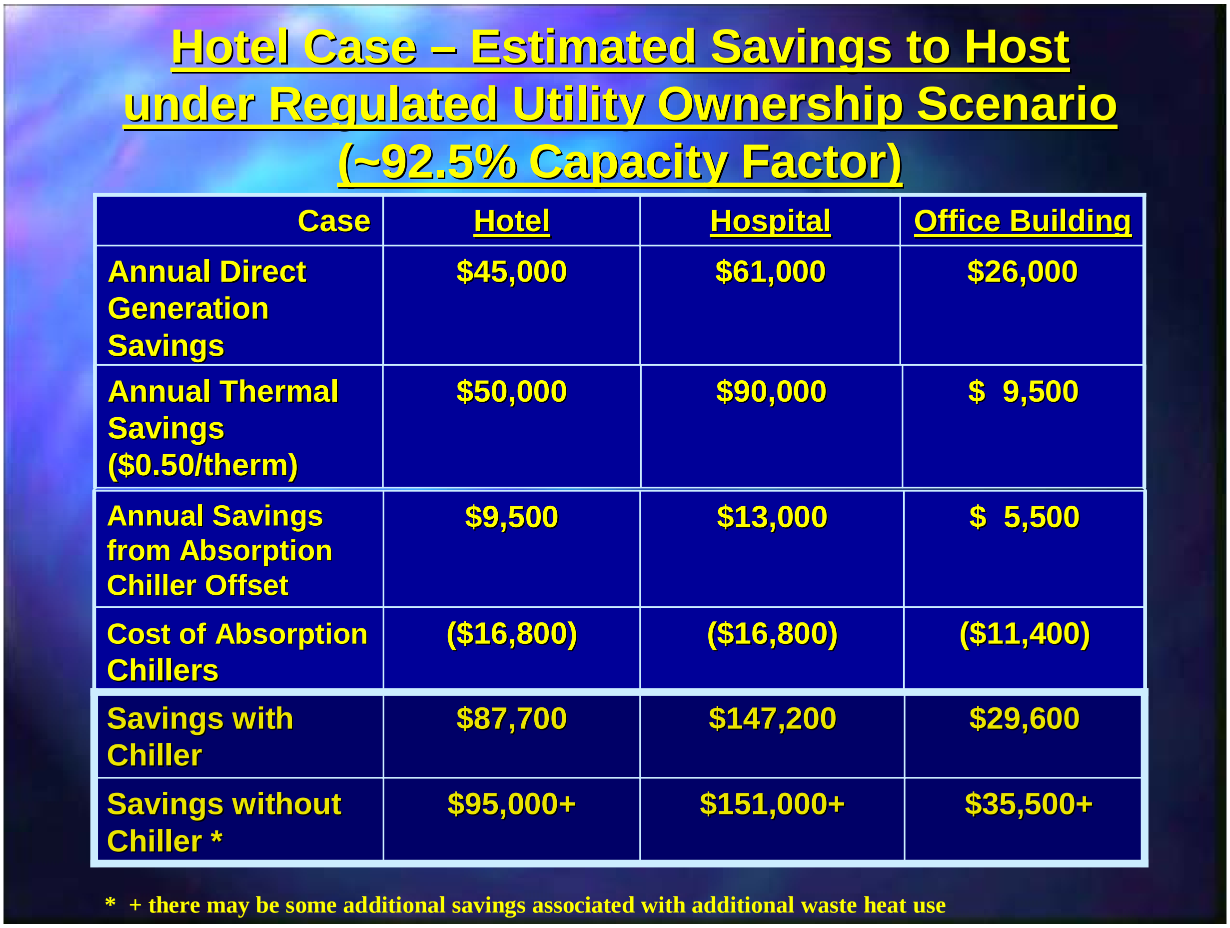
HECO's Proposed DER Rates for Oahu Customers

- HECO Builds, Owns and Operates Facility
- Customers Charged Under Same Energy Rate Schedule
  - Demand Charges Unaffected
  - 1.0 cent/kwh Discount for Displaced Electric Energy
    - Subject to Minimum 85% Availability Rate
  - Thermal Sales at $0.40/Therm ±50%
    - Subject to project specific negotiations
    - Escalated at GDPIPD
  - Facilities Charges for Absorption Chillers
    - If owned by Utility
    - $560 - $3150 / Mo Depending on Chiller Size
    - Escalated 3%/yr
- Similar Approach for Other Islands in HECO Service Territory

Figure 11 on the next page illustrates annual the savings that a site host is predicted to realize as a result of HECO installing, owning and operating a DER facility at the host's site under terms proposed in the filing. These savings represent an average of the amount of annual savings an owner could realize and could vary within a measurable range as a function of the DER facility operating reliability (85 – 100%), the negotiated value of thermal energy (40 – 60 cents/therm) and the owner's alternate costs for thermal energy.

In this analysis it did not appear to be economic to exercise the chiller leasing option on Oahu as the costs of leasing absorption chillers from HECO appears to be greater than the economic benefits realized based on the value of electric energy. On the Neighbor Islands, where electricity rates are higher, the chiller option would be more economic.

Figure 11 - HECO Regulated Ownership of DER Facility - Economics for Site Host



Hotel Case – Estimated Savings to Host under Regulated Utility Ownership Scenario (~92.5% Capacity Factor)

Case	Hotel	Hospital	Office Building
Annual Direct Generation Savings	$45,000	$61,000	$26,000
Annual Thermal Savings ($0.50/therm)	$50,000	$90,000	$ 9,500
Annual Savings from Absorption Chiller Offset	$9,500	$13,000	$ 5,500
Cost of Absorption Chillers	($16,800)	($16,800)	($11,400)
Savings with Chiller	$87,700	$147,200	$29,600
Savings without Chiller *	$95,000+	$151,000+	$35,500+

* + there may be some additional savings associated with additional waste heat use

5.2. Host Ownership

As an alternative to installation and ownership of a DER facility by HECO or its affiliated Island utility, a site owner on Oahu or a Neighbor Island might elect to install and operate the DER facility themselves. In this case the host would have the opportunity to realize all of the potential savings achieved through DER, but would also be required to provide the necessary investment dollars and to take on the associated operating risk. The potential benefits of independent facility ownership were markedly different on Oahu in comparison to the neighbor islands.

Table 1 shows the various combinations of number and type of engine that were evaluated for each site and building type as presented in the figure that follows.

Table 1 – Key to Figure 12 - Number and Type of Engines Evaluated for Each Building Type

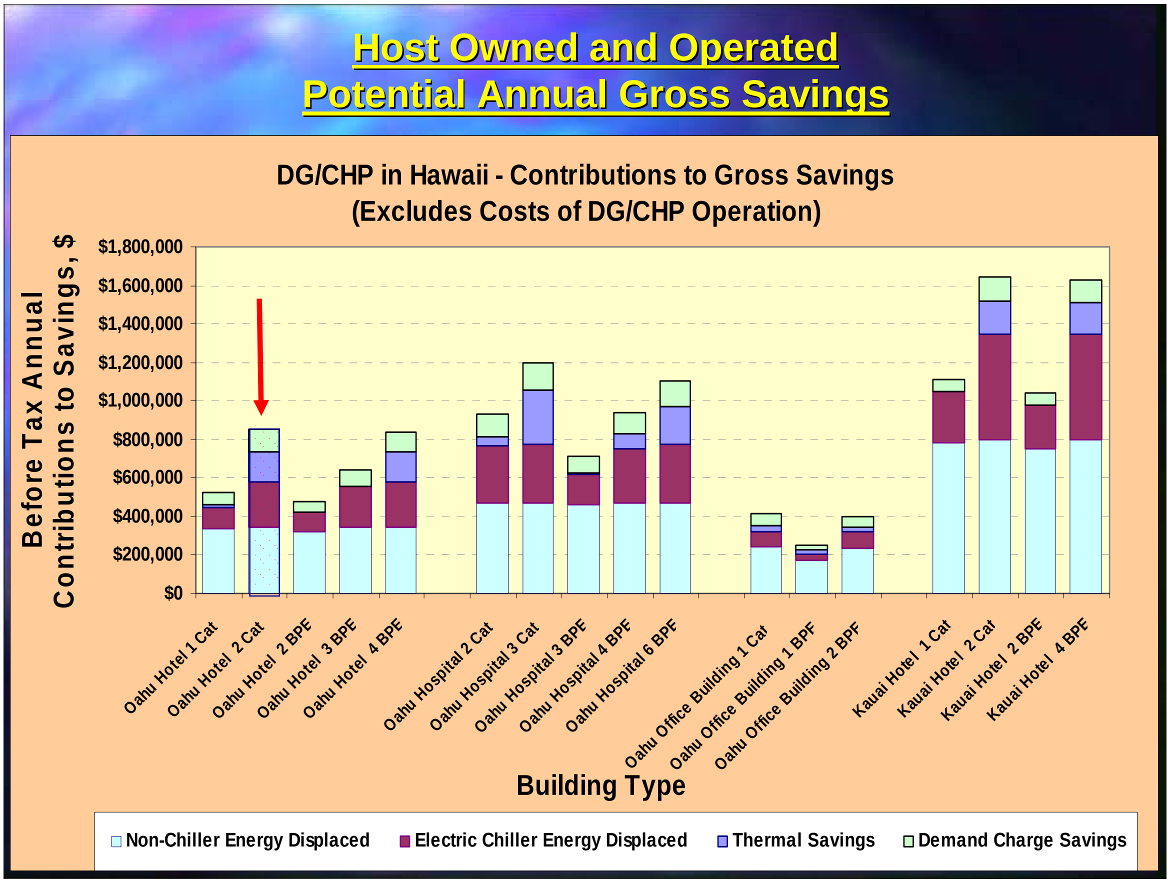
Key: **CAT** = Hawthorne Power Systems Caterpillar DM6342 – 455 kW fired on diesel oil.
BPE = Blue Point Energy Lean One Engine - 260 kW fired on gas, 190 kW on Diesel.

Case	Hotel on Oahu	Hospital on Oahu	Office Bldg on Oahu	Hotel on Kauai
Bar 1	**1 X CAT**	**2 X CAT**	**1 X CAT**	**1 X CAT**
Bar 2	**2 X CAT**	**3 X CAT**	**1 X BPE**	**2 X CAT**
Bar 3	**2 X BPE**	**3 X BPE**	**2 X BPE**	**2 X BPE**
Bar 4	**3 X BPE**	**4 X BPE**		**4 X BPE**
Bar 5	**4 X BPE**	**6 X BPE**		

The matching of the number of engines, capacity and fuel capability to an individual site is a key to optimizing the economics of DER. Incremental benefits of using single or multiple engines will depend on the characteristics of the site and the type of tariff.

Figure 12 illustrates that potential gross annual savings that might be realized by a host who elects to own and operate a DER facility on their own site. This chart only includes savings and does not include costs for installation of the facility or operating expenses which are included in Figure 13 that follows. The cases in Figure 12 shown assume diesel fuel and are representative of the savings realized exclusive of standby charges or demand ratchets.

Figure 12 – Gross Savings Calculated for the Base Case Scenarios



The second bar from the left is highlighted because this is the “Unoptimized Base Case” used for evaluations on Maui and Kauai and for most of the sensitivity analyses performed in the study. In analyses that follow, this case will be used for various sensitivities including optimization of chiller sizing which can substantially improve the economics of DER, especially on Oahu.

Important to note are:

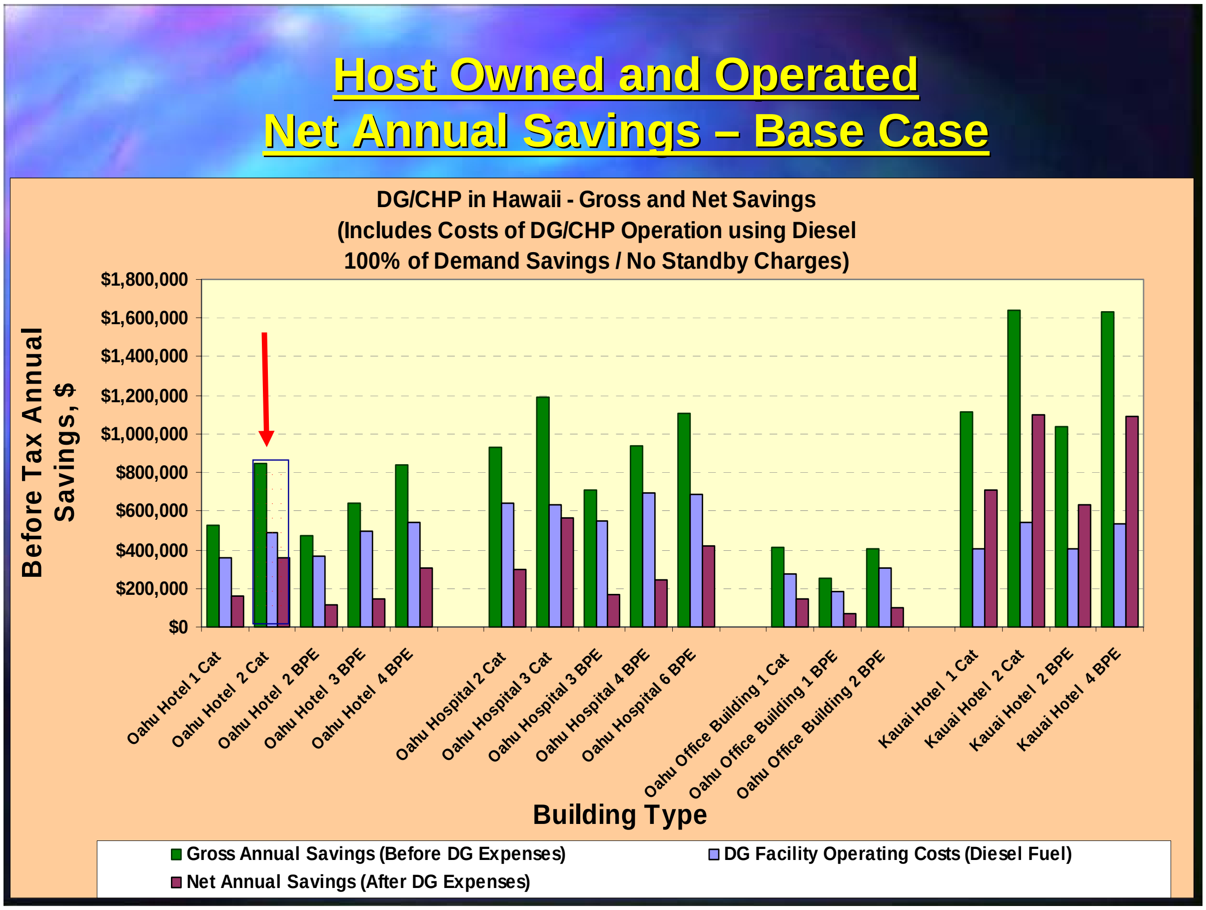
- Due to the lower electric rates on Oahu, sites with substantive thermal offsets should first exercise thermal offsets before the application of waste heat to drive chillers. Sites with the greatest degree of thermal offsets will have substantially better economic potential. This conclusion does not necessarily apply on the Neighbor Islands.
- Due to the high electric rates on Kauai, the economics of DER appear to be compelling on this Island.
- Savings and return on investment can be substantially enhanced by the appropriate combination of the number of engines, the optimized use of thermal offsets and the optimized sizing of the absorption chillers, and optimizing the operating profile of the facilities to match the site needs and tariff. Importantly the tradeoffs between additional capital investment and additional savings must be considered.
- Demand charge savings make an important potential contribution to savings which will not be realized during the first year of operation due to tariff ratchets. Standby charges must also be considered. Savings in future years could be reduced if plants exhibit poor reliability, especially if outages occur during peak periods of site energy use.

Gross Annual Savings measured as the amount of the reduction in electric and thermal purchase by the host are in the range of $800,000 - $1,000,000 / year, however, in order to achieve these savings the site owner will have expenses associated with owning and operating the facility. The next figure shows respectively gross savings, costs of operation and net savings associated with each of the base case scenarios.

It is also important to point out that the interval analysis alone does not lead to the final determinant of whether or not a specific project represents a financially attractive investment opportunity. That analysis requires full discount cash flow analysis. Key factors addressed in the discount cash flow analysis that were not yet included in the preceding interval analysis include:

- Investment costs to install the facility.
- Financing costs and financing benefits.
- Fixed operating costs that do not vary with the level of facility operation including items such as property taxes and insurance.
- Equipment depreciation.
- Income Taxes

Figure 13 - Net Savings Calculated for the Base Case Scenarios

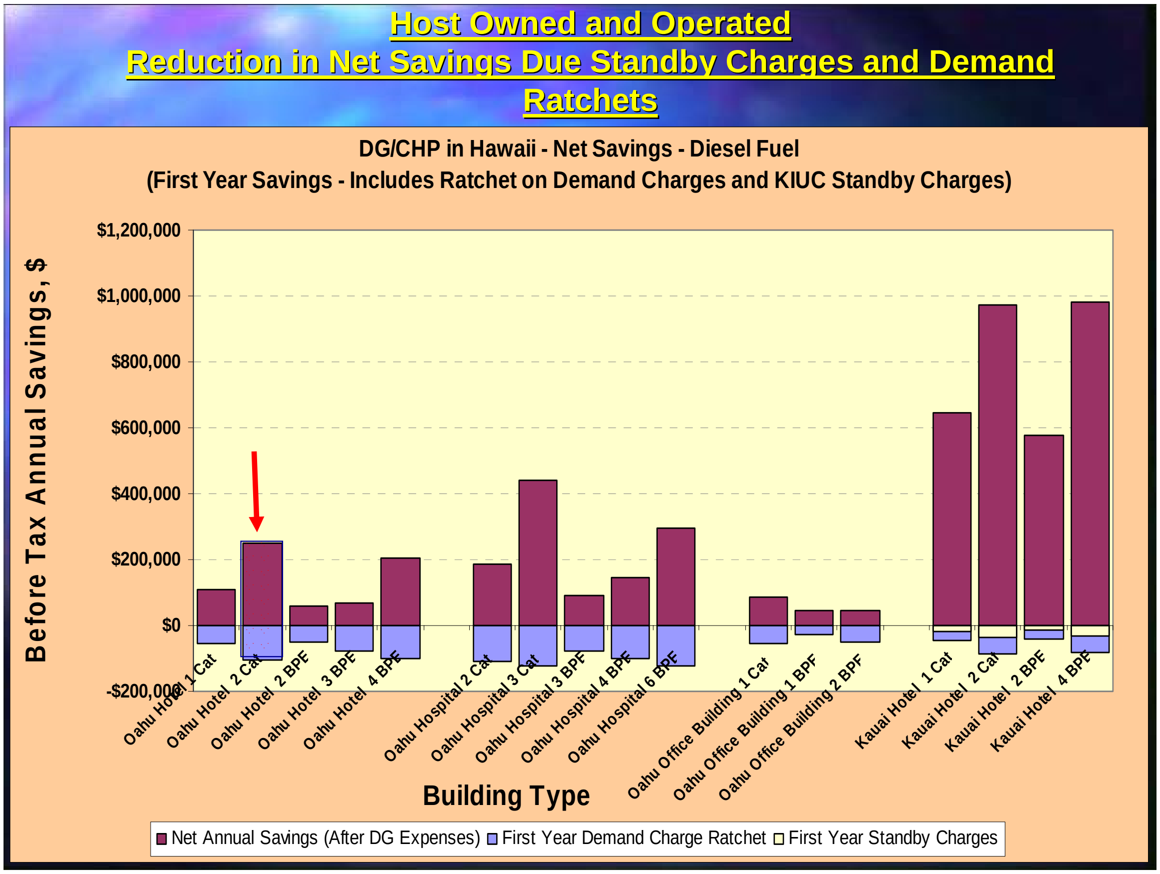


The Gross savings in the base case of $800,000 - $1,000,000 per year are offset by operating costs in the range $525,000 / year producing a net savings to the host in the range of $375,000 / year.

Figure 13 also shows that the net savings for the Hotel on Kauai (group 4 vs. group 1) are substantially better than those on Oahu, due primarily to the higher electric rates on Kauai. Also note the importance of site optimization where the net benefits of adding additional engines at a site can be substantial or marginal depending on the site load profile, equipment operating specifications and tariff.

During the first year of operation and in years where a facility experiences unreliable operations, additional fees may be charged to the owner in the form of standby charges and demand ratchets. *Standby Charges* are a Monthly fee, (in $/kw mo) that represent new charges to the customer to ensure that in the event of an outage in the cogeneration facility, the utility will provide firm backup power. *Demand Ratchets* are a charge used in some tariffs which require the customer to pay a premium on each bill during a specified period, typically related to peak demand or usage during a previous billing period (up to 12 months earlier). Ratchets are often used by utilities as a means to recover costs associated with installed capacity which the utility deems a customer previously used and so therefore should continue to fund for some period. The figure below illustrates under each of the scenarios how standby charges and/or demand ratchets reduce annual savings. Figure 14 shows the net reduction in 1st year savings associated with these charges.

Figure 14 - Impacts of Standby Charges and Demand Ratchets on Potential Savings



On Oahu during the first year of facility operation, demand charge savings will be offset by ratchets which result in inclusion of peak demand ratings metered over the prior 11 months before the DER facility was brought on-line. On Kauai, in addition to demand ratchets, standby charges will also apply based on 75% of the peak demand measured during the previous 11 months. If the DER facility operates reliably, these charges will phase out over the first year of operation as the new lower peak is established, however if the facility experiences frequent outages during peak demand periods the demand ratchet and standby charges could be extend into future years.

For the cases shown here (about 865 kw DER) note that the reduction in savings resulting from the offsetting demand and/or standby charges on the Islands are on the order of $50,000 - $100,000 / year on Oahu and $40,000 to $70,000 / year on Kauai.

In all cases note the relative impacts of demand and standby charges relative to total savings. In the Office Building situation on Oahu, almost all of the potential savings could be reversed whereas on Kauai the demand and standby charges represent a relatively small compared to the total potential savings.

To complete the investment decision analysis, fixed O&M, capital costs financing costs and impacts on income taxes, etc. (using a tool like EconExpert-DG) must be included in the analysis. Sensitivities to key risk factors and alterative design scenarios will also be discussed. These analyses will be presented following the brief discussion of the Third Party Ownership Scenario.

5.3. Third Party Ownership – Sharing of Savings with the Host

As an alternative to Host Ownership, a third party (usually a non-utility experienced in DER operation) might offer to build, own and operate the DER facility on behalf of the host. In this case the third party and site host might share the savings identified in the previous section.

Because regulated ownership would likely specifically limit the amount of the savings that the utility can provide to the host, in many circumstances third party ownership could provide advantages to both the host and the Third Party owner. Cases analyzed later in the study will illustrate various mechanisms for sharing the savings identified in the previous section to incentivize both the host and private Third Party investor to install DER without participation by the utility.

6. Sensitivity of Net Savings to Design and Operating Factors

Provided below are a series of sensitivity analyses performed using the EconExpert model to determine the impacts on savings that might result as function of certain design and operating cost considerations.

6.1. Alternative Fuels (Diesel versus SNG or Propane)

All fuels used available for non-renewable DER in Hawaii are petroleum based, so their pricing is directly linked to current world oil prices. Fuel options generally include Diesel Oil, Synthetic Natural Gas (SNG derived from Naphtha) and Propane, all derived by refining imported oil. Thus, the cost differentials between these fuels on an as delivered basis are directly related to world oil prices, the incremental refining costs and associated refinery yields. In this analysis a world oil price of about $41.00 / bbl was assumed leading to the corresponding estimated costs for diesel oil, SNG and propane.

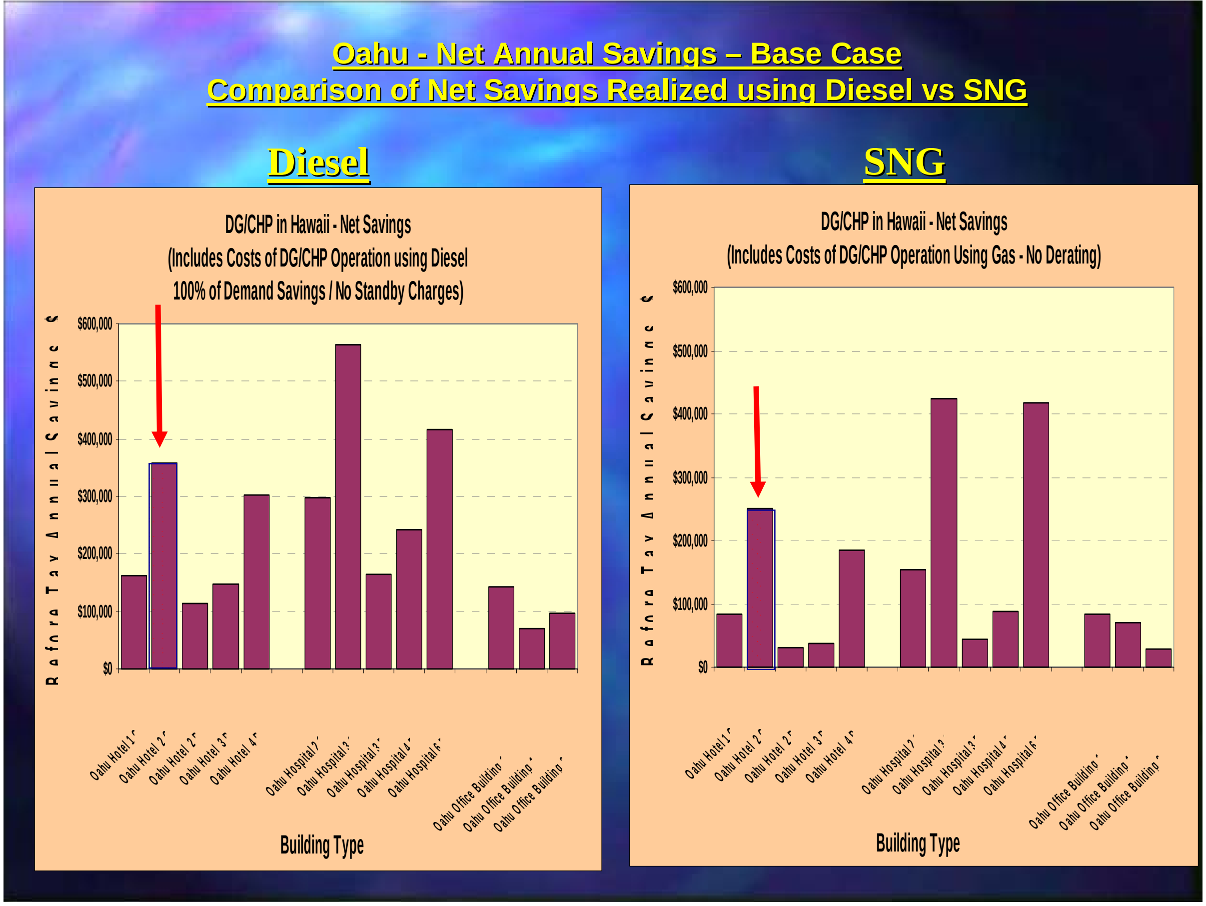
In general, diesel oil is the lowest cost fuel with a 20% - 30% lower cost delivered to the site than alternative fuels such a SNG and propane. This cost differential, however, does not typically include other considerations and externalities such as:

- Transportation convenience: Diesel must typically be delivered to the site by truck. On parts of Oahu SNG can be delivered by pipeline. On some other parts of Oahu and limited areas of Neighbor Islands, except Lanai, propane air mixture is available by utility pipeline. Where utility gas is not available, propane can be delivered by truck.
- Storage convenience: Diesel and non-utility propane must be stored in tanks on-site, while SNG and utility propane do not require on-site storage.
- Environmental Concerns and Externalities. Diesel produces greater emissions than SNG and propane, but can meet all air emissions standards.

Figure 15, on the next page, illustrates the economic net savings at the site comparing diesel to SNG on Oahu without any credits for the fuel specific considerations and externalities listed above. In general, based only on costs, diesel appears to be the most economic fuel in many instances.

Figure 15 - Comparative Savings of DER Fired on Diesel vs. SNG

(No credits for externalities included)



Oahu - Net Annual Savings – Base Case
Comparison of Net Savings Realized using Diesel vs SNG

Diesel

SNG

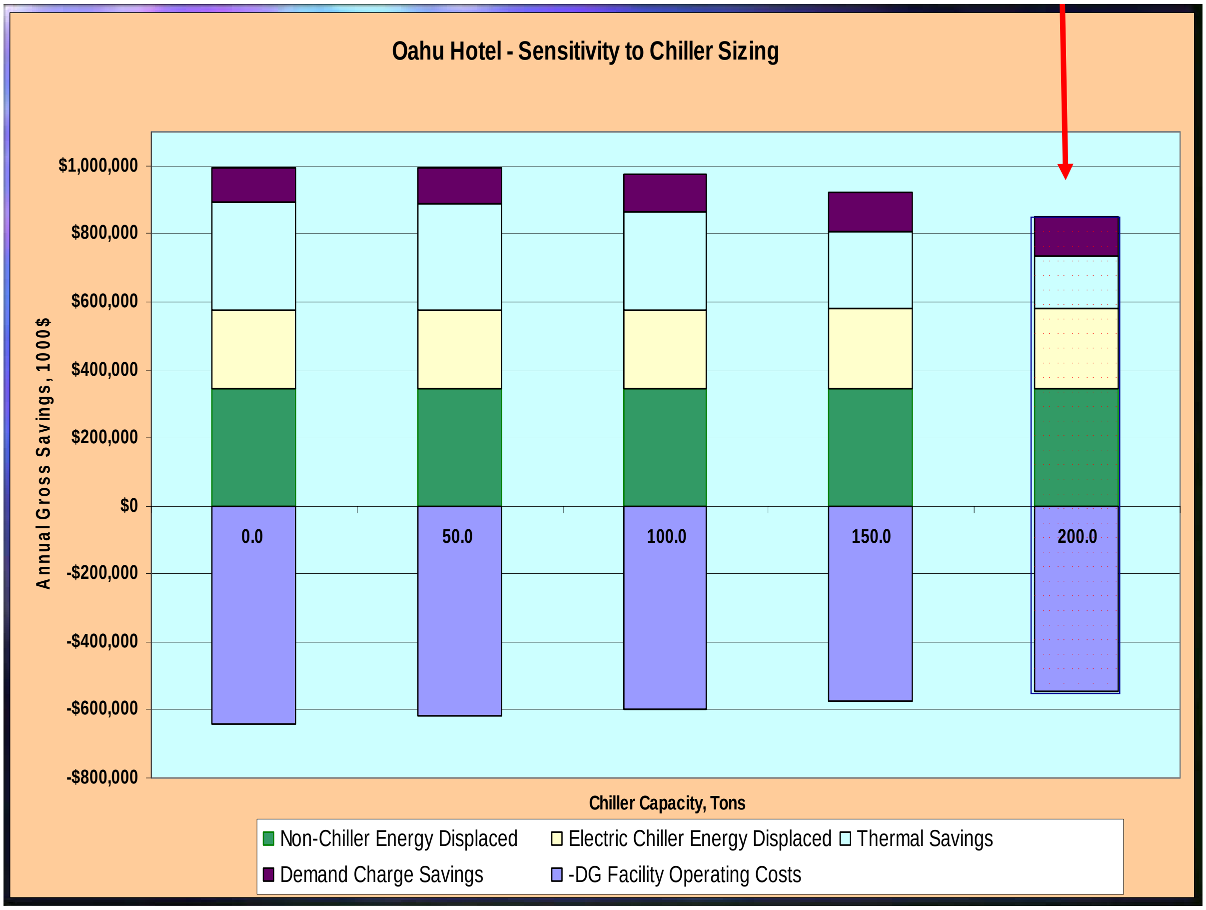
6.2. Optimum Chiller Sizing and the Most Economic Use of Waste Heat

As a result of the high cost of fuel relative to the cost of electricity on Oahu, a key consideration is the optimum use of waste heat from the DER facility. The two primary alternatives for use of waste heat in DER are:

- To drive absorption chillers that will displace electric energy that was otherwise consumed by electric chillers.
- To displace thermal energy (usually hot water uses) that was otherwise generated by burning fuel on site in boilers.

Figure 16 illustrates the gross savings estimated for the proxy Oahu hotel as a function of the amount of absorption chiller capacity that is installed as part of the new DER installation.

Figure 16 - Sensitivity of Potential Savings to Optimized Chiller Sizing and Use of Waste Heat from DER

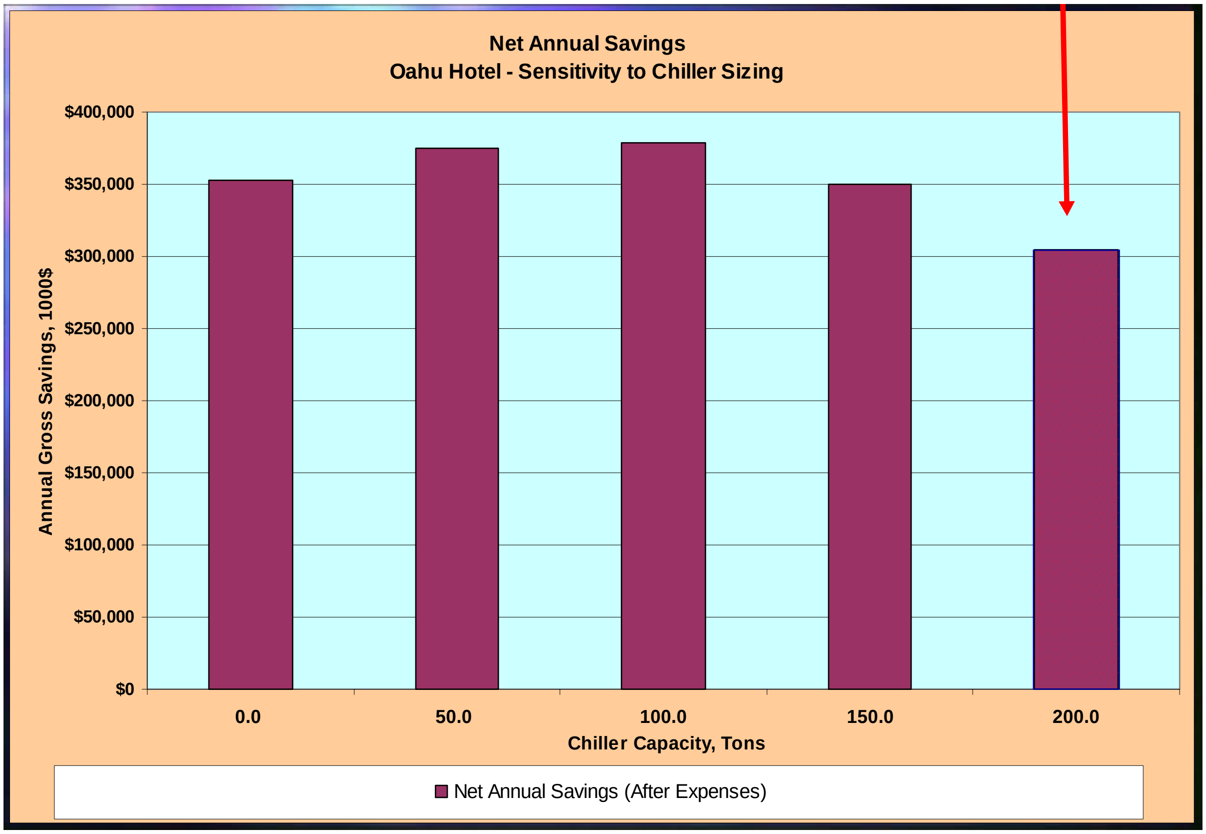


The individual contributions to savings and the offsetting Facility Operating Costs are itemized in Figure 16. Common design practice is to maximize the of size the absorption chillers as dictated by the site needs and the amount of available thermal energy from the DER facility (highlighted case) however, on Oahu it appears to be more economic to first displace thermal applications and to use only any remaining thermal energy for absorption chillers. Contributing factors include:

- The relatively high value of displacing thermal energy in comparison to the commercial electric rates on Oahu, which are significantly lower than on the Neighbor Islands.
- The relative profiles of thermal and chiller uses which can result in selection of an operating profile that maximizes plant operating efficiency and minimizes fuels costs for DER.
- The added costs associated with installing, operating and maintaining new absorption chillers.

Figure 17 illustrates the net impacts of costs of fuel and operations for the DER facility. In this instance, it can be clearly seen that though the site and engine configuration could accommodate 200 tons of absorption chiller capacity, the optimum economics are achieved at about 100 tons of absorption chiller capacity. This result can only be derived by fully understanding and evaluating the demand profile at the site in combination with the applicable of the electric and gas tariffs and the operating characteristics of the DER facility (particularly heat rate and thermal output versus load). Note that the "Base Case" on Oahu where the chiller sizing is maximized to match the DER and site capacities, is the case with the least net savings.

Figure 17 - Net Annual Savings Achievable through Optimized Chiller Sizing and Use of Waste Thermal (On Oahu)



7. Cash Flow and Return on Investment Analysis for Projects on Oahu, Kauai and Maui

Identifying the savings that can be achieved using the preceding Interval Analysis only provides us with a part of the story. In order to achieve these savings the facility owner will have other costs (and benefits) which must be considered in order to determine the net after-tax return on investment that the project has to offer. Examples of key factors that remain to be evaluated include:

- Capital Investment Costs;
- Financing Costs;
- Fixed Operating and Maintenance Costs that do not depend on the level of facility operation (i.e. staffing, certain maintenance, etc.);
- Grant funding benefits;
- Tax benefits including accelerated depreciation (for taxable entities). For non-taxable entities it is oftentimes beneficial to find ways to transfer these tax benefits to third parties who can efficiently use them;
- State and federal income taxes which will be affected as a result of either income from the facility or a resulting reduction in the deductible expenses that the owner will have as a result of reducing their electric and thermal expenses (for taxable entities);
- Time value of money considerations relating to the owner's cost of capital (their alternative investment options) and the timing of when expenses are realized and savings are achieved. For example, $100,000 of savings in the tenth year of operation of the facility is not nearly as valuable as the same $100,000 of savings in the first year of operation. These differences relate both to the impacts of inflation and the alternative investment opportunities that are available for savings or income that are received earlier.

7.1. Discount Cash Flow Analysis - Oahu Hotel

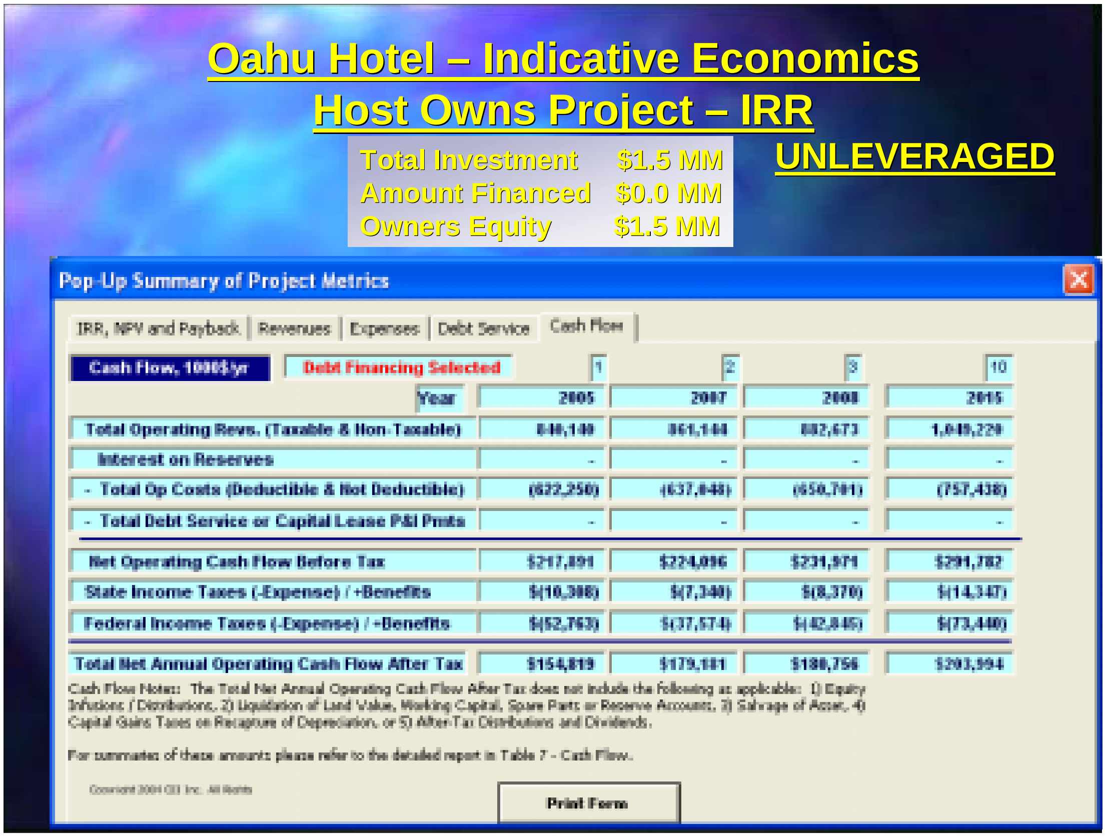
The first set of financial analysis presented for a proxy hotel located on Oahu.

7.1.1. Host Owned Facility Financed with Cash – Oahu Hotel

The EconExpert-DG financial model was used to perform an after-tax discount cash flow analysis to determine if the investment yields a sufficient return, and then to fully understand the risk profile of the facility. The table above is excerpted from the EconExpert-DG model and illustrates the various contributions to after-tax net income that will result from the specified investment and savings for an "Unleveraged Case". **Unleveraged means that the owner provides 100% of the capital to build the facility and does not borrow any of the needed funds, and so in this case there are no associated costs for financing.**

Figure 18, excerpted directly from the EconExpert-DG model, illustrates that on an after-tax basis the Unoptimized Base Case (using maximum chiller capacity) resulted in a net savings of ~$150,000 in the first year and over $200,000 in year 10, with the annual savings growing as a function of projected future escalation of fuel and electric prices, and of the net annual impacts on the owners income taxes (which vary as a function of net savings and the tax depreciation profile for the facility). Because the host makes the investment with 100% of his own cash (unleveraged) and takes the installation and operating risks, all of the associated savings accrue to the host.

Figure 18 - Results of Cash Flow Analysis for the Oahu Hotel with Maximum Absorption Chillers – Cash Financing – Oahu Hotel Host Ownership



Total Investment	$1.5 MM
Amount Financed	$0.0 MM
Owners Equity	$1.5 MM

Cash Flow, 1000$/yr	Debt Financing Selected	1	2	3	10
	Year	2005	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)		840,140	861,144	882,673	1,049,220
Interest on Reserves		-	-	-	-
- Total Op Costs (Deductible & Not Deductible)		(622,250)	(637,048)	(650,701)	(757,438)
- Total Debt Service or Capital Lease P&I Pmts		-	-	-	-
Net Operating Cash Flow Before Tax		$217,891	$224,096	$231,971	$291,782
State Income Taxes (-Expense) / +Benefits		$(10,308)	$(7,340)	$(8,370)	$(14,347)
Federal Income Taxes (-Expense) / +Benefits		$(52,763)	$(37,574)	$(42,845)	$(73,440)
Total Net Annual Operating Cash Flow After Tax		$154,819	$179,181	$180,756	$203,994

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

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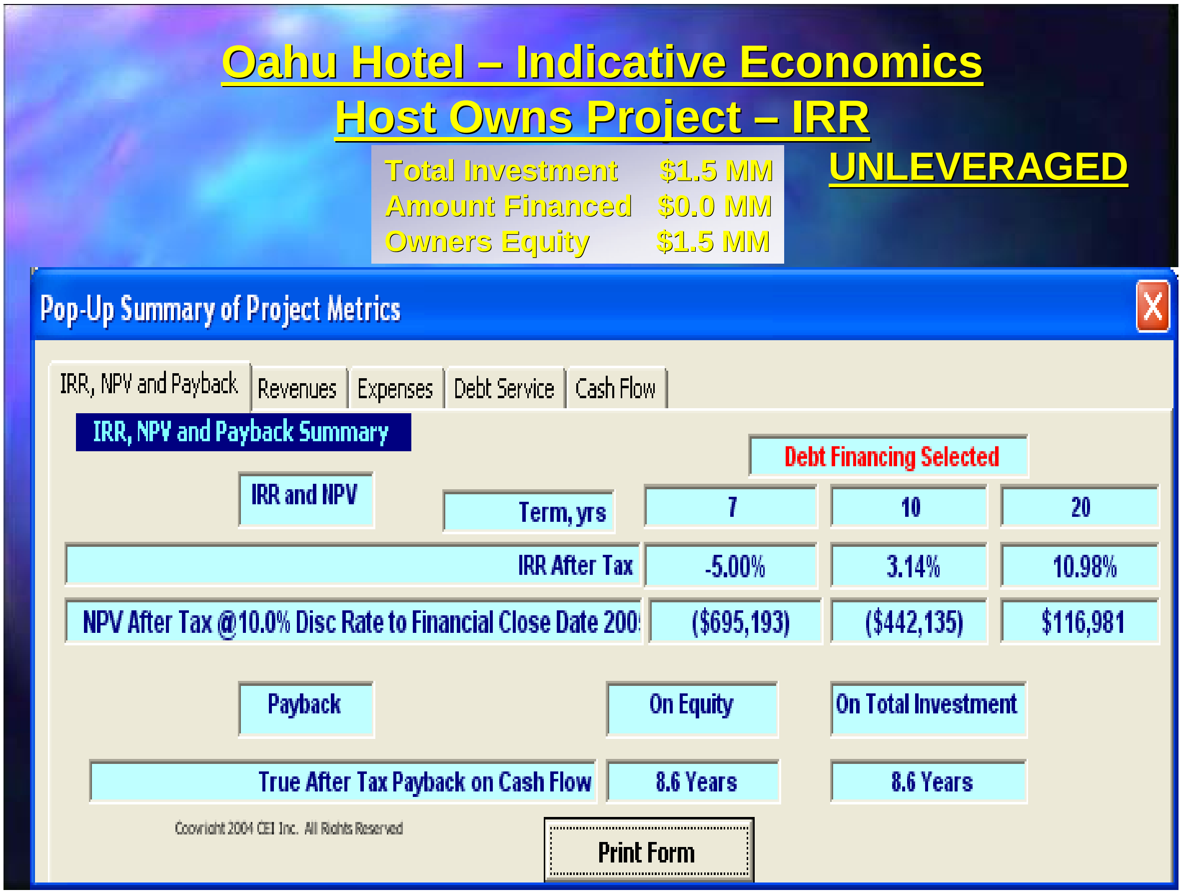
As shown in Figure 19, based on the premised capital investment for this facility (of $1750 / kw = $1.5 MM), one can see that for this facility (the Unoptimized Base Case which does not include optimized chillers) located on Oahu, with the host providing all of the cash to build the facility (unleveraged) the economics of host ownership provide a mildly attractive rate of return of about 11% after-tax. However, this 11% internal rate of return assumes that the facility remains in operation for 20 years. On a 10-year horizon a net after-tax IRR of only just over 3% is achieved. True "After-Tax Payback" calculated based on predicted cash flows and 100% cash financing is about 8.5 years.

While this first case does not appear to be economically attractive, the economics can be substantially improved through optimization of the facility design and the use of efficient financing.

Figure 19 – Return on Investment for the Oahu Hotel
with Maximum Absorption Chillers – Cash Financing – Host Ownership



Oahu Hotel – Indicative Economics
Host Owns Project – IRR

Total Investment	$1.5 MM
Amount Financed	$0.0 MM
Owners Equity	$1.5 MM

UNLEVERAGED

Pop-Up Summary of Project Metrics

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV			
Term, yrs	7	10	20
IRR After Tax	-5.00%	3.14%	10.98%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	($695,193)	($442,135)	$116,981

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	8.6 Years	8.6 Years

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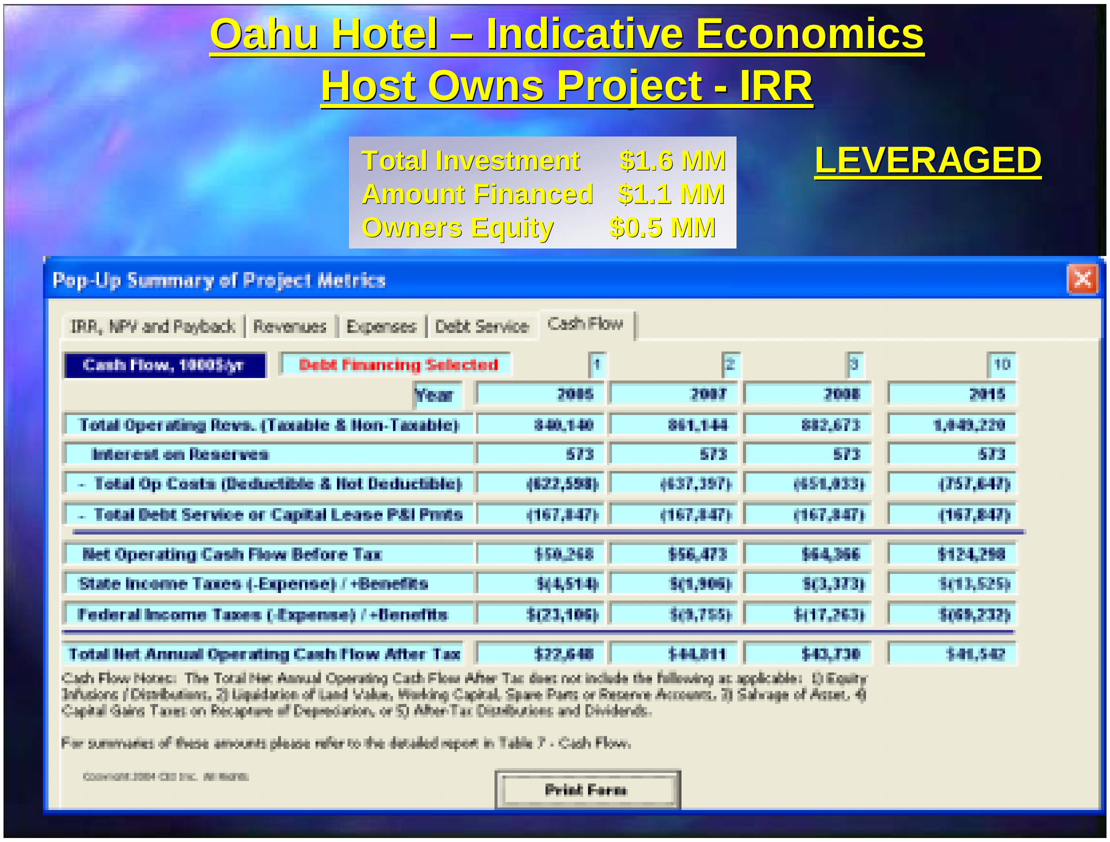
7.1.2. Host Owned Facility Financed by with Debt and Cash – Oahu Hotel

Figure 20 illustrates the incremental benefits (for the Unoptimized Base Case) that can be achieved by partially financing the project with debt. **Leveraged means that the owner borrows money to finance the facility, and may or may not use his own cash to finance part of the installation costs.** Financing allows the host to defer repayment of some of the capital expenses on the project, and to repay those capital costs as the resulting benefits and savings from use of the facility are achieved. Financing, however, also adds costs to the project in the form of up-front fees and interest costs.

Figure 20 summarizes the contributions to net income after-tax on an annual basis for the Unoptimized Base Case of host ownership on Oahu where the installation of the facility is funded with 70% debt and 30% equity. The net result is that the owner's upfront capital is reduced from $1,500,000 to about $500,000 with the addition of $100K of financing costs plus annual interest costs. The owner's return on investment can now be based on this lower level of up-front investment expense, while income tax depreciation benefits are realized at the same rate as the unleveraged case. In general, if rate of return on the project is higher than the after-tax cost of borrowing, leveraging can be used to reduce the owner's up-front capital investment and to increase the net internal rate of return.

Figure 20 - Results of Cash Flow Analysis for the Oahu Hotel with Maximum Absorption Chillers – Debt/Equity Financing – Host Ownership



Oahu Hotel – Indicative Economics
Host Owns Project - IRR

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

LEVERAGED

Pop-Up Summary of Project Metrics

Cash Flow, 1000$/yr	Debt Financing Selected	1	2	3	10
	Year	2006	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)		840,140	861,144	882,673	1,049,220
Interest on Reserves		573	573	573	573
- Total Op Costs (Deductible & Not Deductible)		(622,598)	(637,397)	(651,033)	(757,647)
- Total Debt Service or Capital Lease P&I Pmts		(167,847)	(167,847)	(167,847)	(167,847)
Net Operating Cash Flow Before Tax		$50,268	$56,473	$64,366	$124,298
State Income Taxes (-Expense) / +Benefits		$(4,514)	$(1,906)	$(3,373)	$(13,525)
Federal Income Taxes (-Expense) / +Benefits		$(23,106)	$(9,755)	$(17,263)	$(69,232)
Total Net Annual Operating Cash Flow After Tax		$22,648	$44,811	$43,730	$41,542

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

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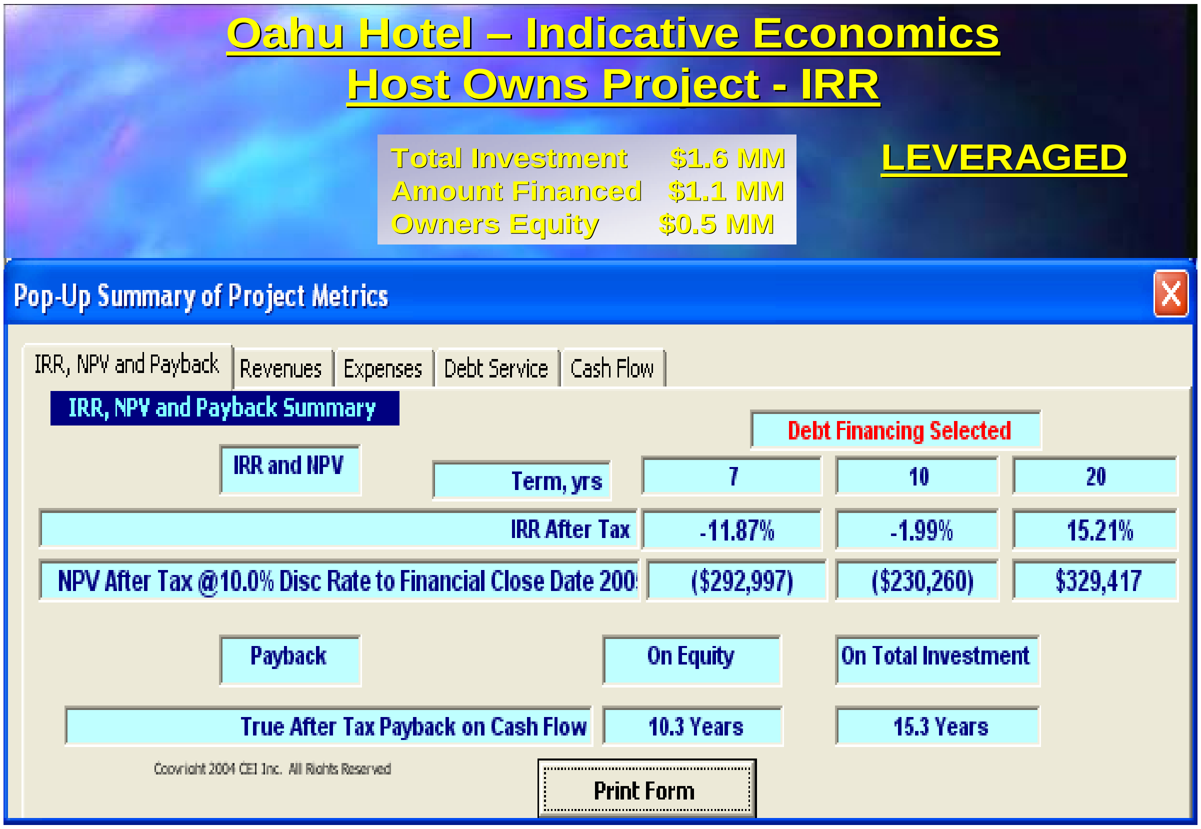
As a result of leveraging, the 20 year project host IRR is improved from about 11% after-tax to over 15% after-tax and the 20 year predicted NPV is increased from about $116,000 to over $329,000. This illustrates how leveraging can improve project returns and can make the difference between a potentially unattractive and an attractive investment opportunity. Importantly, these returns on Oahu can be further enhanced by optimizing the sizing and operation of the absorption chillers to make more cost effective use of the waste heat for thermal offsets.

As described on pages 41 and 42 if the thermal / chiller configuration and operating profile are optimized about $60,000 / year of additional savings can be generated. To complement this, the installed cost of the facility might be reduced by as much as $100,000 due to the lower absorption chiller capacity installed, substantially enhancing the owner's economics, improving the IRR by about 5% to a net of over 20% and would add about $300,000 to the NPV. In this "optimized" case the after-tax payback on the owner's cash investment on Oahu would be reduced to 6 - 7 years.

Next, we will take a look at the economics if a third party were to make the investment and to share some of the resulting savings with the host.

Figure 21- Return on Investment for the Oahu Hotel with Maximum Absorption Chillers – Debt/Equity Financing – Host Ownership



Oahu Hotel – Indicative Economics
Host Owns Project - IRR

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

LEVERAGED

Pop-Up Summary of Project Metrics

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV			
Term, yrs	7	10	20
IRR After Tax	-11.87%	-1.99%	15.21%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	($292,997)	($230,260)	$329,417

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	10.3 Years	15.3 Years

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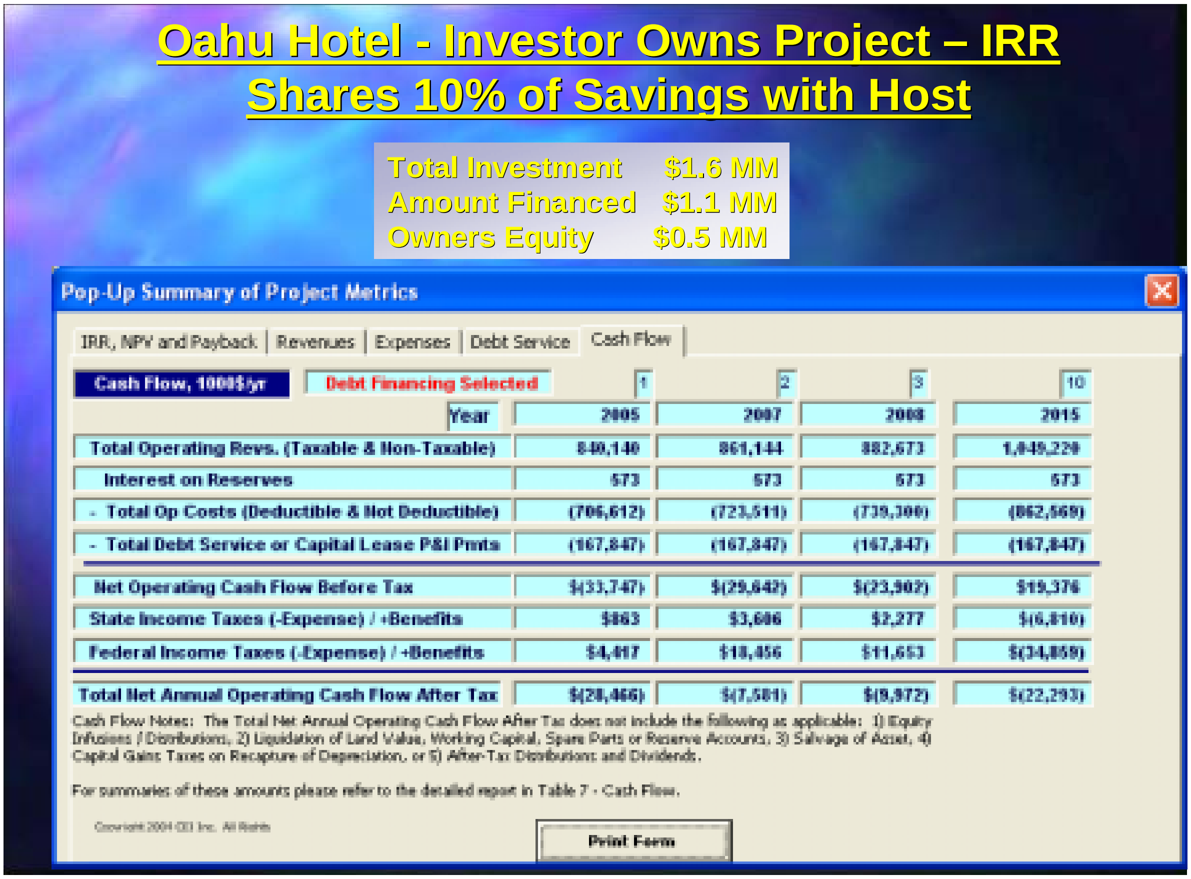
7.1.3. Third Party Owned Facility Financed by with Debt and Cash – Oahu Hotel

Figure 22 summarizes the contributions to net income after-tax on an annual basis for the Unoptimized Base Case in a scenario where a Third Party builds, owns, financings the project ownership with a 70/30 debt/equity ratio and shares 10% of the gross thermal, electric and demand charge savings with the host. In this instance, the host would probably not be required to make any up-front investment and a substantial portion of the risk would be assigned to the Third Party Owner. To incentivize the host to participate in this transaction, the third party would share 10% of the reduction in electric and thermal costs with the host. In other words, the third party owner while taking on 100% of the expenses receives only 90% of the benefits.

In this unoptimized scenario as a result of the relatively low electric rates on Oahu, if 10% or more of the savings are shared with the host the net resulting cash flow does not appear to be sufficient to cover debt service and to yield a sufficient rate of return to incentivize private investment. In this case even without leveraging the economics appear to be unattractive on Oahu. Without net income there is no calculated internal rate of return.

Figure 22 - Results of Cash Flow Analysis for the Oahu Hotel with Maximum Absorption Chillers – Third Party Ownership



Oahu Hotel - Investor Owns Project – IRR Shares 10% of Savings with Host

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

Cash Flow, 1000$/yr	Debt Financing Selected	1	2	3	10
	Year	2005	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)		840,140	861,144	882,673	1,049,220
Interest on Reserves		573	573	573	573
- Total Op Costs (Deductible & Not Deductible)		(706,612)	(723,511)	(739,300)	(862,569)
- Total Debt Service or Capital Lease P&I Pmts		(167,847)	(167,847)	(167,847)	(167,847)
Net Operating Cash Flow Before Tax		$(33,747)	$(29,642)	$(23,902)	$19,376
State Income Taxes (-Expense) / +Benefits		$863	$3,606	$2,277	$(6,810)
Federal Income Taxes (-Expense) / +Benefits		$4,417	$18,456	$11,653	$(34,859)
Total Net Annual Operating Cash Flow After Tax		$(28,466)	$(7,581)	$(9,972)	$(22,293)

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

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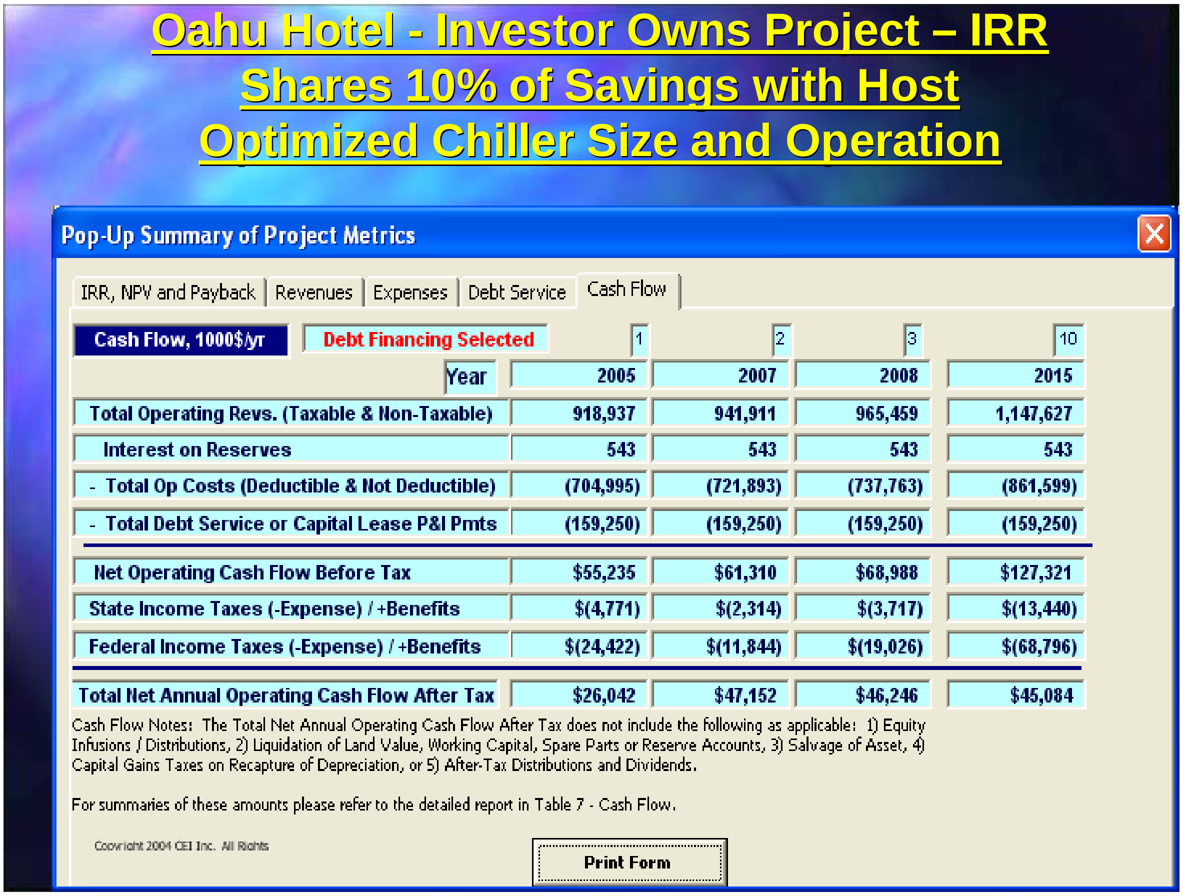
Figure 23 illustrates the incremental economics that could be achieve through optimized chiller design and more efficient use of waste heat for thermal offsets for a third party facility located at a hotel on Oahu. This table summarizes the contributions to net income after-tax on an annual basis for the Base Case with the chiller sizing now optimized resulting in greater use of waste heat to maximize thermal offsets, with only residual waste heat used to offset chillers. As in the previous slide, in this scenario a Third Party builds, owns and finances the project at a 70/30 debt/equity ratio and shares 10% of the net thermal, electric and demand charge savings with the host. When the thermal / chiller configuration design and operating profile are optimized, the higher relative value of thermal offsets now achieved on Oahu result in about $60,000 / year of additional savings to the owner. To complement this, the installed cost of the facility might be reduced by as much as $100,000 due to the lower amount of absorption chiller capacity installed. This combination of cost reductions and increased savings are sufficient reverse the negative cash flow scenario observed on the previous slide, and to generate net income for the third party owner even after sharing of 10% of the savings.

Figure 23 - Results of Cash Flow Analysis for the Oahu Hotel with Maximum Absorption Chillers – Third Party Ownership - Chillers Optimized



Oahu Hotel - Investor Owns Project – IRR Shares 10% of Savings with Host Optimized Chiller Size and Operation

Cash Flow, 1000$/yr	Debt Financing Selected	1	2	3	10
	Year	2005	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)		918,937	941,911	965,459	1,147,627
Interest on Reserves		543	543	543	543
- Total Op Costs (Deductible & Not Deductible)		(704,995)	(721,893)	(737,763)	(861,599)
- Total Debt Service or Capital Lease P&I Pmts		(159,250)	(159,250)	(159,250)	(159,250)
Net Operating Cash Flow Before Tax		$55,235	$61,310	$68,988	$127,321
State Income Taxes (-Expense) / +Benefits		$(4,771)	$(2,314)	$(3,717)	$(13,440)
Federal Income Taxes (-Expense) / +Benefits		$(24,422)	$(11,844)	$(19,026)	$(68,796)
Total Net Annual Operating Cash Flow After Tax		$26,042	$47,152	$46,246	$45,084

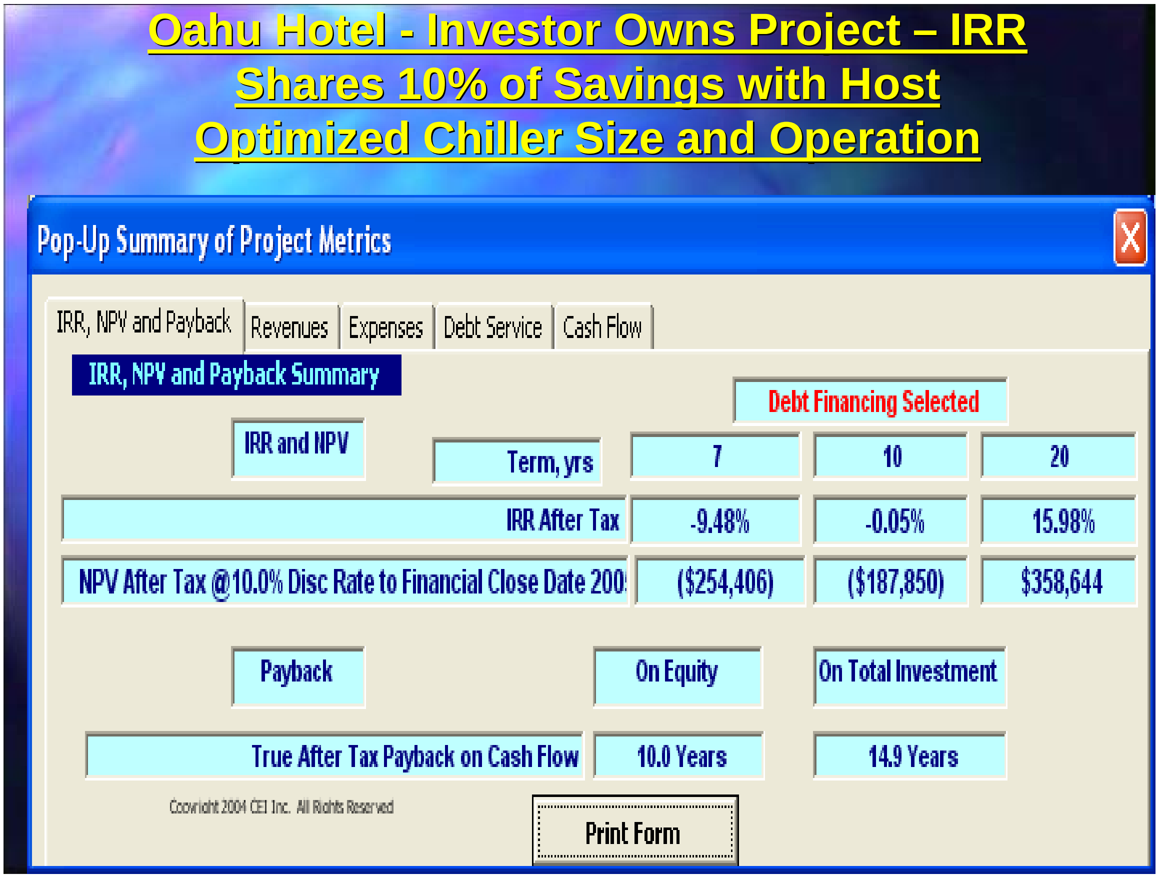
Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

As shown in Figure 24, as a result of optimizing the chiller configuration, the 20 year project host IRR is reversed from a loss to a net after-tax IRR of about 16% for the third party owner. This illustrates how optimizing the plant design can substantially improve project returns and can make the difference between an unattractive and a potentially attractive investment opportunity.

Still, at the lower electric rates on Oahu, the economic attractiveness of third party investment appears to be marginal with after-tax paybacks on the order of 10 years and as 20 year IRR of less than 25%.

Figure 24 - Return on Investment for the Oahu Hotel with Maximum Absorption Chillers – Third Party Ownership - Chillers Optimized



Oahu Hotel - Investor Owns Project – IRR
Shares 10% of Savings with Host
Optimized Chiller Size and Operation

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV			
Term, yrs	7	10	20
IRR After Tax	-9.48%	-0.05%	15.98%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	($254,406)	($187,850)	$358,644

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	10.0 Years	14.9 Years

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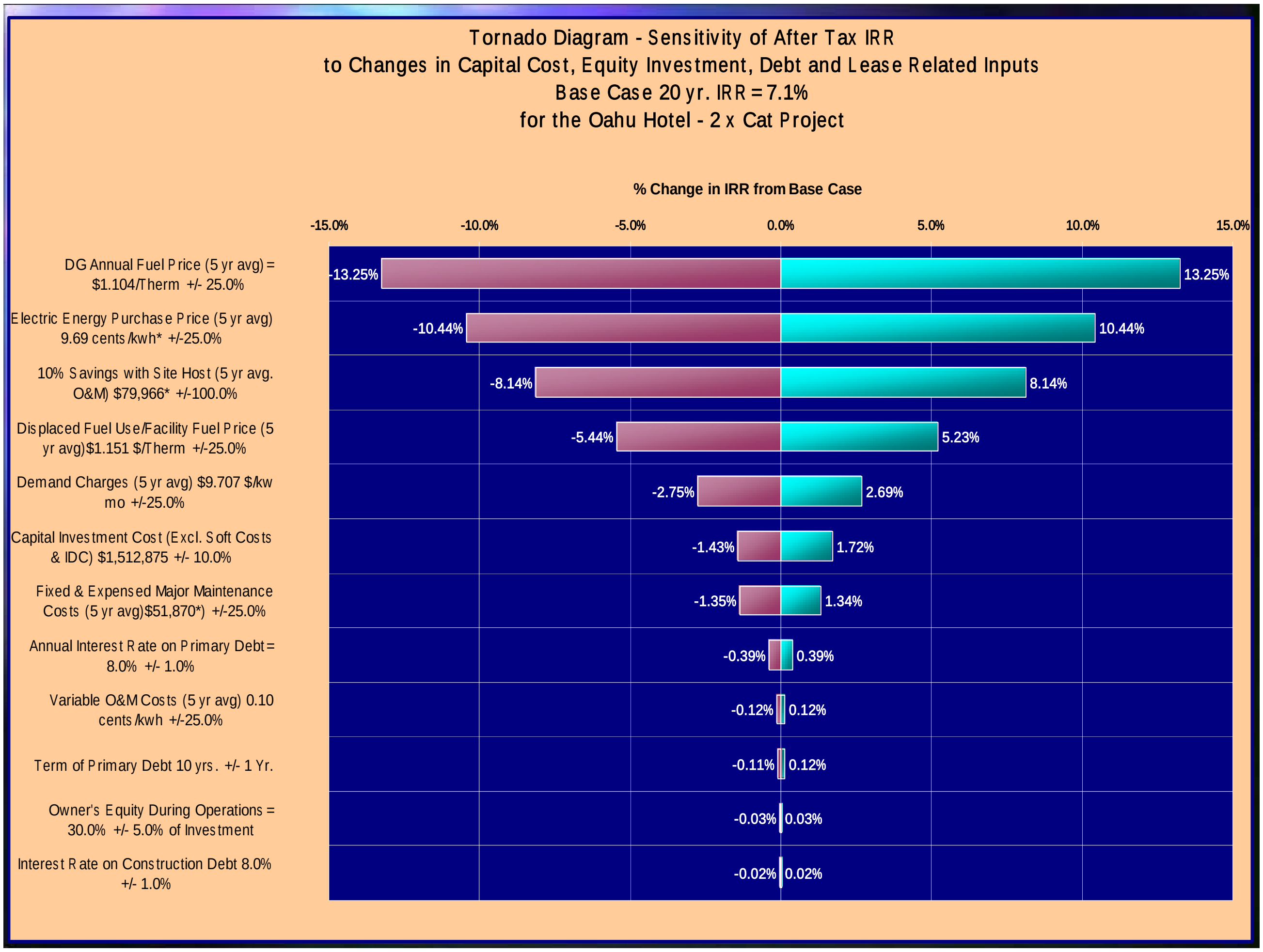
7.1.4. Upside Profitability and Downside Risk Analysis for Oahu Hotel

Figure 25 presents a “Tornado Diagram”, an automated feature in EconExpert-DG that allows the user to understand the relative impacts on the project discount cash flow economics of changes in a wide array of parameters including factors such as plant performance, thermal and electric prices, financing, etc.

As one might expect, on Oahu, fuel prices are the most sensitive economic parameter, followed by electric prices, amount of savings shared with the host and thermal offsets. Changes in capital investment costs, operations and maintenance costs, or financing costs had substantially lesser impacts on the overall project economics.

<u>Figure 25 - Tornado Diagram Illustrating Sensitivity of for Return on Investment for the Oahu Hotel to key Project Parameters</u>



7.2. Discount Cash Flow Analysis - Kauai Hotel

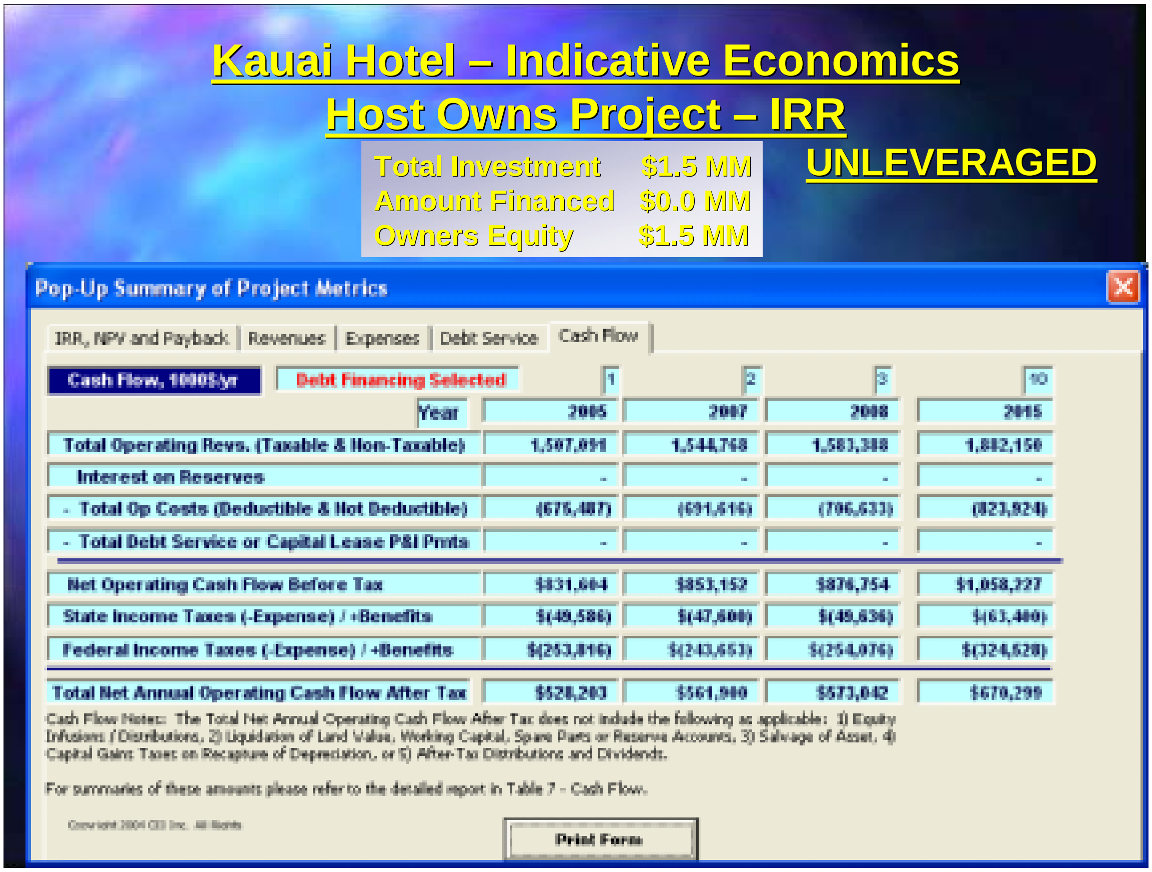
The next set of financial analysis presented for a proxy hotel located on Kauai where the economics of host or third party ownership appear to be compelling.

7.2.1. Host Owned Facility Financed with Cash – Kauai Hotel

As a direct result of the substantially higher electric rates on Kauai, the economics of DER appear to be substantially more attractive on Kauai than on Oahu. Annual net savings (Gross savings minus operating expenses) before for the base case are increased from about $900,000 / year on Oahu to over $1,500,000 / year, even with a sharing by the Third Party Owner of 10% of the gross electric and thermal savings which equates to a rebate to the host of over $150,000 / yr. After tax next cash flow for the third party owner in this scenario is over $500,000 / year if the project is financed entirely with cash.

Because of the higher electric costs on Kauai, the optimum case appears to be to maximize the capacity of the absorption chillers to match the sites chiller demand and the thermal output from the engine.

Figure 26 - Results of Cash Flow Analysis for the Kauai Hotel with Maximum Absorption Chillers – Cash Financing – Host Ownership



Kauai Hotel – Indicative Economics

Host Owns Project – IRR

Total Investment	$1.5 MM
Amount Financed	$0.0 MM
Owners Equity	$1.5 MM

UNLEVERAGED

Pop-Up Summary of Project Metrics

Cash Flow, 1000$/yr	Debt Financing Selected	1	2	3	10
	Year	2006	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)		1,507,091	1,544,768	1,583,388	1,882,150
Interest on Reserves		-	-	-	-
- Total Op Costs (Deductible & Not Deductible)		(675,487)	(691,616)	(706,633)	(823,924)
- Total Debt Service or Capital Lease P&I Pmts		-	-	-	-
Net Operating Cash Flow Before Tax		$831,604	$853,152	$876,754	$1,058,227
State Income Taxes (-Expense) / +Benefits		$(49,586)	$(47,600)	$(49,636)	$(63,400)
Federal Income Taxes (-Expense) / +Benefits		$(253,816)	$(243,653)	$(254,076)	$(324,528)
Total Net Annual Operating Cash Flow After Tax		$528,203	$561,900	$573,042	$670,299

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

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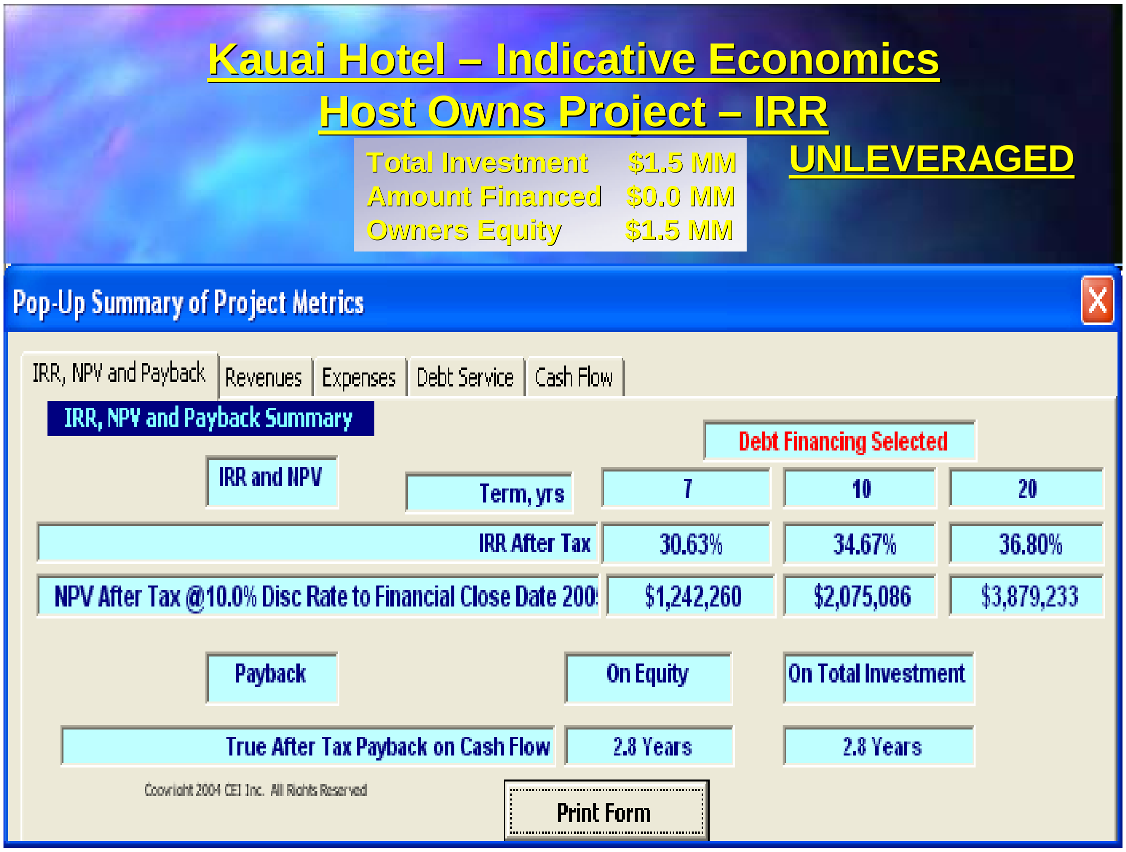
Figure 27 illustrates that as a result of the greater net after-tax savings illustrated on the previous slide, the economic case for DER on Kauai, even without leveraged financing, appears to be compelling. For the base case with maximum chillers, estimated after-tax returns for a third party owner exceeded 30% with a 20 year NPV of over $3,800,000 and an after-tax payback on the owner's cash investment of less than 3 years.

Figure 27 - Return on Investment for the Kauai Hotel with Maximum Absorption Chillers – Cash Financing –Host Ownership



Kauai Hotel – Indicative Economics
Host Owns Project – IRR

Total Investment	$1.5 MM
Amount Financed	$0.0 MM
Owners Equity	$1.5 MM

UNLEVERAGED

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV	Term, yrs	7	10	20
IRR After Tax		30.63%	34.67%	36.80%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200		$1,242,260	$2,075,086	$3,879,233

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	2.8 Years	2.8 Years

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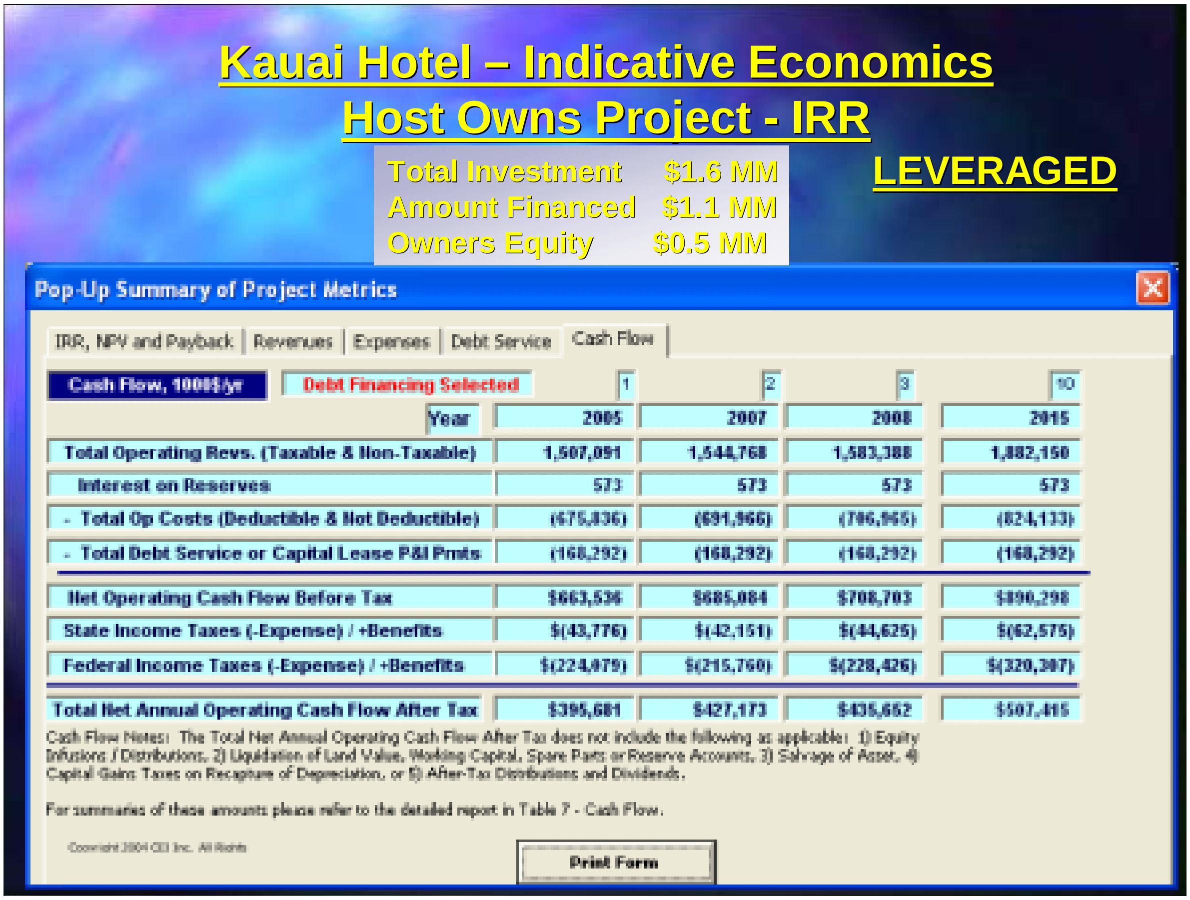
7.2.2. Host Owned Facility Financed with Debt and Cash – Kauai Hotel

Figure 28 illustrates the incremental benefits for the Base Case Hotel on Kauai that can be achieved by partially financing the project with debt. The table summarizes the contributions to net income after-tax on an annual basis for the Base Case of host ownership on Kauai where the installation of the facility is funded with 70% debt and 30% equity. The owner's return on investment can now be based on this lower level of up-front investment expense, which income tax depreciation benefits are realized at the same rate as the unleveraged case. In general, if rate of return on the project is higher than the after-tax cost of borrowing, leveraging can be used to reduce the owner's up-front capital investment and to increase the net internal rate of return.

Figure 28 – Results of Cash Flow Analysis for the Kauai Hotel with Maximum Absorption Chillers – Debt and Cash Financing –Host Ownership



Kauai Hotel – Indicative Economics
Host Owns Project - IRR

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

LEVERAGED

Cash Flow, 1000$/yr — Debt Financing Selected

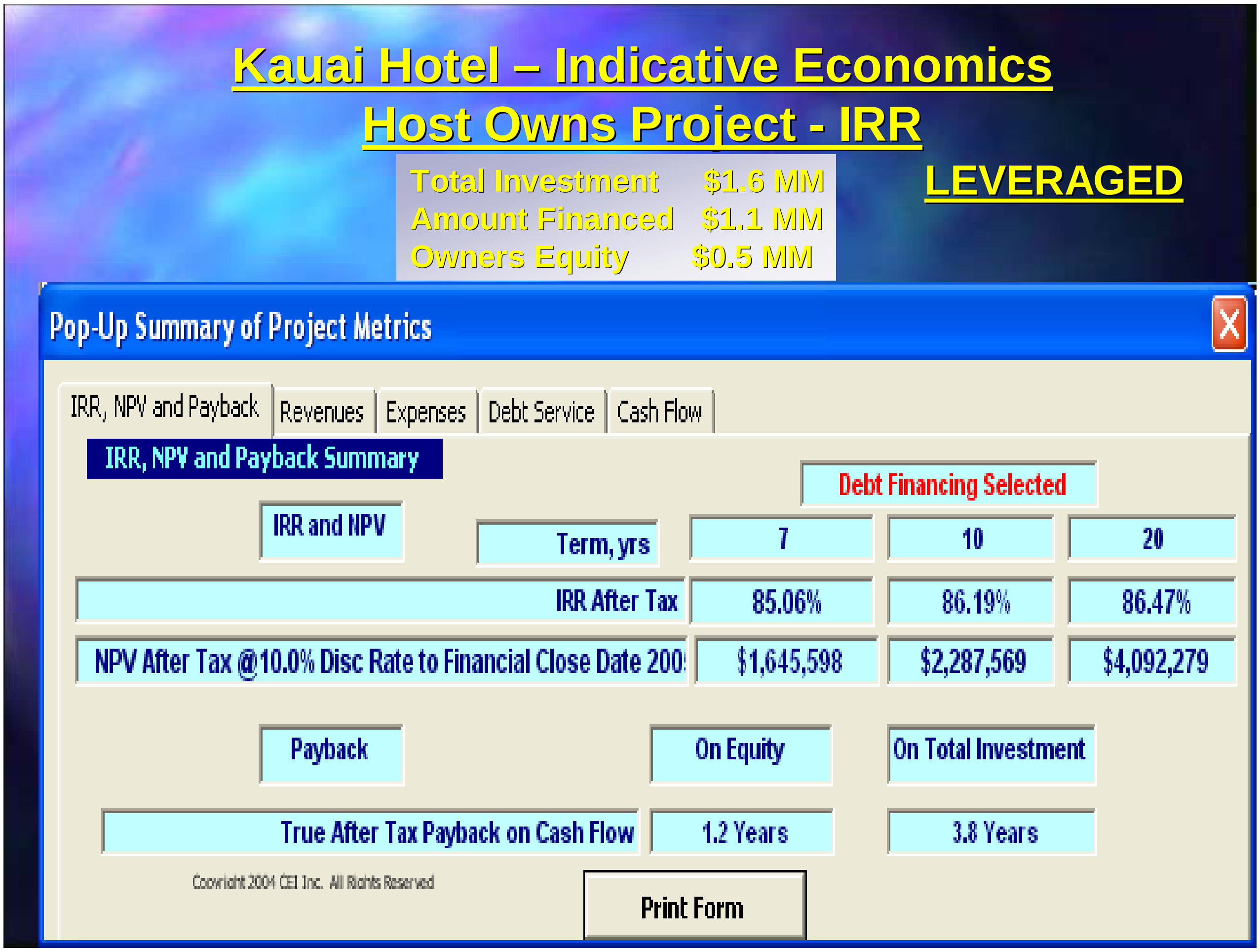
	1	2	3	10
Year	2006	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)	1,507,091	1,544,768	1,583,388	1,882,150
Interest on Reserves	573	573	573	573
- Total Op Costs (Deductible & Not Deductible)	(675,836)	(691,966)	(706,965)	(824,133)
- Total Debt Service or Capital Lease P&I Pmts	(168,292)	(168,292)	(168,292)	(168,292)
Net Operating Cash Flow Before Tax	$663,536	$685,084	$708,703	$890,298
State Income Taxes (-Expense) / +Benefits	$(43,776)	$(42,151)	$(44,625)	$(62,575)
Federal Income Taxes (-Expense) / +Benefits	$(224,079)	$(215,760)	$(228,426)	$(320,307)
Total Net Annual Operating Cash Flow After Tax	$395,681	$427,173	$435,652	$507,415

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

Figure 29 shows that as a result of the leveraging, the economic case for DER on Kauai can be made even stronger. In this case, leveraging increases the estimated after-tax returns for a third party owner from over 30% to over 80%, with an increase in NPV to over $3,800,000 (on a substantially lower up-front investment) and an after-tax payback on the owner's cash investment of just over 1 year.

Figure 29 – Return on Investment for the Kauai Hotel with Maximum Absorption Chillers – Debt and Cash Financing –Third Party Ownership



Kauai Hotel – Indicative Economics
Host Owns Project - IRR

LEVERAGED

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

Pop-Up Summary of Project Metrics

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV			
Term, yrs	7	10	20
IRR After Tax	85.06%	86.19%	86.47%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	$1,645,598	$2,287,569	$4,092,279

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	1.2 Years	3.8 Years

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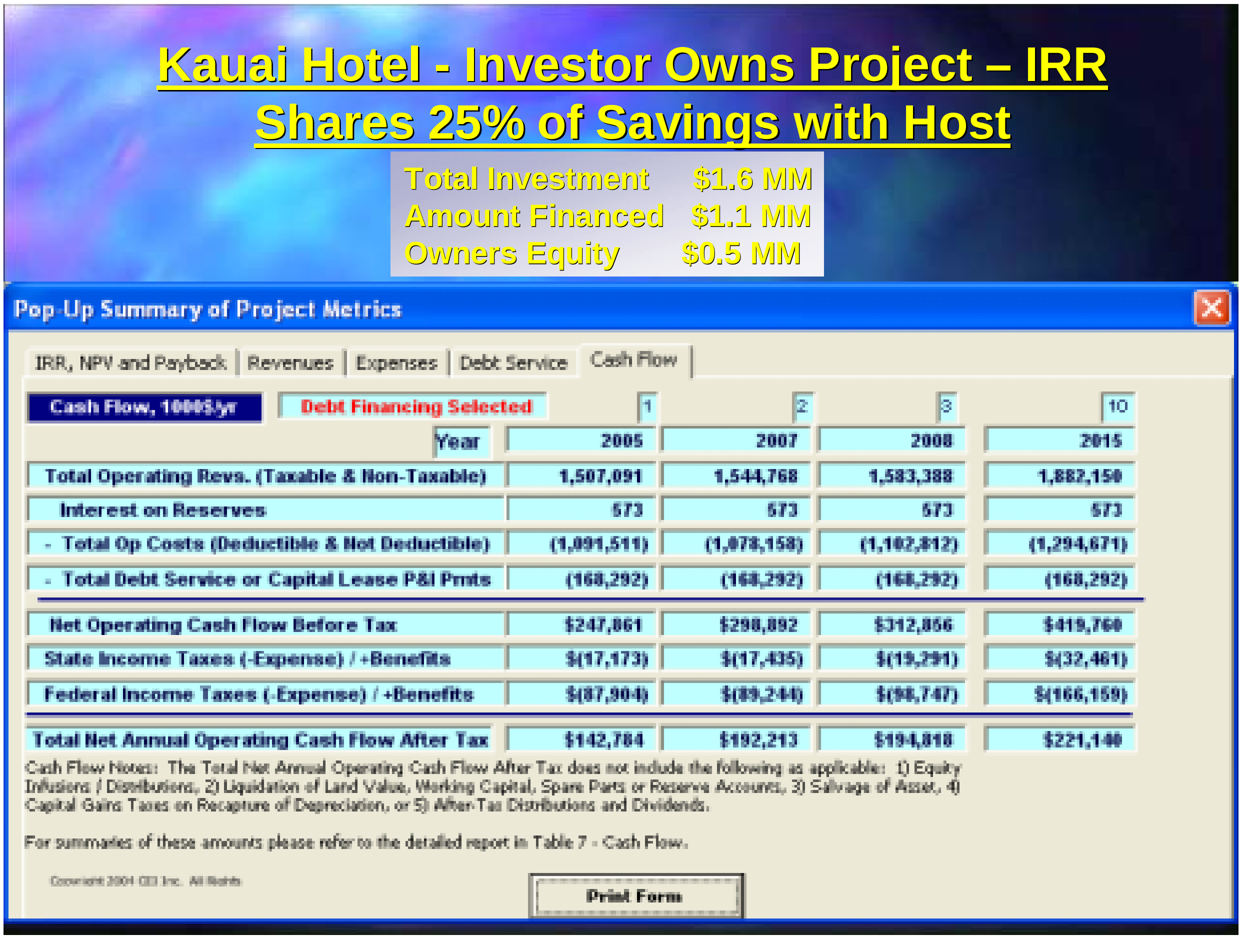
7.2.3. Third Party Owned Facility Financed with Debt and Cash – Kauai Hotel

Figure 30 demonstrates that as a result of the compelling economics on Kauai, third parties might even decide to share a substantially greater proportion of the savings with the host as an incentive to encourage the owner to pursue the project with them. In this case, the amount of savings shared with the host is assumed to be increased from 10% of the gross savings ($150,000 / year) to 25% of the gross savings ($375,000 / year). Even in this case, substantial benefits can accrue to the third party owner.

Figure 30 - Results of Cash Flow Analysis for the Kauai Hotel with Maximum Absorption Chillers – Debt and Cash Financing – Third Party Ownership



Kauai Hotel - Investor Owns Project – IRR Shares 25% of Savings with Host

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

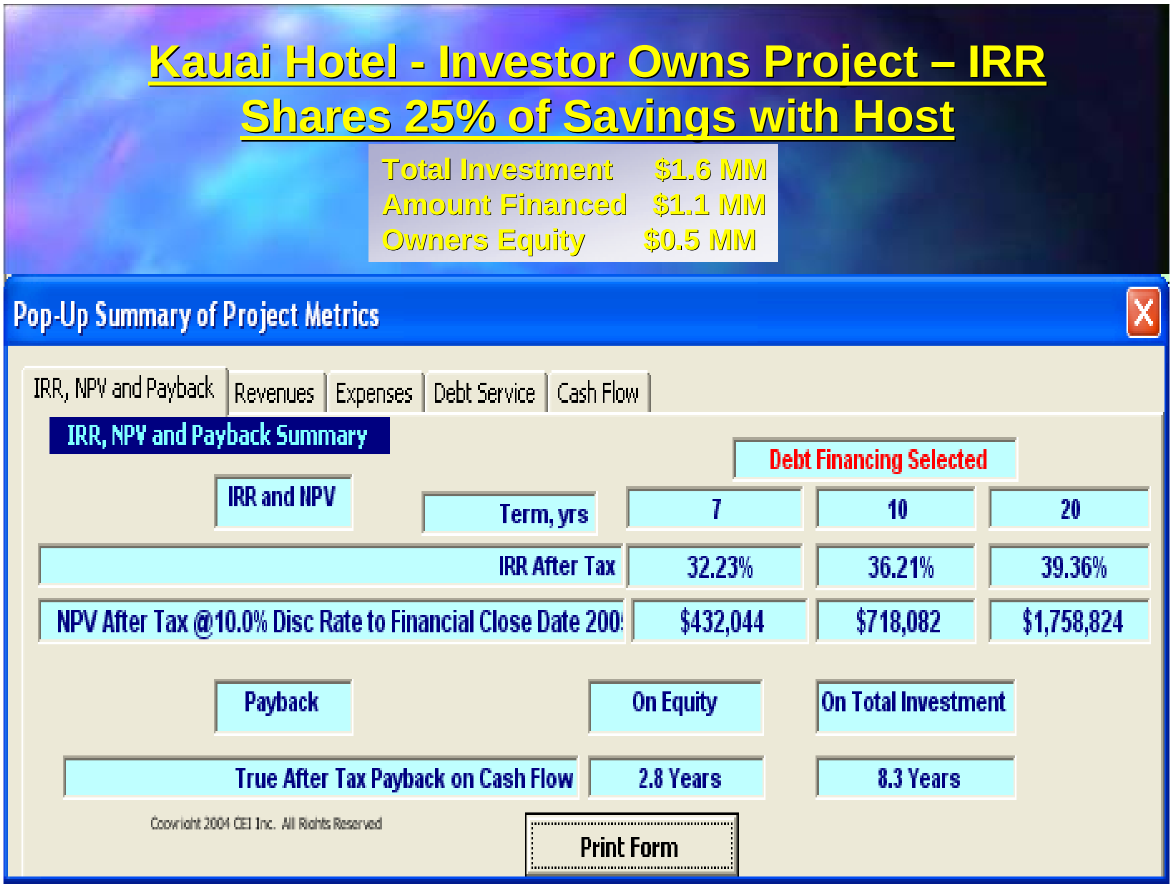
Cash Flow, 1000$/yr	1	2	3	10
Year	2005	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)	1,507,091	1,544,768	1,583,388	1,882,150
Interest on Reserves	573	573	573	573
- Total Op Costs (Deductible & Not Deductible)	(1,091,511)	(1,078,158)	(1,102,812)	(1,294,671)
- Total Debt Service or Capital Lease P&I Pmts	(168,292)	(168,292)	(168,292)	(168,292)
Net Operating Cash Flow Before Tax	$247,861	$298,892	$312,856	$419,760
State Income Taxes (-Expense) / +Benefits	$(17,173)	$(17,435)	$(19,291)	$(32,461)
Federal Income Taxes (-Expense) / +Benefits	$(87,904)	$(89,244)	$(98,747)	$(166,159)
Total Net Annual Operating Cash Flow After Tax	$142,784	$192,213	$194,818	$221,140

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

Figure 31 illustrates that even with this liberal sharing of savings with the host the economic case for DER on Kauai can be very attractive. In this case, even when as much as 25% of the savings are shared, the estimated after-tax return for a third party owner is still over 30% and the 20 year NPV is over $1,700,000 with an after-tax payback on the owner's cash investment of less than 3 years.

Figure 31 - Return on Investment for the Kauai Hotel with Maximum Absorption Chillers – Debt and Cash Financing – Third Party Ownership



Kauai Hotel - Investor Owns Project – IRR Shares 25% of Savings with Host

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

Pop-Up Summary of Project Metrics

IRR, NPV and Payback Summary

Debt Financing Selected

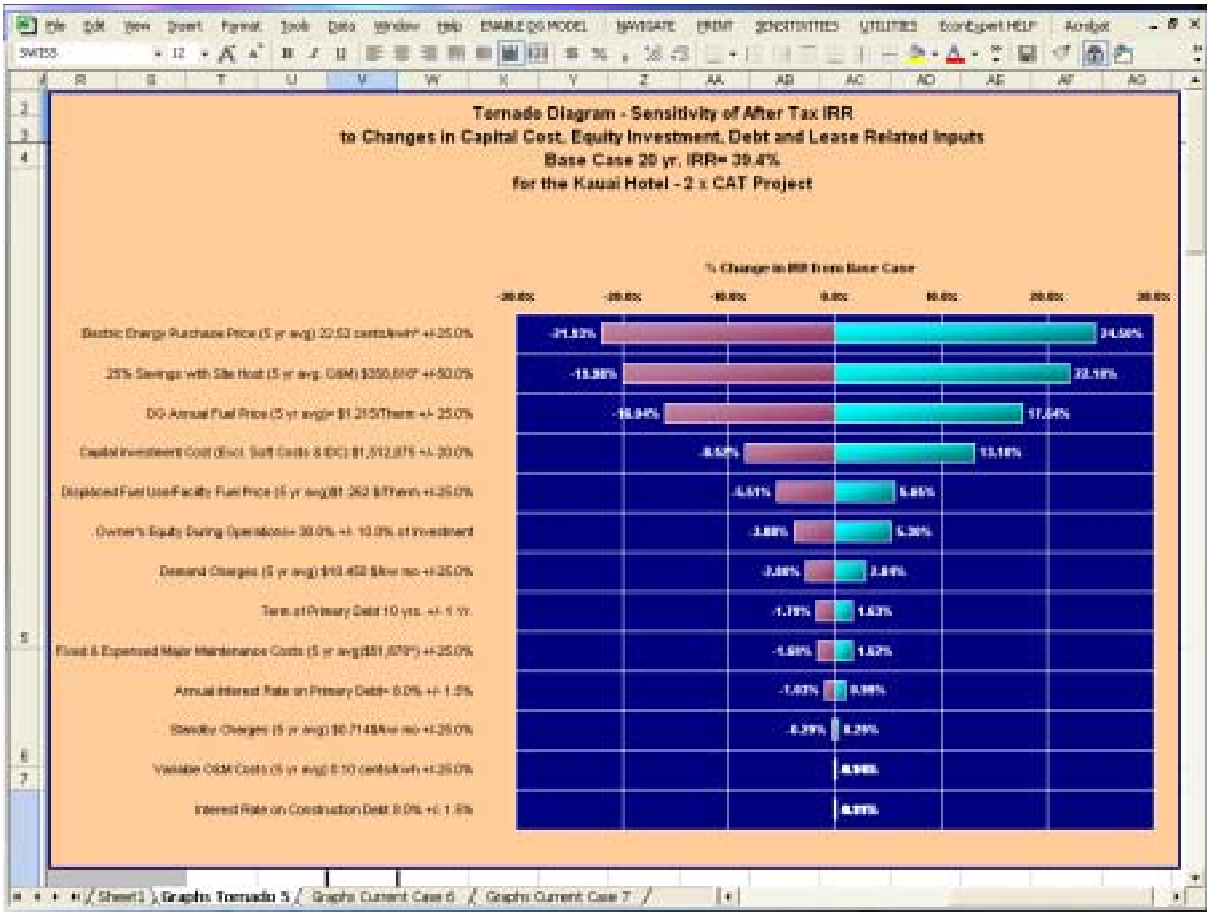
IRR and NPV			
Term, yrs	7	10	20
IRR After Tax	32.23%	36.21%	39.36%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	$432,044	$718,082	$1,758,824

Payback	On Equity	On Total Investment
True After Tax Payback on Cash Flow	2.8 Years	8.3 Years

7.2.4. Upside Profitability and Downside Risk Analysis for Kauai Hotel

Figure 32 provides a “Tornado Diagram” for the Base Case Hotel on Kauai. On Kauai, electric rates are the most sensitive economic parameter, followed by the percentage of savings shared with the host and then by fuel prices. Because of the higher relative rates of return on Kauai, changes in capital investment costs have a greater net impact while changes in operations and maintenance costs and financing costs had substantially lesser impacts on the overall project economics.

Figure 32 - Tornado Diagram Illustrating Sensitivity of for Return on Investment for the Kauai Hotel to key Project Parameters



7.3. Discount Cash Flow - Maui Hotel

The next set of financial analysis presented for a proxy hotel located on Maui where the economics of host or third party ownership appear to be very attractive subject to efficient design and operations. DER economics on the Island of Hawaii are anticipated to be similar to those on Maui.

7.3.1. Third Party Owned Facility Financed with Debt and Cash – Maui Hotel

Figure 33 illustrates that as was the case for the Hotel on Kauai, the electric rates on Maui (and on the Island of Hawaii) appear to provide substantial incentives for third party ownership of DER. This table summarizes the contributions to net income after-tax on an annual basis for the Base Case of host ownership on Maui where the installation of the facility is funded with 70% debt and 30% equity. Net after-tax income to the third party owner is predicted to be in the range of $125,000 to $150,000 / year based on a sharing of 10% of the gross savings (about $125,000/year shared) with the host. In this instance this is as much as 50% more than the savings that the local island utility might be permitted to provide with a regulated project under the HECO DER filing.

Figure 33 - Results of Cash Flow Analysis for the Maui Hotel with Maximum Absorption Chillers – Debt and Cash Financing – Third Party Ownership

Maui Hotel - Investor Owns Project – IRR Shares 10% of Savings with Host

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

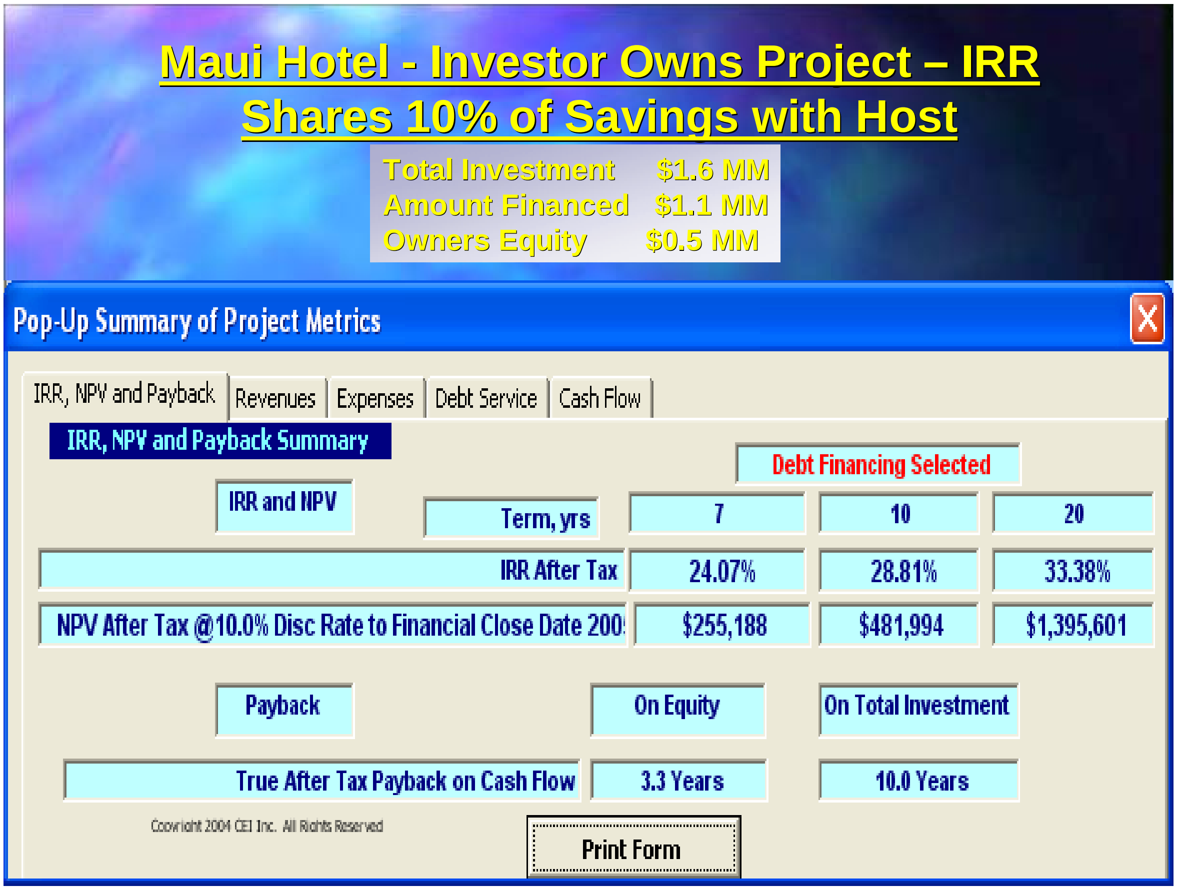
Cash Flow, 1000$/yr	1	2	3	10
Debt Financing Selected				
Year	2005	2007	2008	2015
Total Operating Revs. (Taxable & Non-Taxable)	1,186,242	1,215,898	1,246,296	1,481,454
Interest on Reserves	573	573	573	573
- Total Op Costs (Deductible & Not Deductible)	(794,460)	(813,555)	(831,595)	(972,279)
- Total Debt Service or Capital Lease P&I Pmts	(168,292)	(168,292)	(168,292)	(168,292)
Net Operating Cash Flow Before Tax	$224,063	$234,624	$246,982	$341,456
State Income Taxes (-Expense) / +Benefits	$(15,650)	$(13,322)	$(15,075)	$(27,449)
Federal Income Taxes (-Expense) / +Benefits	$(80,108)	$(68,190)	$(77,166)	$(140,507)
Total Net Annual Operating Cash Flow After Tax	$128,305	$153,113	$154,740	$173,500

Cash Flow Notes: The Total Net Annual Operating Cash Flow After Tax does not include the following as applicable: 1) Equity Infusions / Distributions, 2) Liquidation of Land Value, Working Capital, Spare Parts or Reserve Accounts, 3) Salvage of Asset, 4) Capital Gains Taxes on Recapture of Depreciation, or 5) After-Tax Distributions and Dividends.

For summaries of these amounts please refer to the detailed report in Table 7 - Cash Flow.

Figure 34 shows that under the current tariff rates on Maui, the economic case for DER appears to be very attractive. For the base case with maximum chillers, estimated after-tax returns for a third party owner exceeded 30% with a 20 year NPV of over $1,300,000 and an after-tax payback on the owner's cash investment of just over 3 years.

Figure 34 - Return on Investment for the Maui Hotel with Maximum Absorption Chillers – Debt and Cash Financing – Third Party Ownership



Maui Hotel - Investor Owns Project – IRR Shares 10% of Savings with Host

Total Investment	$1.6 MM
Amount Financed	$1.1 MM
Owners Equity	$0.5 MM

IRR, NPV and Payback Summary

Debt Financing Selected

IRR and NPV

Term, yrs	7	10	20
IRR After Tax	24.07%	28.81%	33.38%
NPV After Tax @10.0% Disc Rate to Financial Close Date 200	$255,188	$481,994	$1,395,601

Payback

	On Equity	On Total Investment
True After Tax Payback on Cash Flow	3.3 Years	10.0 Years

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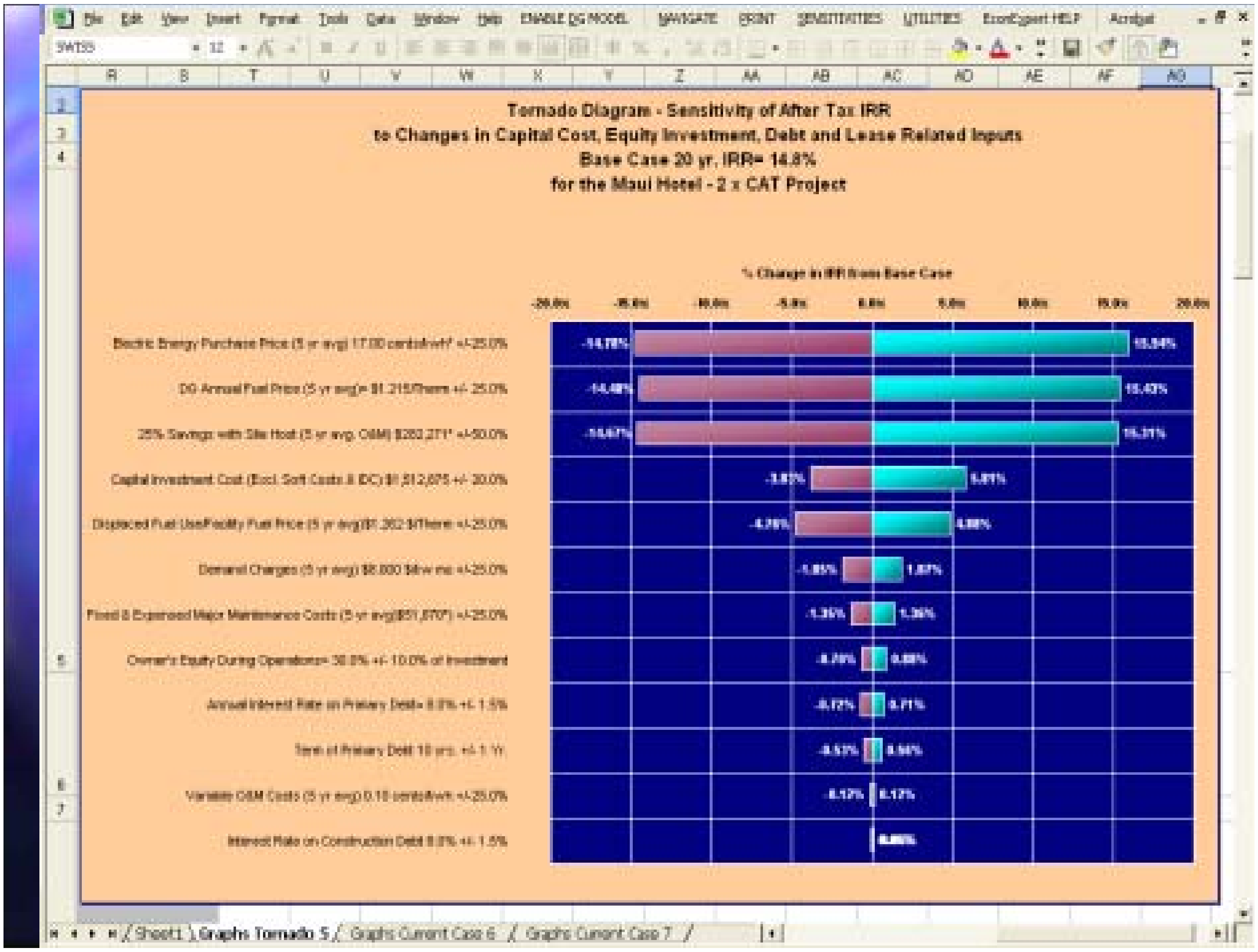
7.3.2. Upside Profitability and Downside Risk Analysis for Kauai Hotel

Figure 35 presents a “Tornado Diagram” for the Base Case Hotel on Maui. On Maui, electric rates are the most sensitive economic parameter, followed fuel prices, and the % savings shared. Because of the higher relative rates of return, changes in capital investment costs have a greater net impact while changes in operations and maintenance costs and financing costs had substantially lesser impacts on the overall project economics. Similar results are anticipated for the Island of Hawaii.

Figure 35 - Tornado Diagram Illustrating Sensitivity of for Return on Investment for the Maui Hotel to key Project Parameters

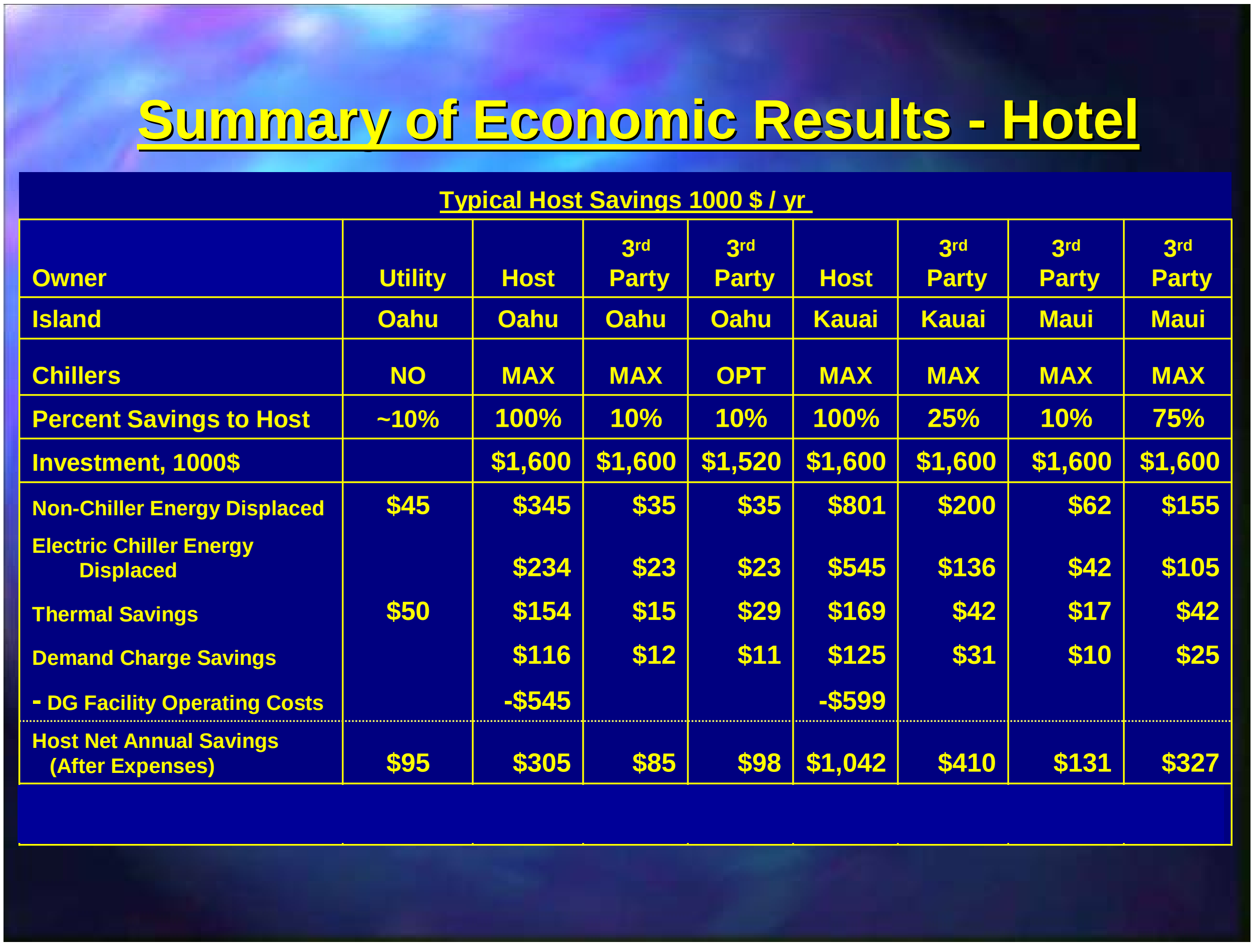


8. Summary

Figure 37 presents a consolidated summary of all of the cases described in the previous slides. As discussed in the previous sections:

- The Utility (HECO) ownership case provides savings to the customer in the form of reduced rates while defraying all of the costs and most of the risks associated with DER to the utility rate base. These savings appear to represent slightly over 10% of the net savings in retail tariff and thermal costs that would result from the displaced energy produced by the DER facility.
- If the host were to own and operate the facility on Oahu at premised rates about three times the annual savings would be realized, even after accounting for fuel and operating costs.
- If a third party were to own and operate the facility at the host site on Oahu and were to provide about 10% of the gross savings back to the host, the host would realize a comparable savings to those proposed by HECO.
- On Kauai and Maui the economics of host or third party ownership are substantially superior to Oahu. This is primarily due to the higher electric energy rates on the Neighbor Islands.

Figure 36 - Consolidated Results of Return on Investment Analysis - All Cases



Summary of Economic Results - Hotel

Typical Host Savings 1000 $ / yr

Owner	Utility	Host	3rd Party	3rd Party	Host	3rd Party	3rd Party	3rd Party
Island	Oahu	Oahu	Oahu	Oahu	Kauai	Kauai	Maui	Maui
Chillers	NO	MAX	MAX	OPT	MAX	MAX	MAX	MAX
Percent Savings to Host	~10%	100%	10%	10%	100%	25%	10%	75%
Investment, 1000$		$1,600	$1,600	$1,520	$1,600	$1,600	$1,600	$1,600
Non-Chiller Energy Displaced	$45	$345	$35	$35	$801	$200	$62	$155
Electric Chiller Energy Displaced		$234	$23	$23	$545	$136	$42	$105
Thermal Savings	$50	$154	$15	$29	$169	$42	$17	$42
Demand Charge Savings		$116	$12	$11	$125	$31	$10	$25
- DG Facility Operating Costs		-$545			-$599			
Host Net Annual Savings (After Expenses)	$95	$305	$85	$98	$1,042	$410	$131	$327

8.1. Conclusions and Recommendations

Key conclusions described in the analysis are summarized here:

- Hawaii presents a very exciting and economically attractive market opportunity for DER
- The economics of DER are island and site specific
- The economics of Third Party Ownership are better the on Neighbor Islands
    - On Oahu – There is a strong preference for sites with substantial thermal uses.
    - On Maui and Big Island – The economics of most applications attractive subject to optimization, efficient design and risk management
    - On Kauai – Very strong economics were revealed driven by high cost of electric energy on this island.
- The economics of DER tend to favor diesel fuel based on the lower cost of diesel relative to other available fuels such as synthetic natural gas (SNG) or propane. This conclusion is highly subject to the important considerations of transportation, storage, permitting and environmental benefits offered by gas fuels such as SNG or Propane which for many sites may prevail over the fuel cost difference.
- Both diesel and gas fuels can exhibit attractive returns for host, Third Party or utility investment, especially on the Neighbor Islands.
- The HECO-filed program provides an attractive alternative option for hosts:
    - Especially on Oahu where electric rates are lower
    - It would provide guaranteed savings to the host with capital and risk management by the Utility
- In many circumstances host or Third Party Ownership can offer additional savings compared to regulated projects

Importantly it was noted that each site will have its own unique features that must be addressed to maximize value. In order for third parties and hosts to successfully and profitability benefit from the economics of non-regulated DER applications they must:

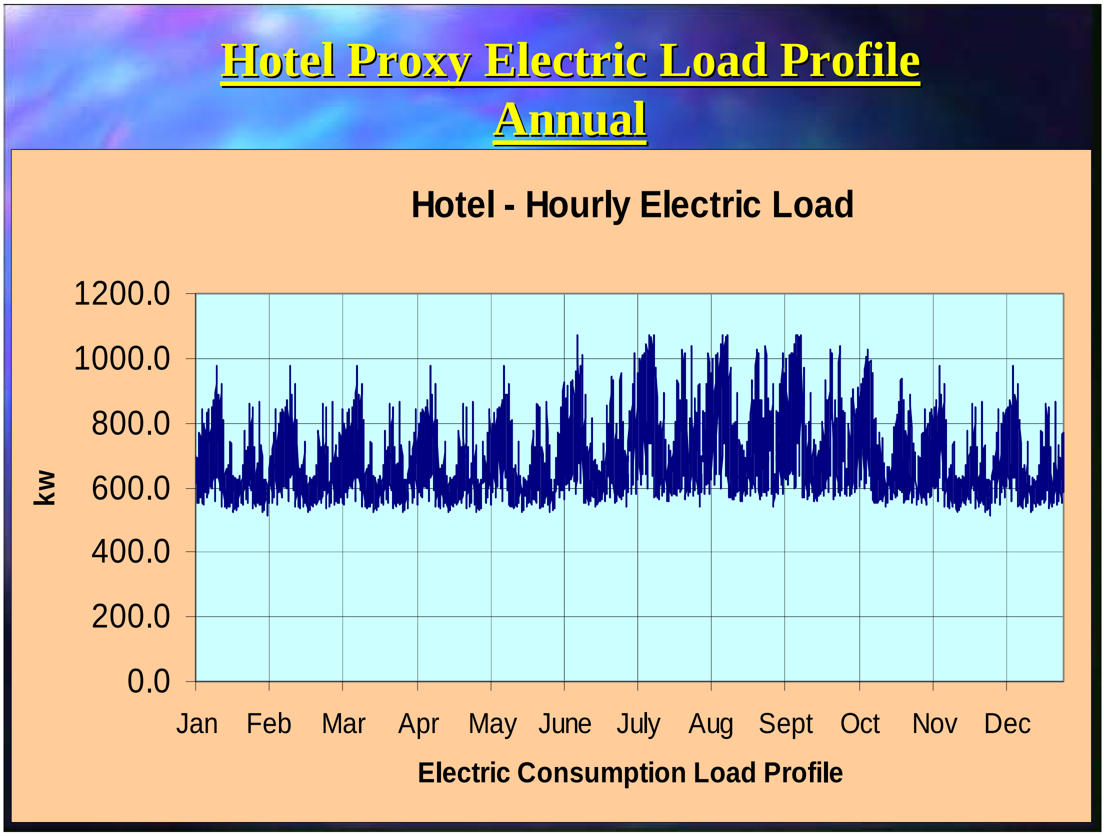
- Carefully consider pertinent site specifics,
- Select the optimum configuration of equipment and operations to match the site needs,
- Design a system that operates reliably, especially during peak energy pricing periods,
- Properly manage fuel pricing risk,
- Make efficient use of waste heat, and
- <u>Perform proper and thorough up-front engineering and financial analysis to ensure that right things are done right the first time and every time!</u>

APPENDICES

Hotel Hourly Electric Load Profile

Figure 37 provides a closer look at the Hourly Total Electric Load profile for the Base Case Hotel. Common profiles used from month to month were due to the reuse of a single month profile over the calendar year with an upward 20% adjustment for the summer months. Peaks and dips represent both time-of-day and occupancy variations.

Figure 37 - Proxy Hotel - Hourly Electric Load Profile



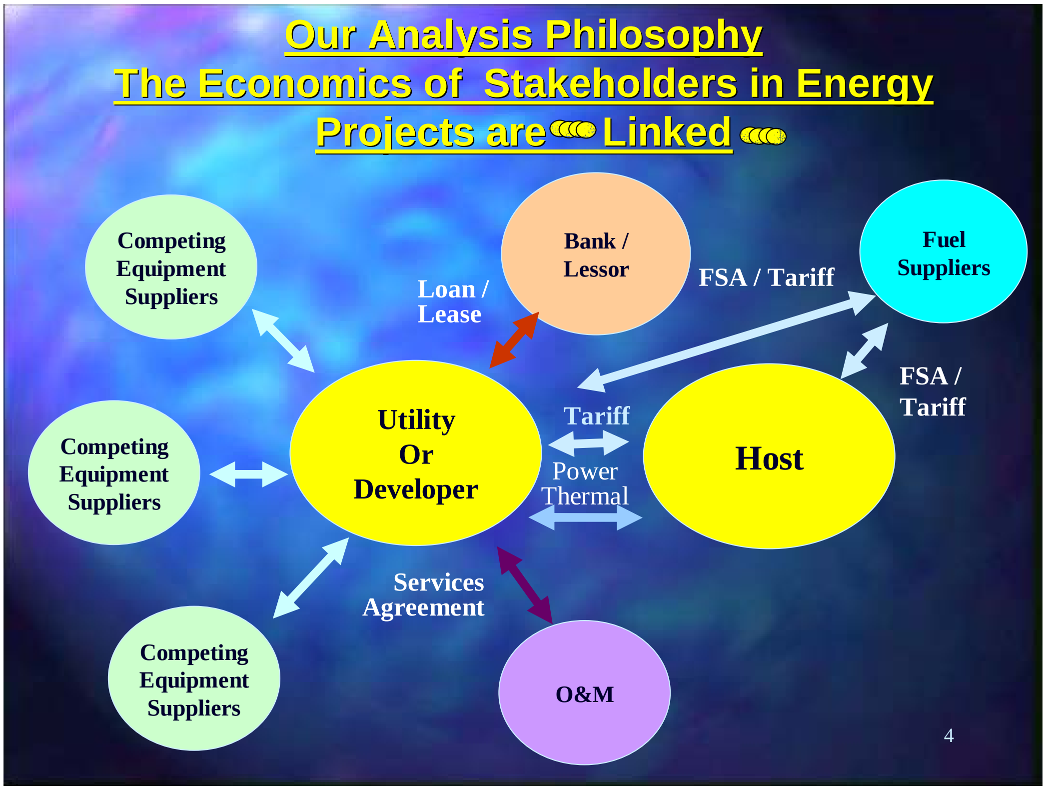
Background on Competitive Energy Insight and the Economic Modeling Tools Used in the Analysis

Founded in 1997, Competitive Energy Insight Inc. provides project development, financial analysis, contract development, asset management, asset valuation, business and management and specialty software to the Electric Power and Distributed Energy Resources industries.

CEI has developed a suite of software products which we use extensively in our consulting practice and which can be licensed for independent use by developers, business owners, engineers, consultants and utilities. CEI's "world-class" analytical software and its complementary power generation and project development skills and experience have been applied internationally to an array of power, combined heat and power, renewable energy and energy savings technologies and applications valued in the billions of dollars.

All of the EconExpert tools are menu driven and include on-line help, documentation and data entry wizards to assist with data input and set-up. Importantly these tools are Excel-based and are completely customizable allowing the user to apply them for any technology or transaction. In addition, automated sensitivities allow quick and accurate assessment of risks. For additional information, please visit the CEI website at www.EconExpert.NET or www.CEIInc.NET.

Figure 38 - The Economics of DER Stakeholders are Linked



Our Analysis Philosophy
The Economics of Stakeholders in Energy Projects are Linked

Competing Equipment Suppliers

Bank / Lessor

Fuel Suppliers

Loan / Lease

FSA / Tariff

Competing Equipment Suppliers

Utility Or Developer

Tariff

Power

Thermal

Host

FSA / Tariff

Services Agreement

Competing Equipment Suppliers

O&M

4

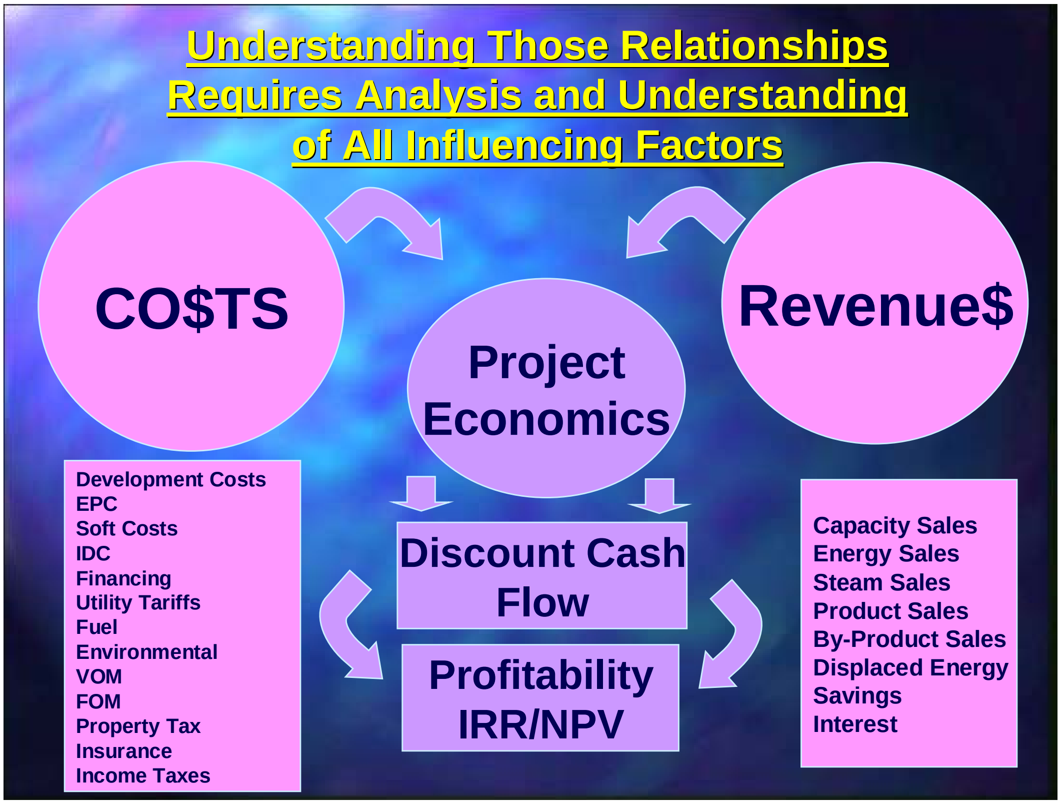
The key to the analysis philosophy used in this evaluation is that the economics of each and every stakeholder in a DER project are closely related. Each party to the transaction is usually directly impacted, by contract or tariff, to changes in the economics or performance that also affect other parties to the transaction.

For example:

- The operating reliability of a DER facility will determine:
  - The amount of thermal and electric energy supplied by a facility to the host site
  - The magnitude of operations and maintenance costs.
  - The savings realized by the host and the revenues realized by a third party owner.
- Fuel costs will affect both the costs of operating the DER facility and the thermal savings that can be achieved as a result of using DER.
- The relative electric tariffs energy, demand charge and standby charge rates will directly determine when and to what extent it is economic to operate a DER facility as opposed to buying energy from the utility.
- Equipment type and selection will affect the amount and distribution of thermal and electric offset that can be achieved at the site, as well as capital costs, operating costs and plant reliability.

These examples are but a few of the many cross-influencing factors that mean that impacts on one party will have direct impact on the costs and benefits of one or more other parties to the transaction. In this analysis the benefits, impacts and risk allocation to the various parties in the associated transactions will be evaluated from the perspectives of each individual stakeholder.

Figure 39 - Factors Contributing to Thorough Analysis of DER Economics



Understanding Those Relationships Requires Analysis and Understanding of All Influencing Factors

CO$TS

Project Economics

Revenue$

Development Costs
EPC
Soft Costs
IDC
Financing
Utility Tariffs
Fuel
Environmental
VOM
FOM
Property Tax
Insurance
Income Taxes

Discount Cash Flow

Profitability IRR/NPV

Capacity Sales
Energy Sales
Steam Sales
Product Sales
By-Product Sales
Displaced Energy Savings
Interest

Understanding the Relationships of the Economics Between Stakeholders Requires an Understanding of All of the Factors That Influence Those Economics.

In addition to the cross-influencing factors described in the previous slide, proper analysis of DER economics on the cost side must also consider:

- The up-front costs and risks associated with developing the project, costs which often times will be sacrificed if the project is not built.
- Costs to build and start-up the facility
- Soft costs which are often overlooked including spare parts inventory, working capital and financing costs.
- Alternative financing structures including debt, equity and operating leases.
- Site energy usage profiles and facility operating profiles.
- The design of the applicable utility tariffs including energy charges, demand charges, standby charges, seasonal considerations and tier structures or time-of-use considerations.
- Fuel use and fuel pricing risk.
- Environmental costs including emissions, noise, land use and associated permitting.
- Facility operating costs including fixed costs and variable costs that relate to facility operating factors.
- Costs under third party contracts including operations and maintenance agreements, fuel supply agreements, and thermal or electric purchase agreements.
- Impacts of site improvements on assessed property tax valuations.
- Insurance costs.
- Payment of local, state and federal income taxes.

On the revenue or savings side proper analysis must also include:

- Site energy usage profiles and facility operating profiles.
- The design of the applicable utility tariffs including energy charges, demand charges, stand by charges, seasonal considerations and tier structures or time-of-use considerations.
- Savings associated with displacement for thermal energy, electric energy and demand charges.
- Potentials for product or by-product sales (if applicable)
- Revenues or savings under third party contracts including operations and maintenance agreements, fuel sales agreements, and thermal or electric sales agreements.
- Impacts on site market value.
- Interest revenues.
- Opportunities for grant funding or special financing.
- Income tax benefits including deprecation credits and income tax credits and the most efficient utilization of those benefits.

Frequently, all of the identified information may not be available to the evaluator and some data may be subject to changes in future market conditions and regulatory tariffs. In these cases, educated assumptions should be made followed by sensitivity analysis to understand the impacts of changes in the specified variables on project economics and economic viability.

Once fully assessed, the above costs and revenues are fully documented, proper analysis must be requires discount cash flow analysis which takes into account annual project cash flows, the time value of money and which provides metrics (measurement sticks) including factors such as internal rate of return and net present value. Often used by others, Simple Payback can actually provide misleading or erroneous conclusions since simple payback does not usually consider impacts of depreciation and income taxes, the time value of money, financing costs, forward electric and gas prices and other critical economic factors. CEI strongly recommends against the use of oversimplified analysis to make investment decisions in DER.

While these analyses always involve some element of projecting future prices, costs and savings which have a high degree of uncertainty, the use of sensitivity analysis techniques to quantify and bracket those risk profiles is the most prudent approach for making sound decisions on these types of investment opportunities. This type of analysis is easily performed using the EconExpert modeling tools.

Figure 40 - The EconExpert-IAT Model

EconExpert-IAT

Interval Make / Buy Analysis

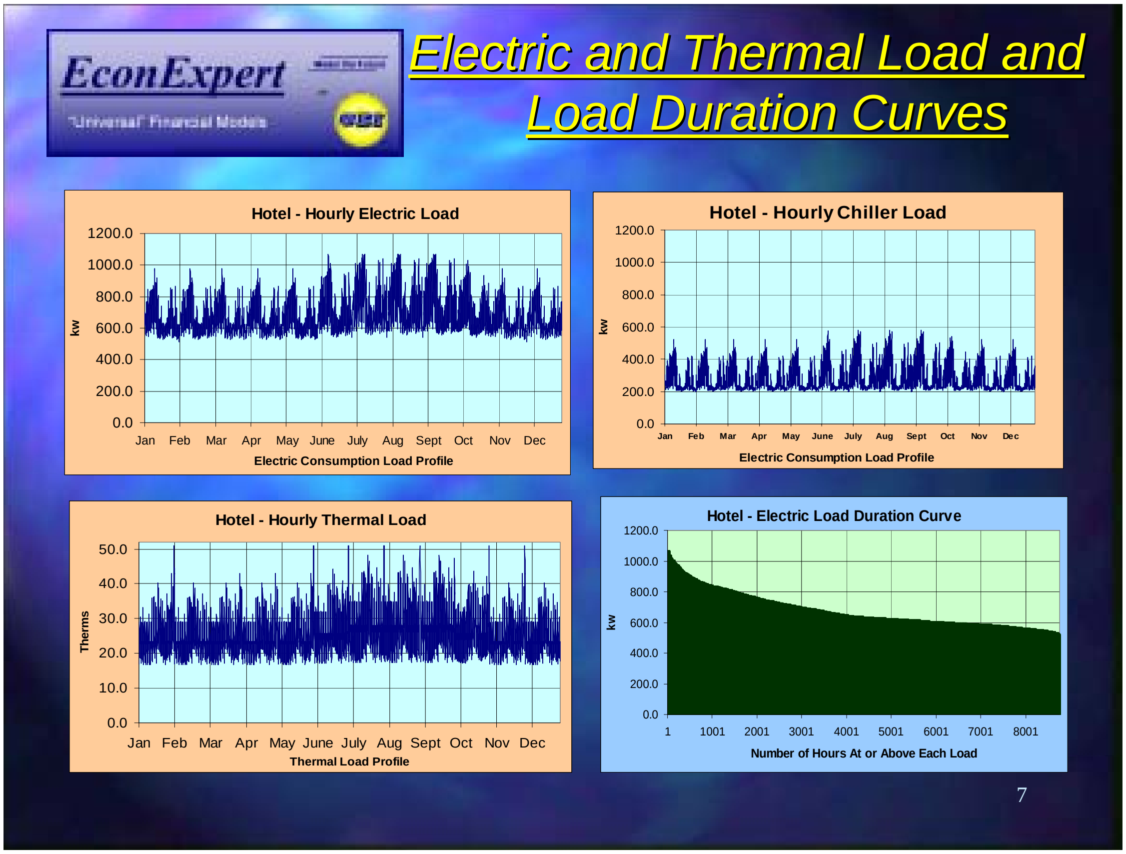
- Hourly Operating Analysis
  - Dynamics of DG/CHP Operations
  - Optimize Equipment Selection and Sizing
- Data Sources
  - Electric/Thermal meter & sub-metering data
    - Or simulated profiles
  - Fuel and Electric Tariffs
  - Equipment Technical & Performance Data
- Consolidated Reports & Graphics
  - Operating Profiles
  - Hourly Performance
  - Monthly Reports
    - Thermal and Electric Bills Before & After DG

The ***EconExpert-IAT* Interval Analysis Tool**, used in this analysis simulates the automated dispatch (self-generate versus buy-from-utility decisions) of DER facilities as a function of hourly thermal and electric demand profiles at a site, facility operating characteristics and pricing signals imposed from the applicable electric and gas tariffs. This tool incorporates a complete database of building thermal and electric profile data that allows the simulation of time-of-use energy and thermal profiles for virtually any building type or configuration for use when specific metering data is not available.

The methodical analysis that is automatically performed by EconExpert-IAT assesses the dynamics of DER operations during each hour of the month or year, and allows the user to optimize equipment selection and sizing. This is important from every stake holder's perspective since the point of optimum economics for virtually any DER facility occurs in the between the site minimum load and the site maximum demand. Typically, below the minimum load, a propensity of the lowest valued energy is displaced, while near the maximum demand a relatively low capacity factor may be realized meaning inefficient use of the capital investment. At the optimum point all of the parties' benefits can be maximized. This will also require cycling operation of the associated facilities.

Complementing the functionality of the models is a database of electric and thermal load profiles called EnergyShape. EnergyShape, developed by Primen an affiliate of the Electric Power Research Institute, provides hourly projections of electric, thermal and chiller load profiles for 104 different building configurations in a wide variety of alternate climate zones, for a 12 month period. CEI has licensed this database and has sublicensing rights to apply and sell this database to its customers for use with the EconExpert-IAT model.

<u>Figure 41 - Proxy Load Profile Data Provided by the EnergyShape Database developed by Primen</u>



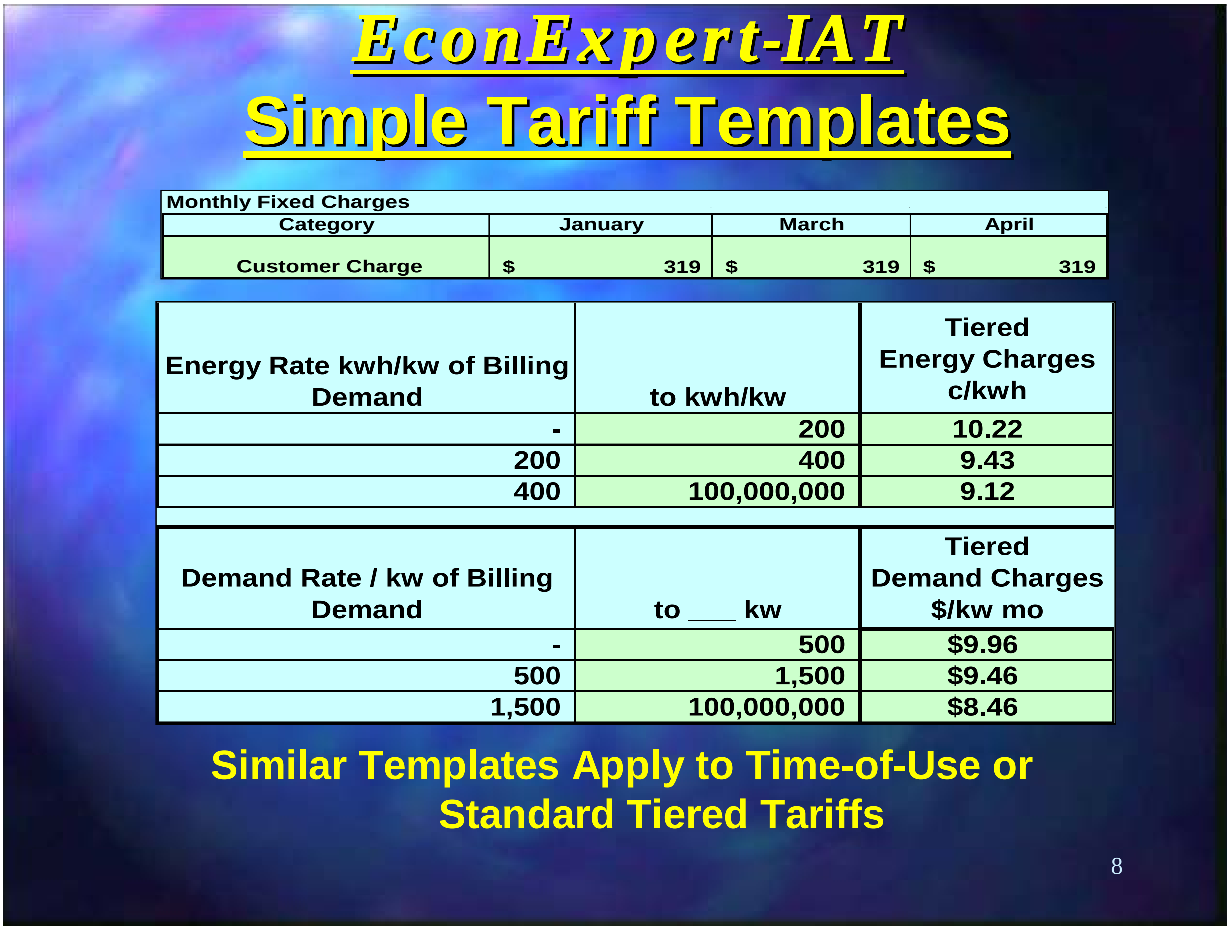
Electric and Thermal Load and Load Duration Curves

From these hourly profiles, load duration curves can also be generated. These curves illustrate the amount of time over a calendar year that a facility exhibits (or operates above or below) a certain set of operating conditions.

To facilitate ease of use, the EconExpert-IAT model is equipped with a complete set of tariff templates allowing the user to quickly and easily model any utility tariff from the applicable utility rate sheets, considering fixed charges, demand charges, energy charges and standby rates.

Shown here is a typical input template from the model used for the HECO Schedule PS tariff for Secondary Voltage Service on Oahu. Any of the Islands tariff structures can be quickly and easily modeled.

Figure 42 - EconExpert-IAT Tariff Templates



EconExpert-IAT

Simple Tariff Templates

Monthly Fixed Charges

Category	January	March	April
Customer Charge	$ 319	$ 319	$ 319

Energy Rate kwh/kw of Billing Demand	to kwh/kw	Tiered Energy Charges c/kwh
-	200	10.22
200	400	9.43
400	100,000,000	9.12

Demand Rate / kw of Billing Demand	to ___ kw	Tiered Demand Charges $/kw mo
-	500	$9.96
500	1,500	$9.46
1,500	100,000,000	$8.46

Similar Templates Apply to Time-of-Use or Standard Tiered Tariffs

Complementing EconExpert-IAT, the ***EconExpert-DG*** financial model for Distributed Energy Resources and Combined Heat and Power applications was used to analyze the discount cash flow economics of each investment scenario.

EconExpert-DG is a highly functional automated business and financial analysis tool that allows the user to fully address all aspects of the valuation and transaction ranging from simple screening analyses, to detailed project development, negotiations and financing analyses. Included in *EconExpert-DG* is a suite of automated sensitivities ranging from investment, operations and financing analyses, to asset valuation, tariff analysis, fuel hedging, and contract mechanism risk analyses, allowing the user to gain a thorough understanding of a project's risk profile and to properly structure win-win agreements to manage those risks.

IMPORTANTLY, EconExpert-DG allows the evaluation from the perspective of every stakeholder in a transaction including the equipment supplier, buyer, seller, developer, host, financer or leasor, etc. positioning anyone to fully understand the economic benefits and risk profiles from their own perspective as well as from the perspective of the parties they are negotiating with. This offers huge value by strengthening your negotiating posture, identifying appropriate risk management strategies and facilitating the capture of the maximum value in each transaction.

EconExpert-DG is fully integrated and interoperable with EconExpert-IAT.

Figure 43 - The EconExpert-DG Financial Model

EconExpert

"Universal" Financial Models

EconExpert-DG

Economic / Financial Analysis

- Full Before and After-Tax Discount Cash Flow
- Critical Considerations for Project Analysis
  - Host's Appetite for Electric Energy and Waste Heat
  - Regulatory Requirements and Tariffs
  - Costs of Installation and Operation
  - Performance Characteristics of the Technology
  - Fuel Costs and Pricing Risk
  - Income Taxes and Efficient Utilization of Tax Benefits
  - Sources for Grant Funding
  - Financing Alternatives including Operating Leases
- Fully Integrated with *EconExpert-IAT*

Like EconExpert-DG, ***EconExpert-LP*** is an economic and financial analysis tool, but is applied for power plants that sell energy to the grid or to third parties under all types of bilateral contracts (PPA's, tolling, options, etc.). Such applications frequently include renewable applications like wind, geothermal and solar. The same tool can be applied over the full range of the business and project cycle starting from simple deal screening analyses and evolving in the same tool to detailed contract development and negotiations, financial closing, asset acquisition/divestiture analyses and remonetization of equity.

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