Caribbean Renewable Energy Development Programme
(CREDP-GIZ)

CHENACT Audit Findings & Recommendations

November 2011

CREDP - GIZ

- AGENDA

  - 1.0 Introduction to CREDP-GIZ
  - 2.0 Explanation of the Detailed Audit Report
  - 3.0 CHENACT Detailed Audit Findings
  - 4.0 CHENACT Energy Savings Opportunities (ESO's) & Recommendations
  - 5.0 Conclusion

1.0 CREDP - GIZ

What or Who is CREDP?

- CREDP – Caribbean Renewable Energy Development Programme - CARICOM – programme for the promotion of Renewable Energy and Energy Efficiency in CARICOM plus Dominican Republic.

- CREDP/UNDP (2004 – 2009) was financed by GEF and implemented by UNDP/CARICOM.

- CREDP/GIZ (2003 – 2012) is financed by the government of Germany with contribution from Government of Austria and implemented by GIZ headquartered in St. Lucia (at CEHI)
Total volume (Sept. 2010): 8.2 Mio EUR (approx. 11.3 Mio USD)

- Counterpart of CREDP is the Energy Unit of the CARICOM Secretariat in Guyana.

- CREDP assist the Energy Unit of the CCS in its clearing house function to provide coordination and facilitation of donor support to the CARICOM region.

1.0 CREDP - GIZ

CREDP's Project Region (currently)

CREDP-Member countries (15):

- **Antigua & Barbuda**
- (Bahamas)
- Barbados
- Belize
- **Dominica**
- Dominican Republic
- **Grenada**
- Guyana
- (Haiti)
- Jamaica
- **St. Lucia**
- **St. Kitts & Nevis**
- **St. Vincent & the Grenadines**
- Suriname
- Trinidad & Tobago

1.0 CREDP - GIZ

- CREDP – GIZ is one of the funding agencies of the CHENACT programme for the following countries:
  - St. Kitts & Nevis
  - Antigua & Barbuda
  - St. Lucia
  - St. Vincent & the Grenadines
  - Grenada
- CREDP – GIZ contracted local energy consultants for the audits in the respective countries:
  - Dr. Frederic Isaac
  - Herbert Samuels
  - Erwin Roden
  - Christine Wilkinson

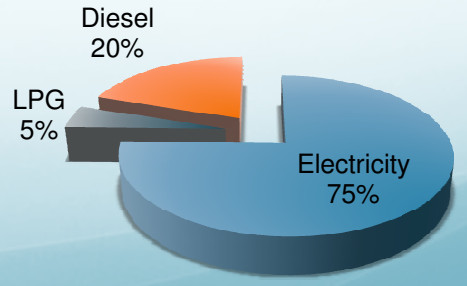
2.0 CHENACT Detailed Audit Reports

- 2.0 Explanation of the Detailed Audit Report
- Each Audit report is broken down into different analyses.
  - Executive Summary
  - Introduction
  - Energy Audit & Accounting
    - Energy Consumption and Cost (incl. Water)
    - Electrical Bill Analysis
    - Organizational Analysis
    - Maintenance Effectiveness
  - Carbon Dioxide Emission Analysis
  - Solar Energy Performance Analysis
  - LPG, Diesel & Gasoline Analysis
  - Energy Saving Opportunities
  - Discussion and Recommendations
  - Appendices

2.0 CHENACT Detailed Audit Reports

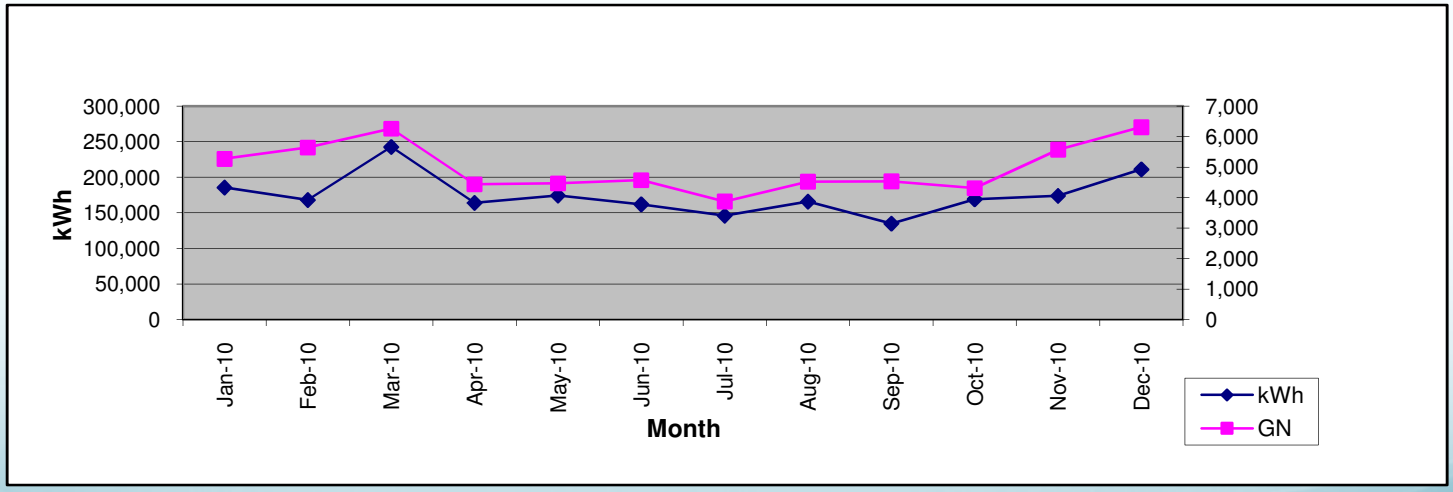
- ENERGY AUDIT AND ACCOUNTING
  - This portion of the report analyses the consumption of the actual facility based on the equipment used.
  - Energy Consumption and cost is based on the billing information provided by the hotel. This is done for Electricity, Water, LPG, Diesel and Gasoline (if used)
  - From this information we developed the following data:

2010	Electricity	LPG	Diesel	Total Energy
Energy (kWh)	2,097,897	130,863	554,756	2,783,517
Cost (EC$)	2,143,002	188,980	134,937	2,466,919
Energy %	75.37%	4.70%	19.93%	100%
Cost %	86.87%	7.66%	5.47%	100%



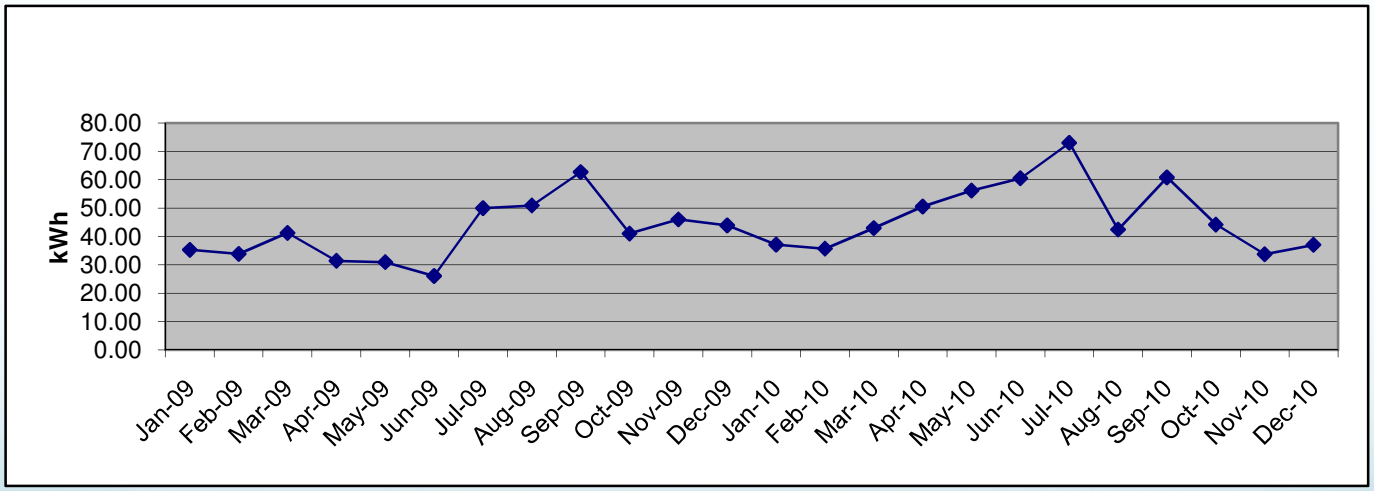
2.0 CHENACT Detailed Audit Reports

- ENERGY AUDIT AND ACCOUNTING
  - Through this analysis of consumption, patterns can be seen through graphical data.
  - This graph compares Electrical consumption with Occupancy



2.0 CHENACT Detailed Audit Reports

- Energy Audit and Accounting
- The following graph illustrates the Hotel's Energy Index per Guest Night



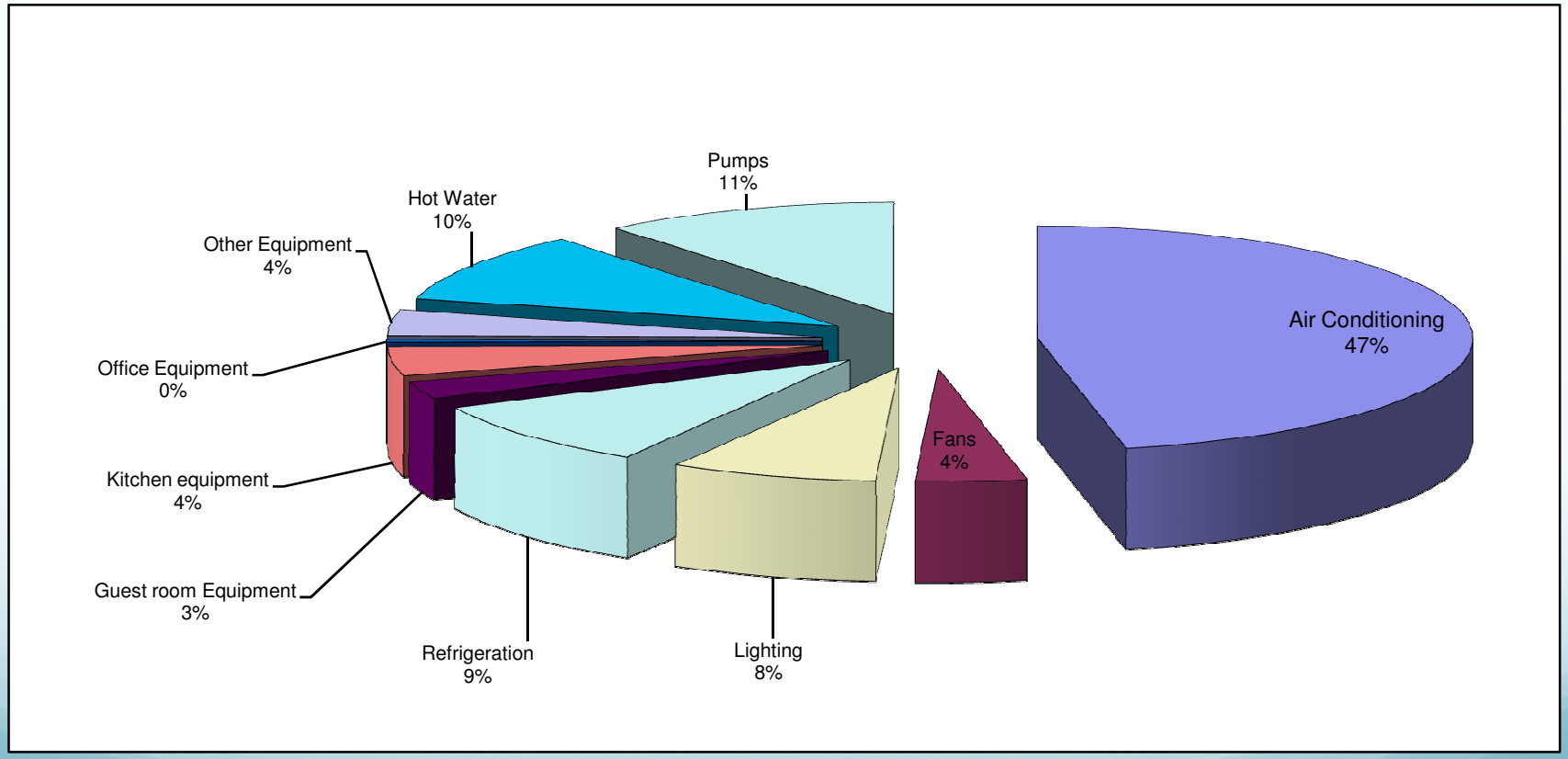
2.0 CHENACT Detailed Audit Reports

- ENERGY AUDIT AND ACCOUNTING
- The actual Energy accounting process tabulates all of the following data:

Energy Consumer Description	Annual Energy kWh	% of total	Annual Costs in EC$
Air Conditioning	980,644	47%	996,334.22
Fans	85,884	4%	87,258.44
Lighting	161,236	8%	163,815.50
Refrigeration	199,085	9%	202,270.82
Guest room Equipment	53,678	3%	54,537.12
Kitchen equipment	89,610	4%	91,043.53
Office Equipment	7,991	0%	8,118.86
Other Equipment	77,975	4%	6,633.16
Hot Water	211,128	10%	214,506.40
Pumps	230,665	11%	234,355.41
TOTAL	**2,097,897**	**100%**	**2,058,873**

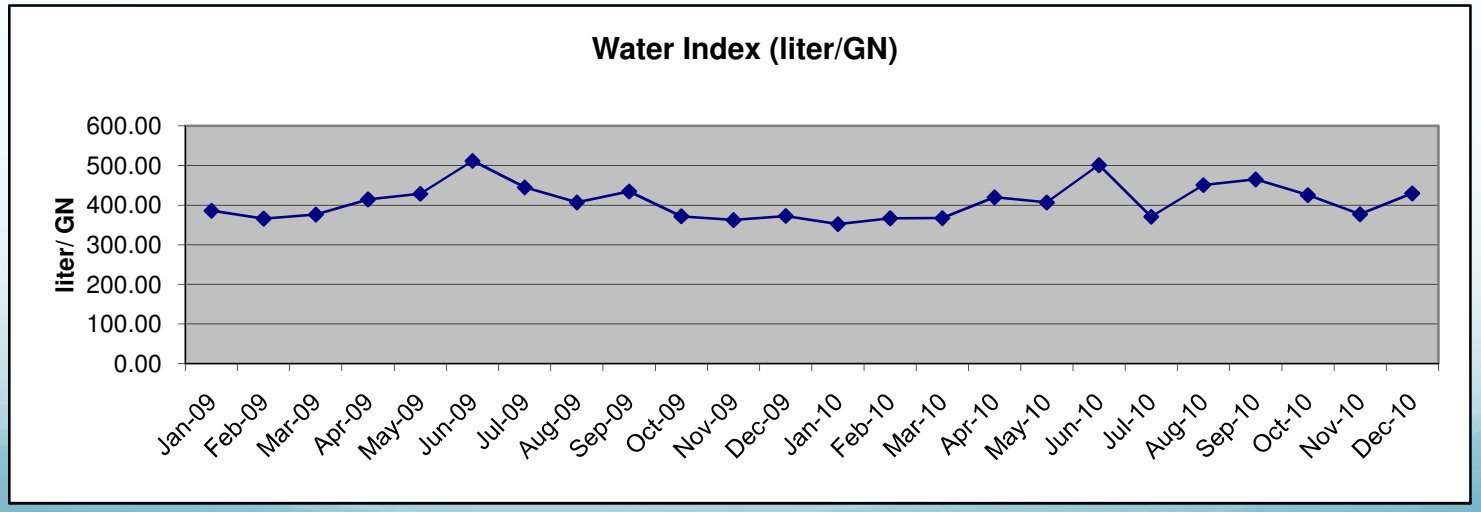
2.0 CHENACT Detailed Audit Reports

- ENERGY AUDIT & ACCOUNTING



2.0 CHENACT Detailed Audit Reports

- Water consumption analysis is also done. This is based on the water bills provided in comparison to the Hotel's Guest Nights.
- This graph illustrates a sample of LITER per Guest Night



2.0 CHENACT Detailed Audit Reports

- ELECTRICAL BILL ANALYSIS
  - Each hotel provided copies of their bills which allowed the audit team to determine the Voltage Rating of the facility and all their associated charges on a monthly basis
    - Customer Charge
    - Electric kWh Charge
    - Demand Charge (at the moment not applicable)
    - Fuel Charge

2.0 CHENACT Detailed Audit Reports

- Organizational Analysis
  - This section analyses the Hotel's performance in terms of :
    - Energy Management Policy
    - Organization & Accountability
    - Staff Motivation and Communication
    - Information, tracking and reporting systems
    - Awareness, Training and Promotion of Energy Efficiency
    - Planning & Investment

2.0 CHENACT Detailed Audit Reports

	Energy Management Policy	Organization & Accountability	Staff Motivation & Communication	Tracking, Monitoring & Reporting Systems	Awareness, Training & Promotion	Investment
LEVEL 0	No explicit policy. No energy manager or any formal delegation of responsibility for energy consumption	No contact with users	No information system	No accounting for energy consumption	No promotion of energy efficiency	No investment in increasing energy efficiency in premises/sites
LEVEL 1	Unwritten set of guidelines. Energy management the part-time responsibility of someone with only limited authority and influence	Informal contact between energy manager and a few users	Energy manager compiles reports for internal use within technical department	Cost reporting based on invoice data	Informal contacts used to promote energy efficiency	Only low-cost measures taken
LEVEL 2	Unadopted energy management policy set by energy manager or senior departmental manager	Energy manager in post, reporting to ad-hoc committee but line management and authority unclear	Contact with major users through ad-hoc committee chaired by senior departmental manager	Monitoring and targeting reports based on supply meter data	Energy Unit has ad-hoc involvement in budget setting. Some ad-hoc staff awareness and training	Investment using short term payback criteria only
LEVEL 3	Formal energy management policy, but no active commitment from top management	Energy manager accountable to energy committee representing all users, chaired by a member of the managing board	Energy committee used as main channel together with direct contact to major users	Monitoring and targeting reports for individual premises based on submetering, but savings not reported effectively to users	Program of staff training, awareness and regular publicity campaigns. Some payback criteria employed as for all other investment	Cursory appraisal of new building, equipment and new refurbishment opportunities
LEVEL 4	Policy, action plan and regular review have commitment of top management as part of corporate strategy. Energy management fully integrated into management structure	Clear delegation of responsibility for energy consumption	Formal & informal channels of communication regularly exploited by energy manager at all levels	Comprehensive system sets targets, monitors consumption, identifies faults, quantifies savings and provides budget tracking	Marketing the value of energy efficiency and performance of energy management in and outside the organisation	Positive discrimination favouring energy saving schemes with detailed investment appraisal of all new building, equipment and refurbishing opportunities
	TOTAL POINTS this column (max 4)	**TOTAL POINTS** this column (max 4)	**TOTAL POINTS** this column (max 4)	**TOTAL POINTS** this column (max 4)	**TOTAL POINTS** this column (max 4)	**TOTAL POINTS** this column (max 4)
2010	3	1	0	1	1	1
2011						
					TOTAL SCORE	**7 out of 24**

2.0 CHENACT Detailed Audit Reports

- MAINTENANCE EFFECTIVENESS
  - This section describes the effectiveness of the Maintenance and Engineering teams at the hotel.
  - This is based on what is observed by the auditor
    - Condition of equipment
    - Condition of insulation on eg. Refrigerant lines
    - Condition of electric panels
    - Transformer room, etc.

2.0 CHENACT Detailed Audit Reports

- CARBON DIOXIDE EMISSION ANALYSIS

  This analysis is based on the sum of all fossil fuels used at the hotel either directly (LPG, Diesel, Gasoline) or indirectly like electricity (when the electricity is made by Diesel)

  The burning of fossil fuels produces Carbon Dioxide emissions, which have a great impact on the environment and add to Global Warming

Annual Carbon Footprint	Consumption	Factor	CO_2 in kg	CO_2 in tonnes	CO_2 in kg/ GN
Electricity (kWh)	2,097,897	0.75	1,573,423	1,573.42	26.31
LPG (l)	18,856.41	1.492	28,134	28.13	0.47
Diesel (l)	55,810.47	2.682	149,684	149.68	2.50
TOTAL			**1,751,240**	**1,751.24**	29.29

2.0 CHENACT Detailed Audit Reports

- SOLAR ENERGY PERFORMANCE ANALYSIS

  If a hotel has any solar thermal applications installed, those were inspected by the auditor for:

  - Proper location
  - System properly sized
  - Back-up elements are installed
    - Can they be switched on and off manually?
    - How much costs are accumulated by the back-up element
  - Hot water lines are insulated, etc.

  This part of the report determines how efficiently the solar water heaters were being used.

2.0 CHENACT Detailed Audit Reports

- LPG, DIESEL & GASOLINE ANALYSIS
  - LPG, Diesel and Gasoline consumption was converted to kWh.
  - The sum of the kWh from Electricity (made from Diesel), LPG, Diesel and Gasoline gives a clearer idea of the total energy consumption of the facility
  - Water consumption was added to show the total costs of utilities.

	Annual Consumption	Cost in EC$	Unit Cost EC$	Consumption per GN in units	Consumption per GN in EC$
Total Electricity Consumption for 2010 (kWh)	2,097,897	2,143,002	1.02	35.09	35.84
Total LPG Consumption for 2010 (kWh)	130,863	188,980	1.44	2.19	3.16
Total Diesel Consumption for 2010 (kWh)	554,756	134,937	0.24	9.28	2.26
Total Energy Consumption 2010 (kWh)	2,783,517	2,466,919	0.89	46.55	41.26
Total Water Consumption for 2010 (liter)	32,648,020	222,969	0.0067 & 0.0062	546.01	3.73

2.0 CHENACT Detailed Audit Reports

- Energy Saving Opportunities (ESO's)

- After a complete inspection and analysis of the property is done ESO's are developed specific to each property.

- The economic feasibility for each ESO is determined:
  - The annual energy and financial savings
  - Simple Payback Period
  - Tons of Carbon Dioxide Saved annually (i.e. not emitted)

2.0 CHENACT Detailed Audit Reports

- DISCUSSION AND RECOMMENDATIONS
  - This is the final portion of the report which indicates the most feasible projects for the hotel to undertake.
  - It calculates:
    - Total Project cost
    - Total Annual savings
    - Simple Payback period
    - Total kWh & Carbon Dioxide Savings
    - Internal Rate of Return (IRR)
    - Net Present Value (NPV)
      - Making this a bankable document

2.0 CHENACT Detailed Audit Reports

- APPENDICES
- The appendix of the reports contains very useful information for every hotel.
  - Energy Accounting Exercise
  - Calculation of the Energy Saving Opportunities
  - Savings Calculations

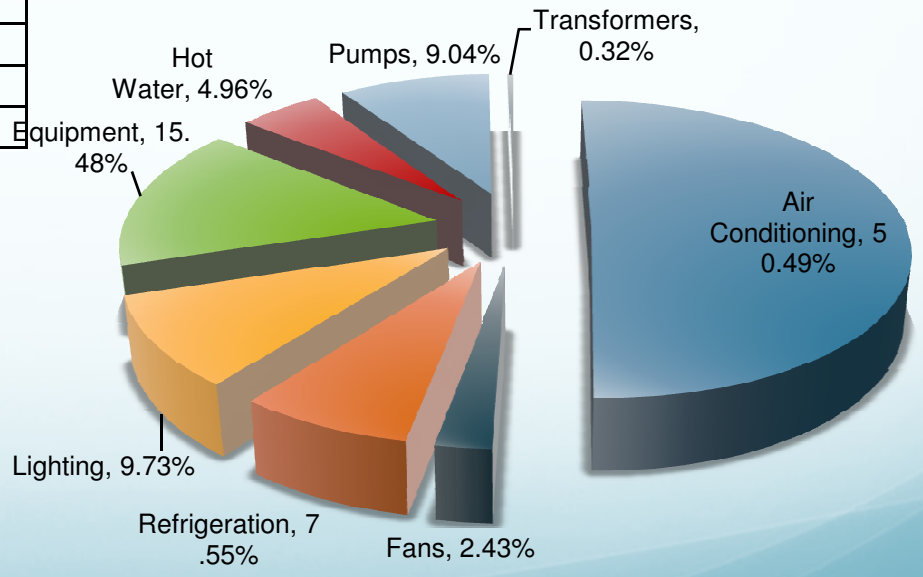
3.0 CHENACT Energy Audit Findings

- CREDP- GIZ conducted 12 detailed Energy Audits in the EC – Countries.
- Major findings:
  - Energy
  - Water
  - Corporate Utility Management
  - Maintenance & Servicing
  - Equipment
    - Air Conditioning
    - Boilers
    - Solar Water Heaters
    - Monitoring
    - Lighting

3.0 CHENACT Energy Audit Findings

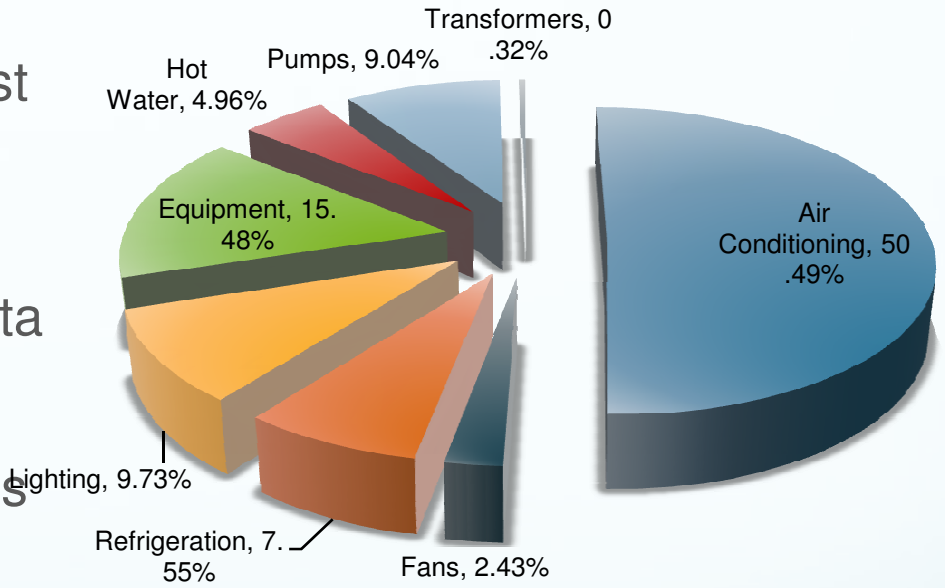
- ENERGY EC HOTELS

Energy Consumer Description	Annual Energy kWh	% of Total
Air Conditioning	5,791,813	50.49%
Fans	278,255	2.43%
Refrigeration	866,286	7.55%
Lighting	1,116,423	9.73%
Equipment	1,775,121	15.48%
Hot Water	568,411	4.96%
Pumps	1,037,156	9.04%
Transformers	36,882	0.32%
TOTAL	11,470,345	1



3.0 CHENACT Energy Audit Findings

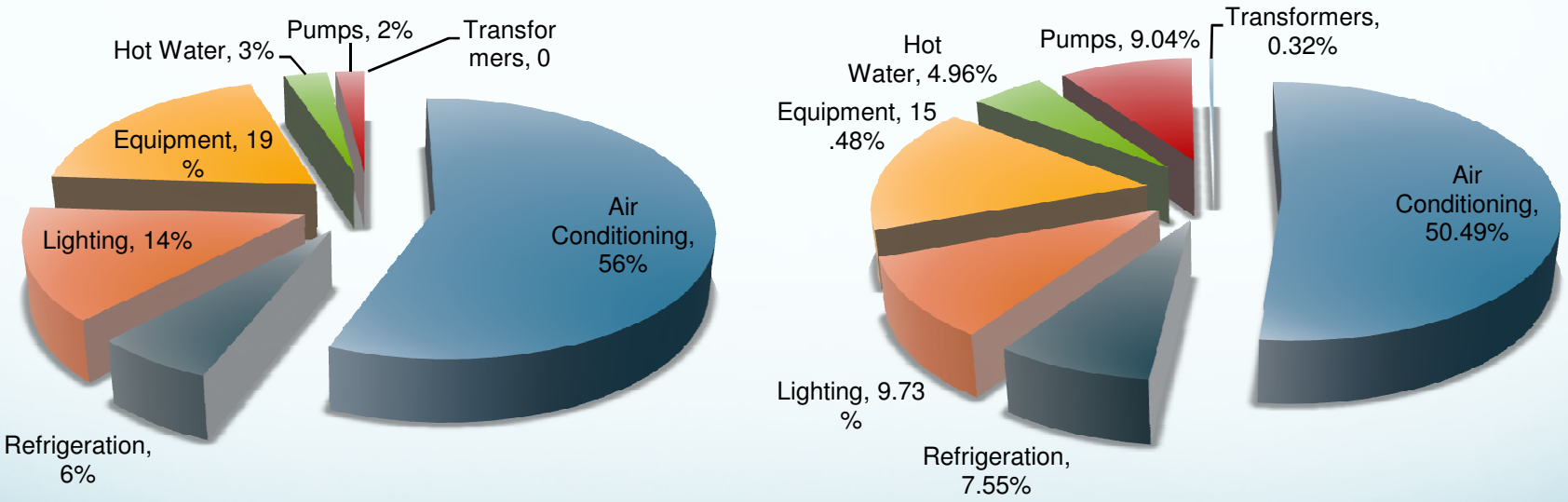
- ELECTRICAL ENERGY
- Air Conditioning is the biggest consumer
- Equipment (rooms, kitchens, offices, restaurants, laundry) are second
- Lighting follows before pumps and refrigeration
- Hot Water production, fans and transformers incl. UPS are lowest



3.0 CHENACT Energy Audit Findings

ELECTRICAL ENERGY USAGE

BARBADOS VERSUS EASTERN CARIBBEAN



3.0 CHENACT Energy Audit Findings

- ENERGY CONTINUED
- There is some awareness of energy conservation at hotels however the majority lack proper Energy Management Procedures.

3.0 CHENACT Energy Audit Findings

- WATER
  - Water is too cheap therefore not enough emphasis is put into effect to conserve it
  - Most hotels have none or wrong faucet aerators which allow wastage
  - Only few hotels have dual flush toilets; they can save up to 9 liters of water per flush (13 liter compared to under 4 liters)
  - Only one hotel of those audited collects rainwater.
  - CEHI in St. Lucia www.CEHI.org

3.0 CHENACT Energy Audit Findings

- MAINTENANCE
  - Maintenance and Engineering staff are extremely familiar with their facilities however in some cases they lack the knowledge (due to a lack of training) to handle all the technical systems in the facility causing a lapse on some areas.

Important pieces of equipment that need scheduled and regular servicing:

- Split Units
- Central Air Conditioning Units
- Refrigeration
- Pumps
- Solar Water Heaters
- Boilers
- Laundry Equipment

3.0 CHENACT Energy Audit Findings

- Maintenance continued:
  - The list can go on, however servicing ensures equipment is continuously performing at the highest efficiency possible
  - The following photos show instances of poor maintenance found by the audit team:

3.0 CHENACT Energy Audit Findings

Dirty Freezer Coils

Main Electrical Room

3.0 CHENACT Energy Audit Findings

Lime Scale collection on SWH

Dirty Freezer Coils

3.0 CHENACT Energy Audit Findings

Kitchen Fresh Air Supply

Poor Split Unit Maintenance

3.0 CHENACT Energy Audit Findings

- Many hotels use subcontractors for servicing of some equipment; however some subcontractors need to:
  - Service more frequently
  - Provide improved servicing of equipment
- There were cases where equipment was installed and never serviced.

3.0 CHENACT Energy Audit Findings

Air Conditioning

- Considering Air Conditioning is the largest energy consumer in EVERY hotel more attention needs to be paid to its management.
- The majority of hotels rely on cleaning staff to shut units off which does not have a 100% success rate from the auditor's findings.
- None of the hotels used Control mechanisms like
  - Energy Eye
  - Card Key System

3.0 CHENACT Energy Audit Findings

Solar Water Heaters (SWH)

- A lot of hotel still use boilers (diesel, LPG or electric) to heat water. Solar water heaters could be used for a fraction of the price.
- Even laundries should preheat the water with solar (free) instead of using only LPG/ electric boilers
- Hot water pipes from panel to the user are mostly NOT insulated, resulting in wastage of water
- Electrical back-up systems were all shut off manually
- In one Hotel the panels were installed too low on the roof and therefor are shaded by trees most of the time.

3.0 CHENACT Energy Audit Findings

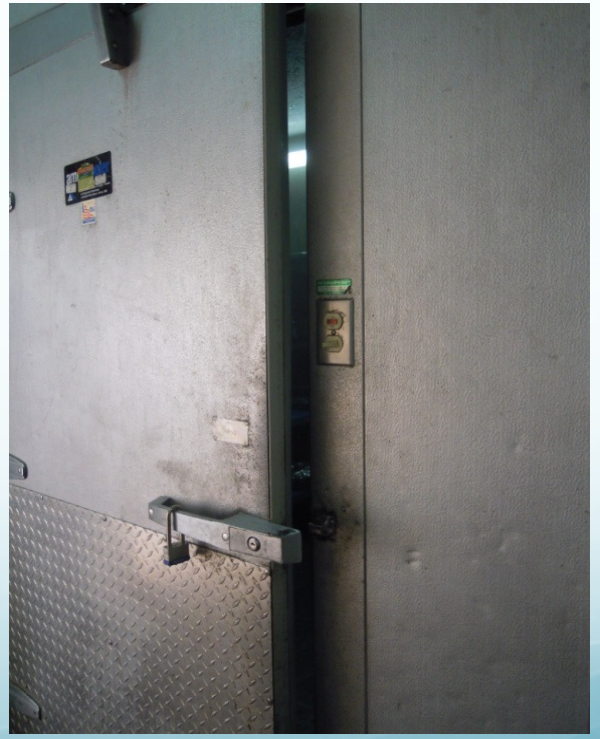
Monitoring

- The constant monitoring of equipment by staff is absolutely necessary to ensure equipment is being used properly and to its full advantage.
- Most times this is done, however there were some instances where more attention needs to be paid as seen in the following photographs.

3.0 CHENACT Energy Audit Findings

Water condensing on the ceiling of a walk-in in

Walk in chiller doors not properly closed



3.0 CHENACT Energy Audit Findings

This was an instance where the switches were left on for the entire duration of the audit.

3.0 CHENACT Energy Audit Findings

- The Set point in this walk in freezer is too low, which causes increased energy consumption by compressors.

4.0 CHENACT Energy Audit

Energy Saving Opportunities & Recommendations

At the end of every report the Energy Saving Opportunities (ESO's) highlight those areas where savings can be achieved either with or without investment.

NO Cost ESO's are mostly small changes in the behavior of employees or procedures:

- Turn off refrigerator in guest room
- Close window drapes when room unoccupied
- Turn off fan when nobody in guest room
- Close door when cleaning a guest room.
- Turn off Fans in Restaurants when restaurant closed
- Set all fans in public areas on medium speed

4.0 CHENACT Energy Audit

Energy Saving Opportunities & Recommendations

LOW COST ESO's

- have an investment up to EC$ 20,000.
- Energy Management / Corporate Utility Management Program
- Improved Maintenance program
- Implement Record keeping of all utilities
- Install weather strips/ insulation at doors to rooms under A/C
- Install Timers & Controls
- Walk-in Chillers: freezer curtains & seals
- Aerators for faucets

4.0 CHENACT Energy Audit

Energy Saving Opportunities & Recommendations

MEDIUM COST ESO's

- Investment between EC$ 20,000 up to EC$ 100,000
- Changes of Air Conditioning
- Installation of Solar Water heaters
- Installation of cool roof application
- Light Retrofits
- Changes of guest room fridges to energy star rated models
- Changes to dual flush toilets
- Installation of rain water tanks

4.0 CHENACT Energy Audit

Energy Saving Opportunities & Recommendations

HIGH COST ESO's

- with Investment of more than EC$ 100,000
  - Solar Cooling Plant:
    - Hottest time of day = time of biggest solar gain
    - Very hot water is used with the help of an absorption chiller to produce cold water for chilled water systems
    - Lifetime 20 years plus
    - One investment
  - Solar Photovoltaic systems to feed back into grid
    - all countries are allowing or in process of allowing PV systems to produce electricity up to 30% of past consumption (annual)
    - Investment in smaller steps possible

4.0 CHENACT Energy Audit Recommendations

- Corporate Utility Management Plan (CUMP)
  - Cooperation of all departments make this program successful.

- CUMP involves:
  - Developing Policy and Program
  - Responsible Manager (Energy Manager or Environmental Manager –
    - full time or contracted
  - Staff Training of all departments
  - Maintenance Training
  - Annual Management System Audit

4.0 CHENACT Energy Audit Recommendations

Corporate Utility Management Process

Utility Management or CUMPs have the ability to save hotels up to 10% of their total utility costs.

The Utility Management Plan and Program will provide sustainable performance because of the following:

- It will have top support from top Management- Policy
- It provides a clear sense of direction – Objectives
- It provides the method of achieving the objectives- Organization
- It indicates the action steps- Execution
- It provides for controlling and monitoring progress – Review
- Increases awareness among staff and guests of the need for energy conservation & sustainability.

4.0 CHENACT Energy Audit Recommendations

Corporate Utility Management Process

There are several ways to reach proper utility management:

- Create system on your own, without any control from an independent outsider
- Join organizations which assist and control annually or every other year e.g. Green Globe, ISO
- Join organizations which control your hotel on a monthly basis e.g. Cristal's Check Safety First –
  Environmental Program with monthly checks;
  Reminders and reports sent to all employees involved with copy to Manager in charge and General Manager

4.0 CHENACT Energy Audit Recommendations

Air Conditioning Systems:

Whenever there is an A/C system installed the following is necessary:

- closed doors and windows
- No air leaks around entrance doors
- Automatic closing mechanism on doors to rooms with open areas (bathrooms with louvered windows, etc.)

Split Units:

Cheapest in purchase price, most expensive in consumption.

Energy Star rated models save at least 10% of electricity consumption

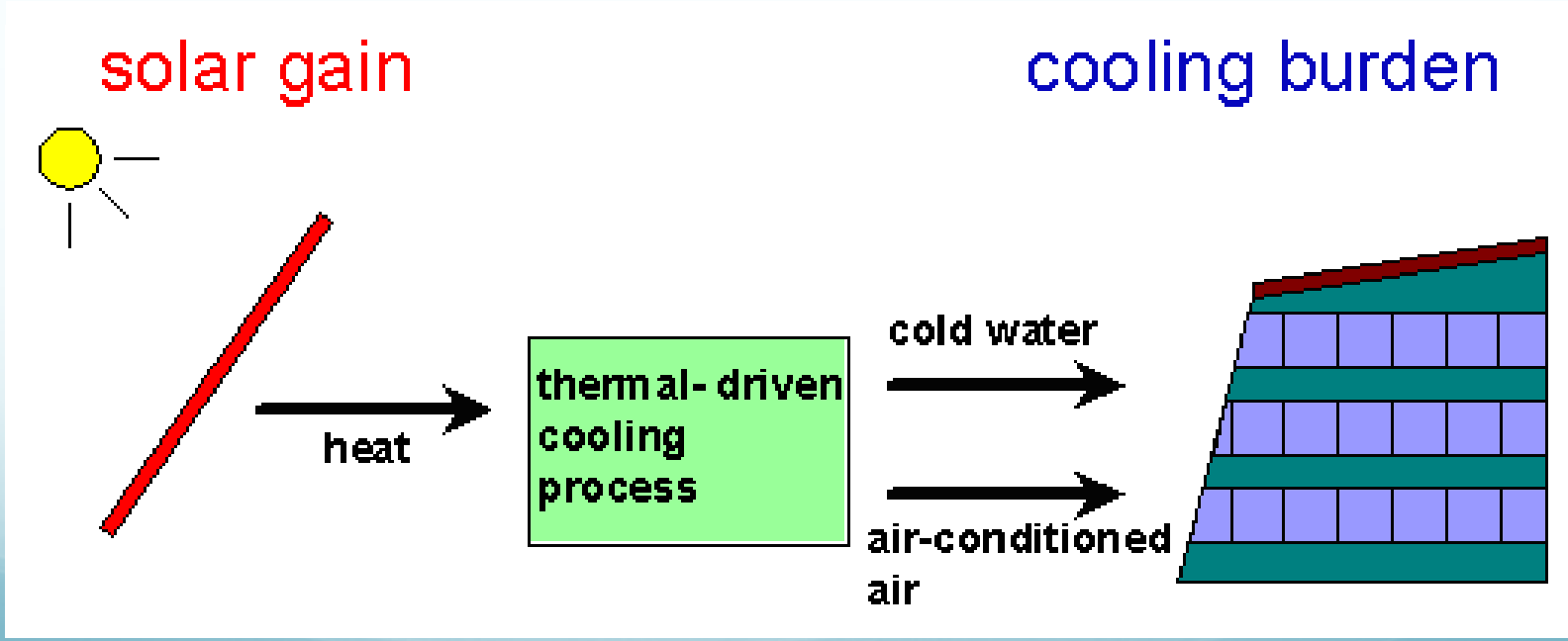
4.0 CHENACT Energy Audit Recommendations – A/C

- VARIABLE REFRIGERANT FLOW SYSTEMS
  - One condensing unit for multiple indoor fan coil units
  - An additional condenser can be installed as back-up
  - Free hot water producing feature
  - Uses less space than multiple units
  - Can be supplied with occupancy sensors to reset room temperature when guests are not there
  - Consumes less energy per unit ton when compared to typical splits
  - Can produce energy savings of up to 30%
  - Costs EC$ 5,400 per ton
  - Payback: 3-5 years

4.0 CHENACT Energy Audit Recommendations – A/C

SOLAR COOLING:

Heat created in the Panels is used to drive an absorption chiller which produces cold water at 9°C. This cold water is distributed by the AC handlers into the building



4.0 CHENACT Energy Audit Recommendations –A/C

SOLAR COOLING

Combination of Special High Temperature Panels and an absorption chiller

The only moving parts on a absorption chiller is a small pump (which is also the only part of the chiller using actual electricity)

The oldest absorption chiller in use is more than 70 years old!

Savings on cooling energy up to 75% for hotels

Each solar cooling plant is specifically designed for the property

Lifetime: 20 years +

Investment from EC$ 800,000

Payback 6 to 10 years

4.0 CHENACT Energy Audit Recommendations

Improved Maintenance

- From the audit findings it is clear maintenance of equipment and electrical needs serious improvement.
- The lack of maintenance can increase equipment's energy consumption. For example a lack of maintenance can increase split unit energy consumption by 20%.
- Upkeep and maintenance of electrical rooms and panels are important for SAFTEY and to ensure electrical code compliance.

4.0 CHENACT Energy Audit Recommendations

LIGHTING RETROFITS:

The following fixtures were most abundant at Hotels:

- 40 Watt T12 Fluorescent Tubes
- 38 Watt T8 Fluorescent Tubes
- 40,60,75 & 100W Incandescent bulbs
- Mercury Vapor/Sodium Halide lamps 100-500 Watts
- Halogen lights on transformers from 20 to 50 Watts
- 100 Watts 12 Volt swimming pool lights

4.0 CHENACT Energy Audit Recommendations

FLOURESCENT TUBES

Consideration to

- Lighting level
- Lifetime
- Lifecycle costs

4.0 CHENACT Energy Audit Recommendations

FLOURESCENT TUBES

make	size	kWh incl. ballast	lumen total	investment in EC$	lifetime hours	total kWh over lifetime	replacement over 50,000 hours	consumption over 50,000 hours	total investment for replacement	total consumption @ EC$ 0.9 per kWh	total invest & consumption over 50,000 hours
T12	4ft	46	2900	6.95	10,000	460,000	5	2,300,000	34.75	2,231.00	2,265.75
T8	4ft	44	2850	7.95	10,000	440,000	5	2,200,000	39.75	2,134.00	2,173.75
T5	4ft	31	2900	30.00	20,000	620,000	2.5	1,550,000	75.00	1,503.50	1,578.50
LED 16	4ft	30	3040	280.00	50,000	1,500,000	1	1,500,000	280.00	1,455.00	1,735.00
LED	4ft	20	1700	147.40	50,000	1,000,000	1	1,000,000	147.40	970.00	1,117.40

4.0 CHENACT Energy Audit Recommendations

Incandescent Bulbs

- Only 5% of the power consumed is used for light – rest is heat
- Lifetime approx. 1000 hours

4.0 CHENACT Energy Audit Recommendations

Incandescent Bulbs

- Only 5% of the power consumed is used for light – rest is heat
- Lifetime approx. 1000 hours

REPLACEMENTS:

Compact Fluorescent (CFL)	L.E.D
Uses 80% less electricity	Uses 90% less electricity
Lifetime 6,000 to 15,000 hours.	Lifetime 20,000 to 50,000 hours
Filled with Quicksilver – recycling	-
Cost from EC$ 15.00	Cost from EC$ 50.00
Dimmable, all colors & shapes	Dimmable, all colors
Constant on/off effect life	Constant on/off does NOT effect

4.0 CHENACT Energy Audit Recommendations

Halogen lights (20, 35-40, 50 Watts)

- Incandescent light bub
- brighter than regular incandescent
- Hotter
- are on transformers

REPLACEMENTS

L.E.D. (1, 3, 4, & 7 Watts)

- Base GU 10 L.E.D.s work on 240 Volts and without transformer

  (40 - 50 Watt halogen = 4 – 7 W LED from EC$ 35.00 upwards)

- Base GU 5.3 (1 & 3 Watts) only work with transformer

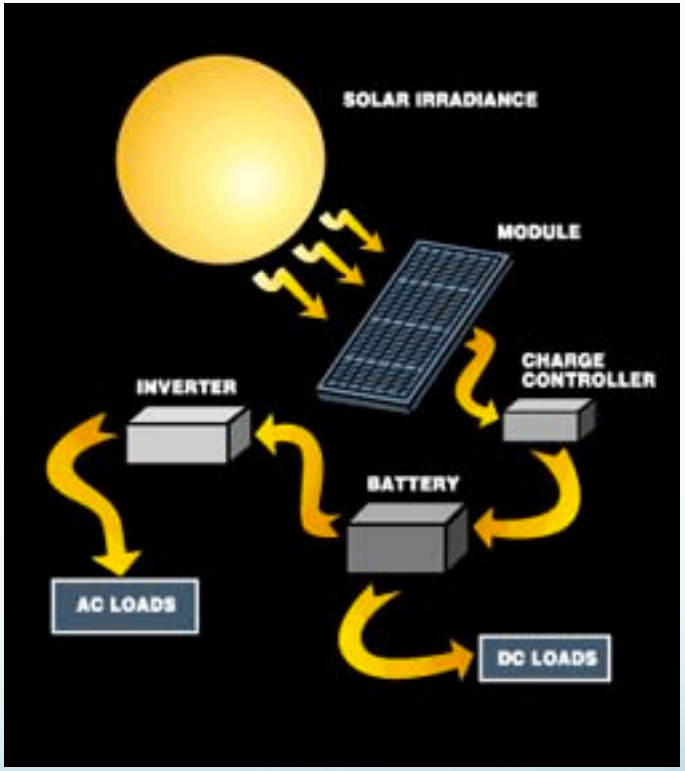
4.0 CHENACT Energy Audit Recommendations

- PROGRAMMABLE TIMERS & CONTROLS
  - These simple devices can ensure equipment is shut of during hours of inactivity
  - Example shutting off of:
    - Pumps
    - Exhaust Fans
    - Lighting
    - Payback: 5 months

4.0 CHENACT Energy Audit Recommendations

PHOTOVOLTAIC (PV) SYSTEMS

- These systems are a large financial investment
- Lifetime 20 years
- Up to 30%of electricity consumption can be installed
- Grid connected systems are more economic
- Systems can be set up in steps
- Payback: 9-10 years



4.0 CHENACT Energy Audit Recommendations

VARIABLE SPEED DRIVES (VSD)

- The majority of hotels have quite a number of pumps.
- Energy savings are attained by using VSD because they basically control speed.
- That means if an application only needs 80 percent flow, pump will run at 80 percent of rated speed and only requires 50 percent of rated power
- Costs EC$2,700/kW

  EC$ 2,000/hp
- Payback of 1-2 years

5.0 CONCLUSION

From the 12 audits undertaken, the following summary was compiled.

Energy Saving Opportunities	Initial Costs EC$	Annual Cost Savings EC$	Average Payback Period Years	Annual Savings kWh	Carbon Dioxide Saved (Tons/year)	savings in 10 years in kWh
No Cost ESO's & recommendations	0	140,804	0.00	136,898	97.56	1,368,979
Low cost (up to EC$ 20,000)	536,815	1,492,083	0.97	1,367,550	1,009.25	13,675,498
Medium (EC$ 20,000 to 100,000)	1,550,616	1,096,950	2.88	1,044,079	737.22	10,440,794
Large (more than EC$ 100,000)	30,448,753	4,595,815	6.47	4,691,256	3,469.49	46,912,557
TOTALS	**32,536,183**	**7,325,651**		**7,239,783**	**5,319.16**	

Energy Saving Opportunities	Initial Costs EC$	Annual Cost Savings EC$	Average Payback Period Years	Annual Savings kWh	Carbon Dioxide Saved (Tons/year)
Small Hotels	2,337,655	885,508	2.33	957,916	668.21
Medium Hotels	7,624,288	2,076,796	2.36	2,175,783	1,626.73
Large Hotels	22,574,241	4,363,347	2.36	4,106,084	3,024
TOTALS	**32,536,183**	**7,325,651**	**2.35**	**7,239,783**	**5,319.16**

5.0 CONCLUSION

The following table presents the savings potential for different hotel sizes.

Hotel Size	Annual Electricity consumption in kWh	Annual Savings kWh	Annual Electricity AFTER implement	% reduction in Electricity Consumption	
Small Hotels	1,648,361	957,916	690,445	58.11%	
Medium Hotels	4,036,407	2,175,783	1,860,623	53.90%	
Large Hotels	5,785,577	4,106,084	1,679,494	70.97%	
TOTALS	11,470,345	7,239,783	4,230,562	63.12%	average

The End

Questions & Comments

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