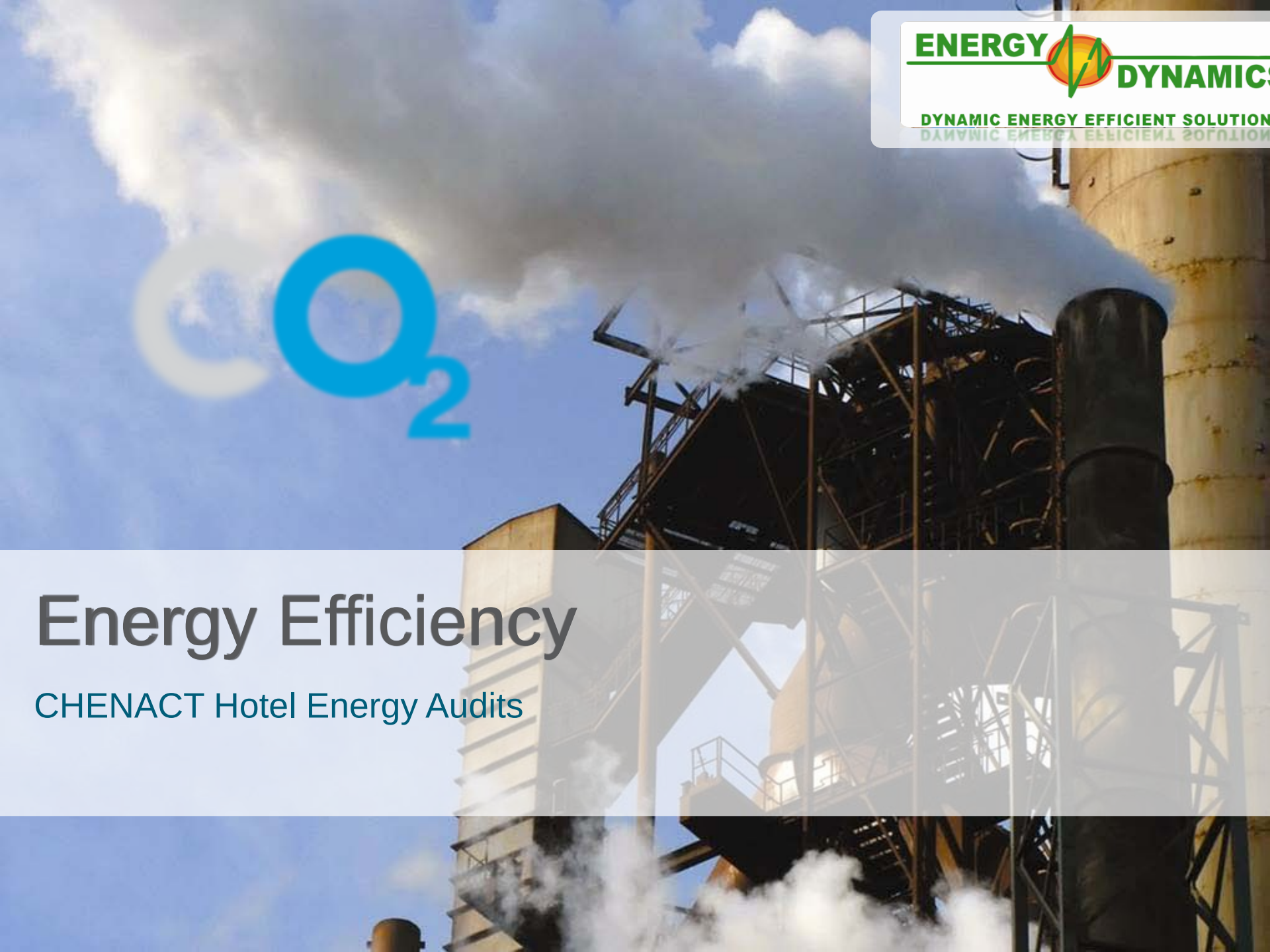


Energy Efficiency

CHENACT Hotel Energy Audits

AGENDA

- 1.0 EDL Overview
- 2.0 CHENACT Energy Audits
- 3.0 Global Energy Review
- 4.0 Caribbean Energy Situation
- 5.0 Bahamas National Energy Policy
- 6.0 Conclusion

1.0 EDL Overview

1.0 EDL an Overview

DYNAMIC ENERGY EFFICIENT SOLUTIONS

Energy Dynamics Limited (EDL) is an Energy Services Company (ESCo) based in Trinidad and Tobago but operating throughout the Caribbean for over ten (10) years. The services offered includes: -

- Energy Engineering Services
  - Energy Audits
  - Design of Building Energy Services
  - Testing, Adjusting & Balancing
  - Measurement & Verification
- Supply of Energy and Water Conservation Products
  - Broad Systems
  - CHP Systems
  - Semco Desiccant Products
  - Alerton BMS
  - Solar PV and Thermal Systems
- Energy Retrofit Projects (ESCo)

ENERGY DYNAMICS Ltd.
DYNAMIC ENERGY EFFICIENT SOLUTIONS

1.0 EDL an Overview cont'd

DYNAMIC ENERGY EFFICIENT SOLUTIONS

- Commenced in 2000
- Operates throughout Caribbean
  - Barbados
  - Eastern Caribbean
  - Dominican Republic
  - Jamaica
  - Dutch Caribbean – St. Maarten, Aruba & Curacao
  - **Central America**
- Provides Sustainable Energy & Environmentally Friendly Solutions

EDL's Mission

DYNAMIC ENERGY EFFICIENT SOLUTIONS

Energy Dynamics Limited exists to profitably provide the most economically and environmentally friendly solutions to satisfy our customers.

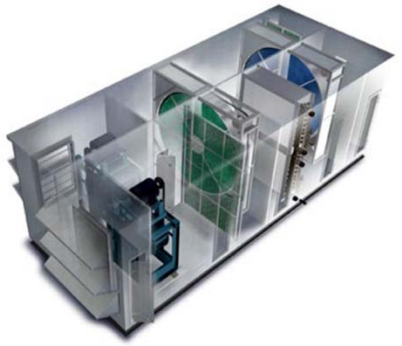
In support of this we are committed to:

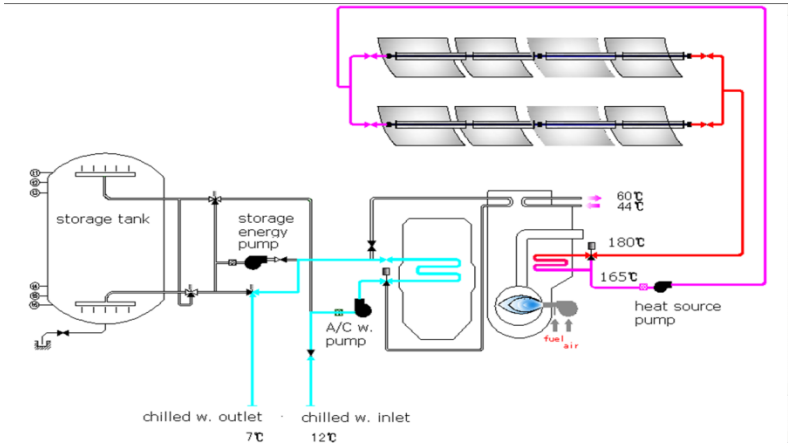
- Developing long term relationships through effective customer service;
- Keeping in the forefront of technology through training and educating our employees and customers;
- Evaluating and selecting appropriate technologies to meet our customer's needs;
- Providing a challenging, profitable and harmonious work environment for our employees;
- Building and maintaining long term and honest relationships with our suppliers.

ENERGY DYNAMICS Ltd.
DYNAMIC ENERGY EFFICIENT SOLUTIONS

1.0 EDL an Overview cont'd

- EDL have pioneered a number of energy efficiency technologies throughout the Caribbean including:
  - Absorption Cooling Systems fuelled by Natural Gas, Diesel, LPG or Waste Heat from Generators.
  - Co Generation Systems – Combined Cooling, Heating and Power (CCHP)
  - Solar Air Conditioning
  - Building Management Systems
  - Semco Desiccant dehumidification systems
  - Chilled Beams Systems





ENERGY DYNAMICS Ltd.
DYNAMIC ENERGY EFFICIENT SOLUTIONS

EDL Technical Staff

- Broad Air Conditioning Certified Service Engineers
- Alerton BMS Certified Engineers (2)
- AEE - Certified Energy Managers (CEM) (4)
- FSEC Certified PV Engineers (1)
- FSEC Certified Solar Thermal Engineers (1)
- AEE - Distributed Generation Certified Professionals (1)
- HVAC Building Testing & Commissioning Professionals (1)

ENERGY DYNAMICS Ltd.
DYNAMIC ENERGY EFFICIENT SOLUTIONS


Caribbean &
Central America
U.S.A.
The Bahamas
Atlantic
Ocean
Turks &
Caicos Islands
Cuba
Cozumel
Mexico
Cayman
Islands
Haiti
Dominican
Republic
British Virgin Islands
U.S. Virgin Islands
Puerto
Rico
St Martin/
Sint Maarten
Saba
Statia
Barbuda
Antigua
St. Kitts & Nevis
Montserrat
Guadeloupe
Jamaica
Belize
Bay Islands
(Honduras)
Caribbean
Sea
Guatemala
Honduras
Dominica
Martinique
El
Salvador
San Andres (Colombia)
Corn Islands
(Nicaragua)
St. Lucia
St. Vincent
Nicaragua
Aruba
Curacao
Bonaire
Grenada
Barbados
Margarita Is.
(Venezuela)
Tobago
Trinidad
Costa
Rica
San Blas
Pacific
Ocean
Colombia
Venezuela
Panama
Isla del Rey
Guyana

2.0 CHENACT AP Energy Audits

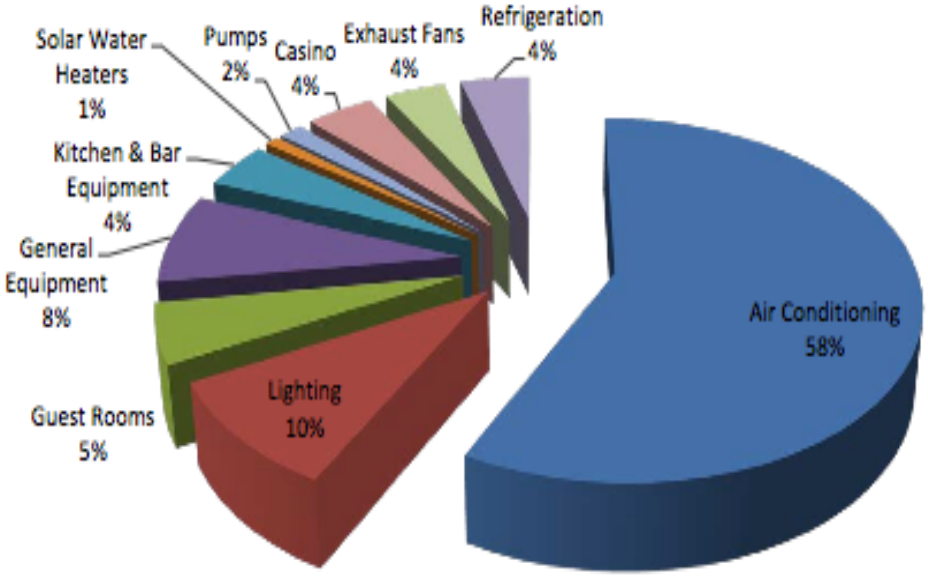
2.0 CHENACT AP Energy Audit Reports

- Each Audit report is broken down into different analyses.
  - Executive Summary
  - Introduction
  - Site Description
  - Utility Analysis
    - Energy Metering and Data Logging
    - Energy Consumption and Cost
    - Electrical Bill Analysis
    - Fuel Analysis
    - Water Analysis
    - Organizational Analysis
    - Maintenance Effectiveness
  - Carbon Dioxide Emission Analysis
  - Energy Saving Opportunities
  - Discussion and Recommendations
  - Energy Accounting Spreadsheet

2.0 CHENACT AP Energy Audit Reports

- ENERGY ACCOUNTING EXERCISE & SAVINGS CALCULATIONS
  - This section is of extreme importance for the facility attempting proper energy management, it provides
    - Data the use and cost for equipment in the entire hotel
    - This is separated by room type which makes it easy to determine how each area is performing.
    - Can be used as a data base of equipment in the hotel which can be continuously updated.

	Power	Average Monthly		Monthly Cost
Energy Consumer Description	kW	Energy kWh	% Total	GYD$
Air Conditioning	190	35,875	50%	$2,488,265
Lighting	23	6,360	9%	$456,526
Guest Rooms	235	3,518	5%	$244,015
General Equipment	35	5,885	8%	$408,158
Kitchen & Bar Equipment	15	2,991	4%	$207,478
Solar Water Heaters	5	175	0%	$12,120
Pumps	2	1,095	2%	$75,958
Casino	4	3,107	4%	$215,466
Exhaust Fans	24	10,906	15%	$756,410
Refrigeration	8	2,190	3%	$151,873
Grand Total	532	72,100	100.0%	$5,000,859



2.0 Energy Accounting and Distribution

CARBON DIOXIDE EMISSION ANALYSIS

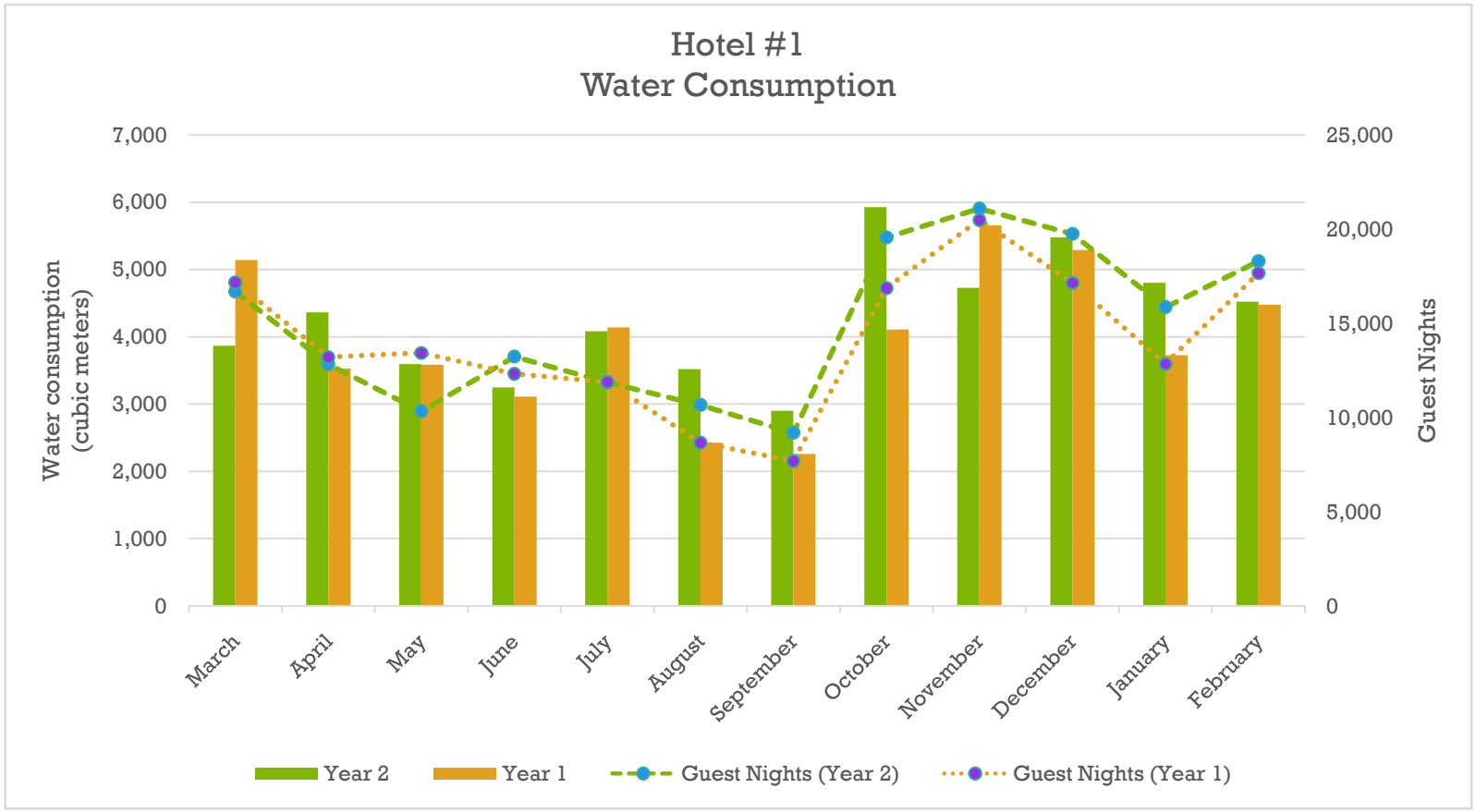
- This is an analysis of the fuels used at the property and also at the utility to produce the required electricity.
- It impacts the environment due to the Carbon Dioxide emissions that come hand in hand with the use of energy
- This table shows a sample analysis for a property

Annual Carbon Footprint	kWh Consumed	CO2 (Lbs)	CO2 (Tonnes)	CO2/GN (Lbs)
Natural Gas (kWh)	36,815	4,970	2	0.2
Electrical (kWh)	389,950	505,765	229	18.9
Annual Carbon Footprint	426,765	510,735	232	19.1

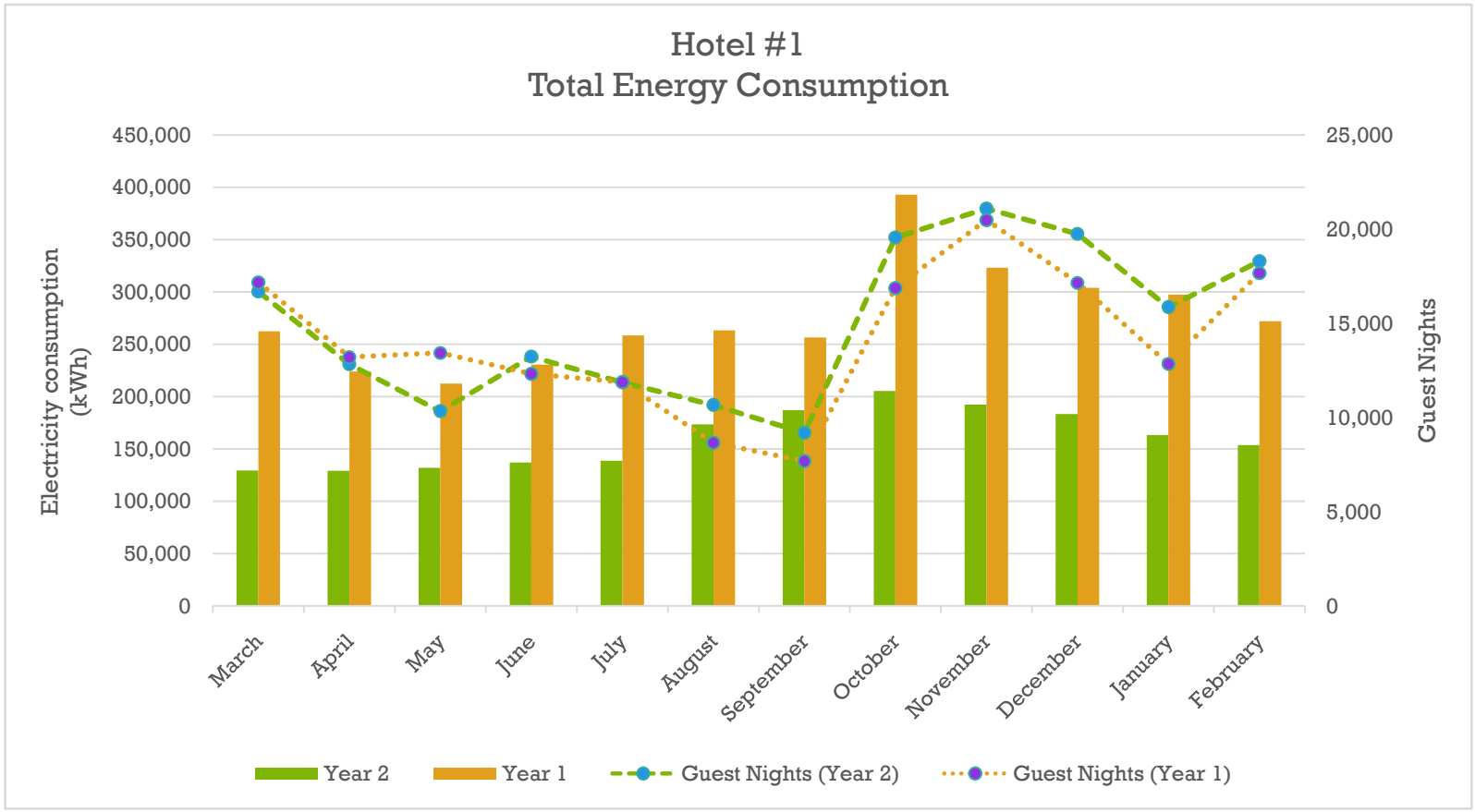
- The total kWh figure is a sum Electrical Energy from the Utility and Natural Gas Consumed annually.

ENERGY DYNAMICS Ltd.
DYNAMIC ENERGY EFFICIENT SOLUTIONS

2.0 CHENACT AP Energy Audit Reports



2.0 CHENACT AP Energy Audit Reports



2.1 CHENACT AP Energy Audit Findings

Hotel #	1	2	3	4	5	6
Number of Rooms	184	404	272	559	223	14
Area (m^2)	0	56,656	0	0	8,094	20,230
Annual Electricity Consumption (kWh)	2,278,000	8,971,180	2,530,342	13,408,000	1,924,570	569,960
Annual LPG Consumption (kWh)	475,957	4,674,992	1,056,033	2,220,171	1,134,050	404,207
Annual Diesel Consumption (kWh)	0	4,981,282	0	2,896,821	62,685	0
Annual Water Consumption (m^3)	42,026	202,758	111,544	179,084	56,174	6,431
Annual CO_2 Emission (Pounds)	3,176,921	14,206,951	3,816,599	18,751,145	3,106,314	945,783
Unit Cost Electricity ($/kWh)	$0.37	$0.39	$0.37	$0.37	$0.38	$0.37
Unit Cost LPG ($/kWh)	$0.15	$0.13	$0.14	$0.13	$0.14	$0.16
Unit Cost Diesel ($/kWh)	$0.00	$0.11	$0.00	$0.13	$0.12	$0.00
Unit Cost Water ($/$m^3$)	$1.54	$3.94	$1.48	$2.94	$6.24	$1.95
Occupancy (%)	49%	78%	66%	66%	81%	36%
Energy Usage Index (kWh/GN)	75	59	25	64	18	360
Energy Usage Index (kWh/RN)	98	118	54	116	49	720
Water Usage Index (m^3/GN)	1.14	0.88	0.79	0.74	0.30	2.37
CO_2 Emission Index (Pounds/GN)	86	61	27	77	18	348
Currency Exchage (to US$)	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00

2.1 CHENACT AP Energy Audit Findings

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

2.1 CHENACT AP Energy Audit Findings

- CORPORATE UTILITY MANAGEMENT PLAN (CUMP)
  - Corporation of Maintenance and Administration can make this a successful plan.

- CUMP involves:
  - Developing Policy and Program
  - Energy manager (full time or contracted)
  - Staff Training
  - Maintenance Training
  - Annual Management System Audit

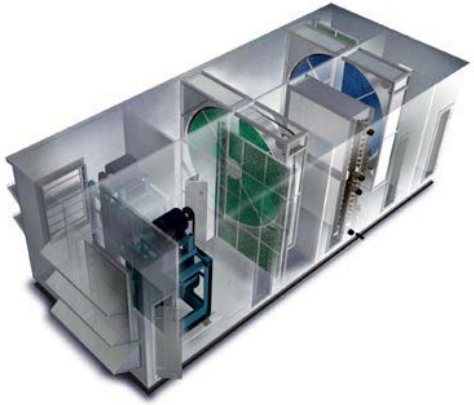
2.1 CHENACT AP Energy Audit Findings

Important pieces of equipment that need scheduled and regular servicing:

- Air Conditioning units
- Refrigeration
- Building Envelope
- Pumps
- Water Heaters
- Laundry Equipment

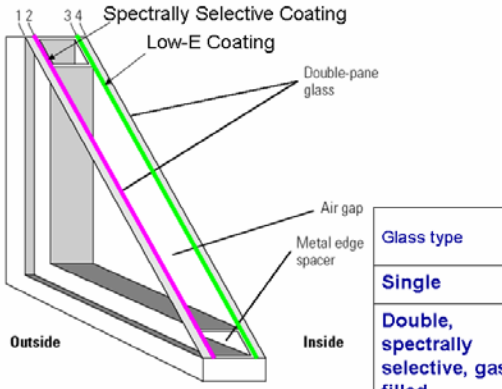
2.2 Energy Saving Opportunities

- HVAC
  - Heat Pump
  - Absorption Cooling
  - Variable Refrigerant Flow Systems
  - High Efficiency Chillers
  - DC Inverter Mini Split units
  - Heat Recovery (air to water)
  - Air to Air Energy Recovery (Desiccant systems)
  - Dehumidification



2.2 Energy Saving Opportunities

- Refrigeration
  - Proper loading
  - Heat Recovery
  - Insulation
  - System Maintenance
- Building Envelope
  - Insulation (roof and wall)
  - Door seals
  - Double / triple paned glass
  - Building Orientation
  - Shading

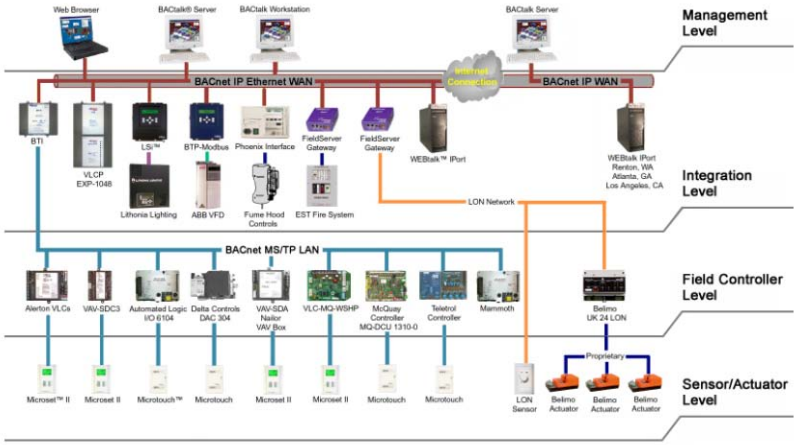


Glass type	Heat %	Light %	U-Value W/m2K
Single	85	85	6
Double, spectrally selective, gas filled	25	50	1

2.2 Energy Saving Opportunities

- Pumps
  - Load Shifting (TOU)
  - Premium efficiency motors
  - Pressure tanks
- Controls
  - Variable Frequency Drive Control
  - Building Management Systems
  - Guest Room Controls
- Lighting
  - T12 to T8 or T5 or LED
  - Incandescent and Halogen to CFL or LED

Four Level Architecture



2.3 Conclusion

- Electricity costs approximately 3 times the cost of Diesel energy and LPG energy.
- To save on energy costs, LPG and Diesel should be used more than electricity. Diesel contributes more to CO_2 emissions, so more LPG should be consumed if possible.
- To save on energy costs, minimize the hours of use of air conditioning units and refrigeration equipment such as mini fridges in guestrooms, split units.
- Use high energy efficient equipment including more use of energy recovery systems.

3.0 Global Energy Review

Retail Prices in Selected Countries (USD/unit)

	Heavy fuel oil for industry[b] (tonne)	Light fuel oil for households (1 000 litres)	Automotive diesel oil[c] (litre)	Unleaded premium[d] (litre)	Nat. gas for industry (10^7 kcal GCV[e])	Nat. gas for households (10^7 kcal GCV[e])	Steam coal for industry[f] (tonne)	Electricity for industry (kWh)	Electricity for households (kWh)	
Australia	..	..	..	1.393	..	..	..	..	..	Australia
Austria	715.73	1 217.04	1.179	1.794	..	946.57	232.78	..	0.2576	Austria
Belgium	650.39	1 055.80	1.562	2.133	354.91	872.86	..	0.1245	0.2317	Belgium
Canada	687.43	1 065.14	1.209	1.250	160.13	430.77	..	0.0699	0.0945	Canada
Chinese Taipei	563.27	x	0.987	1.084	600.92	584.54	..	0.0776	0.0932	Chinese Taipei
Czech Republic	482.00	1 194.19	1.543	1.886	530.45	797.27	c	0.1439	0.1855	Czech Republic
Denmark	720.39	1 837.21	1.503	2.144	..	1 449.36	..	0.1144	0.3563	Denmark
Finland	..	1 442.44	1.486	2.086	350.37	496.51	168.60	0.0948	0.1754	Finland
France	663.65	1 186.09	1.504	2.019	484.43	864.00	..	0.1056	0.1568	France
Germany	633.03	1 075.92	1.604	2.063	..	..	..	..	0.3248	Germany
Greece	714.64	1 127.60	1.587	2.219	517.56	1 084.65	..	0.1139	0.1584	Greece
Hungary	646.03	x	1.461	1.848	..	..	..	..	..	Hungary
India	..	..	..	..	..	..	..	..	..	India
Ireland	885.21	1 348.11	1.512	1.917	431.22	822.78	..	0.1372	0.2326	Ireland
Italy	701.52	1 794.36	1.556	2.026	483.01	1 093.65	111.97	0.2581	0.2632	Italy
Japan	..	1 055.29	1.221	1.715	..	..	114.65	0.1544	0.2322	Japan
Korea	736.89	1 110.08	..	1.673	610.27	655.49	..	..	0.0834	Korea
Luxembourg	..	954.02	1.345	1.716	449.67	673.71	..	0.1219	0.2155	Luxembourg
Mexico	459.78	..	0.660	0.731	..	453.45	x	0.1042	0.0888	Mexico
Netherlands	624.67	..	1.518	2.198	413.85	1 001.23	..	0.1230	0.2212	Netherlands
New Zealand	626.79	..	0.945	1.535	234.01	1 009.50	c	..	0.1815	New Zealand
Norway	..	1 375.65	1.595	2.180	x	x	..	0.0737	0.1758	Norway
Poland	682.08	1 190.60	1.335	1.692	454.78	772.94	96.35	0.1204	0.1791	Poland
Portugal	832.18	1 352.20	1.671	2.066	555.51	942.20	..	0.1203	0.2152	Portugal
Slovak Republic	555.72	..	1.486	1.925	534.71	703.69	..	0.1691	0.2130	Slovak Republic
Spain	642.48	1 135.10	1.445	1.766	390.42	859.14	..	..	..	Spain
Sweden	1 388.29	1 918.67	1.684	2.090	662.73	1 636.48	..	0.0964	0.2180	Sweden
Switzerland	760.49	1 026.02	1.635	1.819	661.55	1 015.73	155.37	0.1023	0.1800	Switzerland
Turkey	1 055.24	1 823.30	2.210	2.541	407.27	526.44	83.68	0.1509	0.1841	Turkey
United Kingdom	c	1 031.26	1.796	2.070	303.30	745.22	116.98	0.1211	0.1990	United Kingdom
United States	609.33	944.90	0.958	0.869	207.37	429.48	70.54	0.0679	0.1158	United States

Source: IEA Key World Statistics 2011

Global Energy Intensities

GDP per unit of energy use (constant 2005 PPP $ per kg of oil equivalent)

Country	GDP per unit of energy use
UK	10.9
Dominican Republic	10
Germany	9.2
USA	6
Canada	4.8
Haiti	4.3
Trinidad and Tobago	1.5

Source:
http://data.worldbank.org/indicator/EG.GDP.PUSE.KO.PP.KD

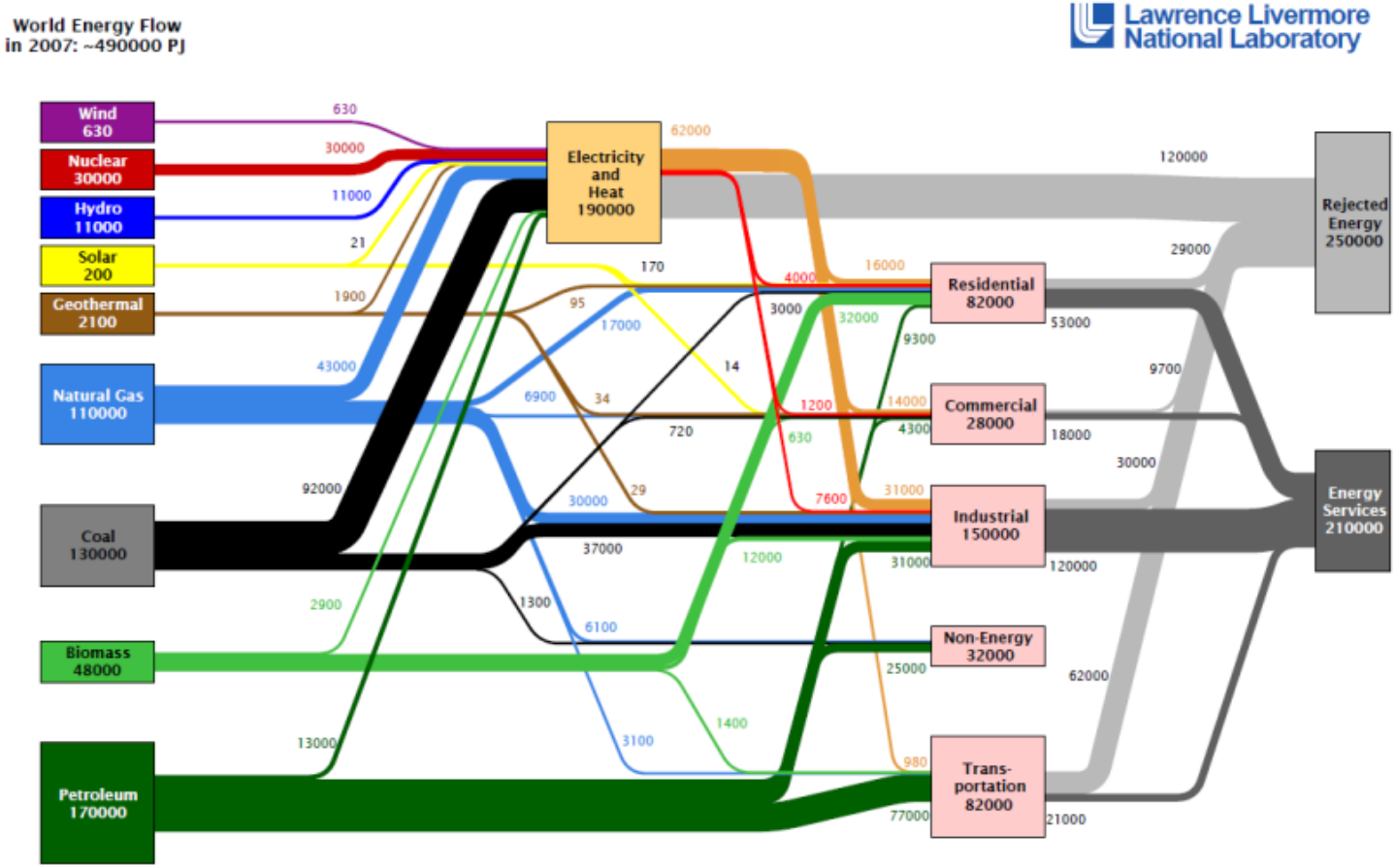
Energy Efficiency

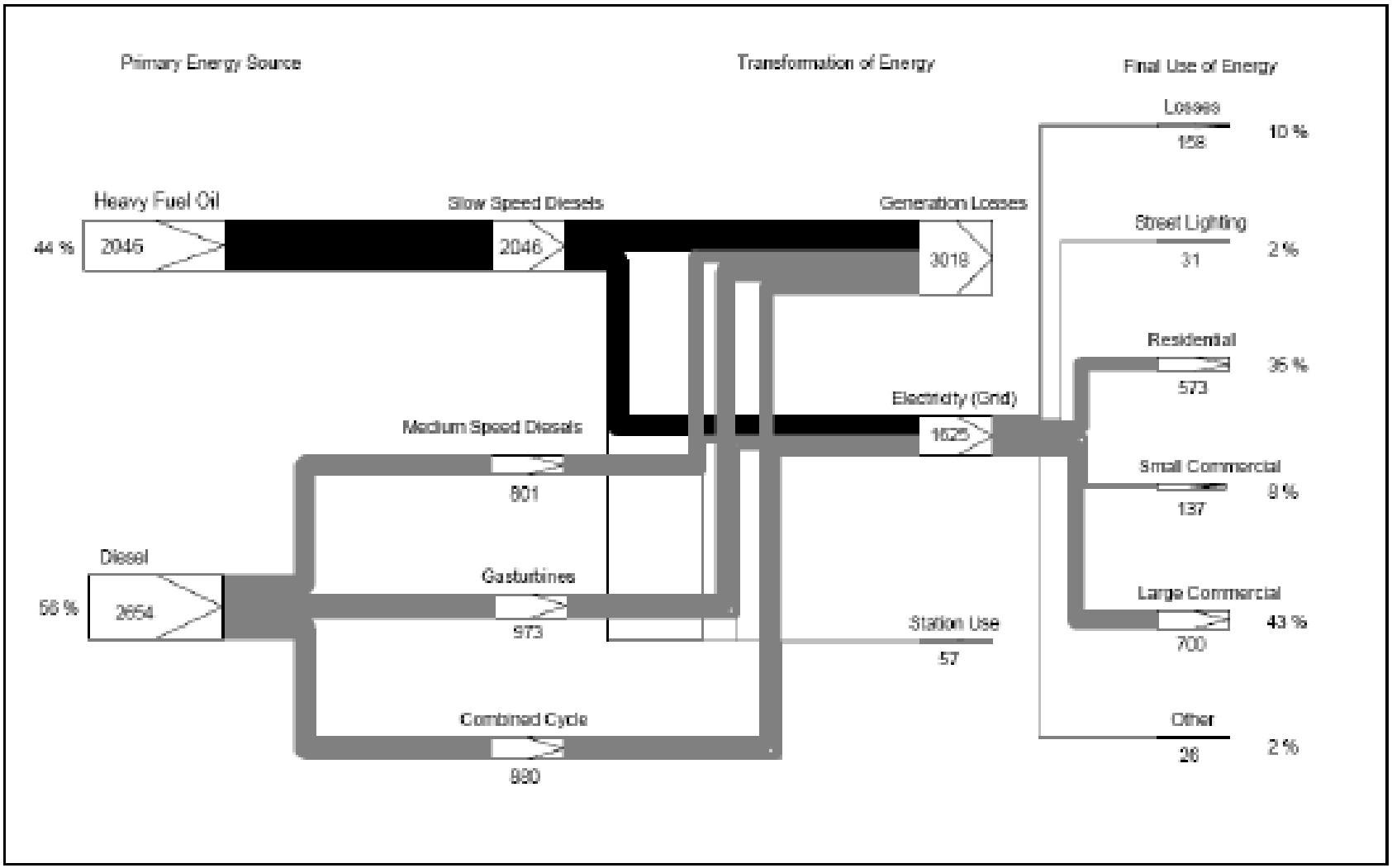
What is Energy Efficiency (EE)?

- "Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input." **International Energy Agency (IEA)**

- "Of all the untapped sources of clean energy in Latin America and the Caribbean, energy efficiency may offer the greatest impact at the lowest cost. IDB researchers have estimated that the region could reduce its energy consumption by **10%** over the next decade and save tens of billions of dollars by adopting existing technologies to increase efficiency.**" Inter-American Development Bank (IDB)**

World Energy Flows - Energy Efficiency





Note: "Large Commercial" includes packinghouses, large warehouses with large motors, large plants with large motors, hospitals, auditoriums, large buildings, hotels, etc.

Figure 1: Present Structure of BEC Power Supply (2009)

3.1 Germany – The Energiewende

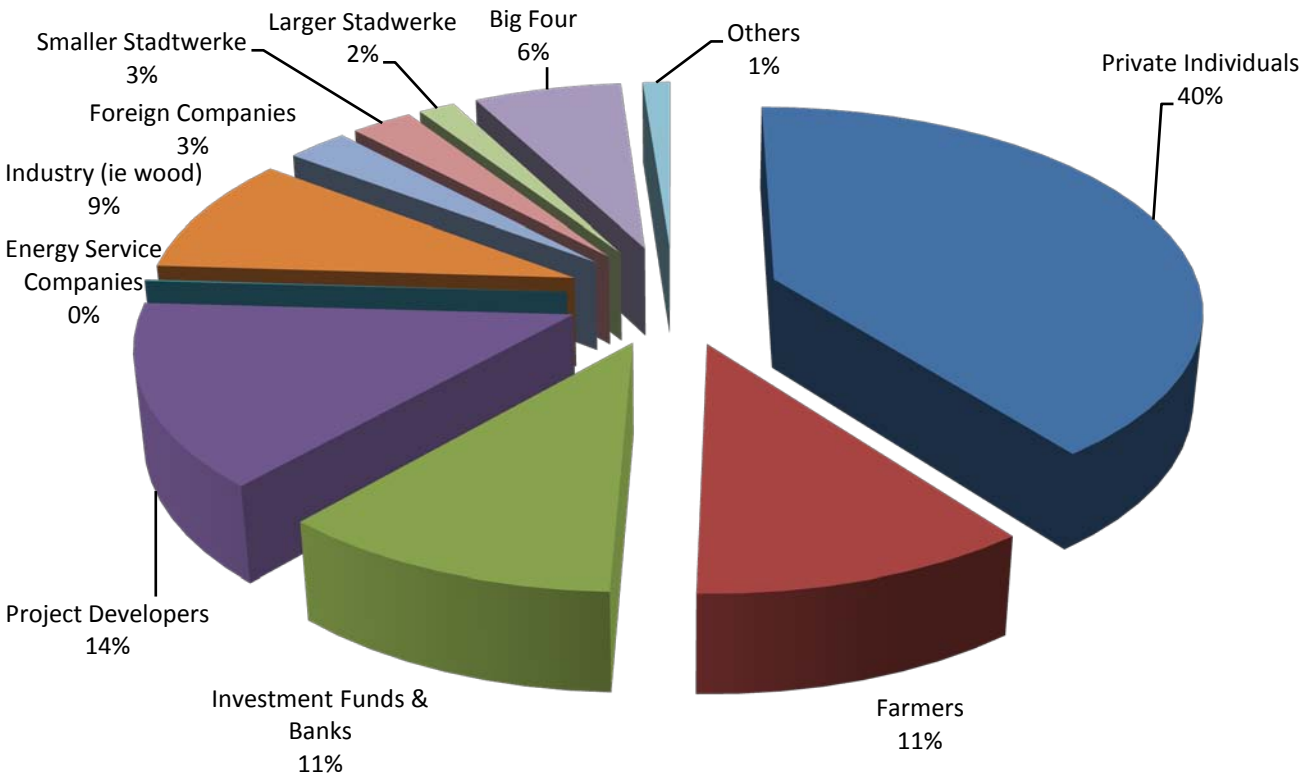
National Energy Transformation Main Targets

- 1/3 Renewable Share of Electricity by 2020
- Reduce Primary Energy Consumption by 20% by 2020 from 2008 levels and by 50% by 2050
- 40% Emission Reduction by 2020 compared with 1990 and 80 to 95 % by 2050.

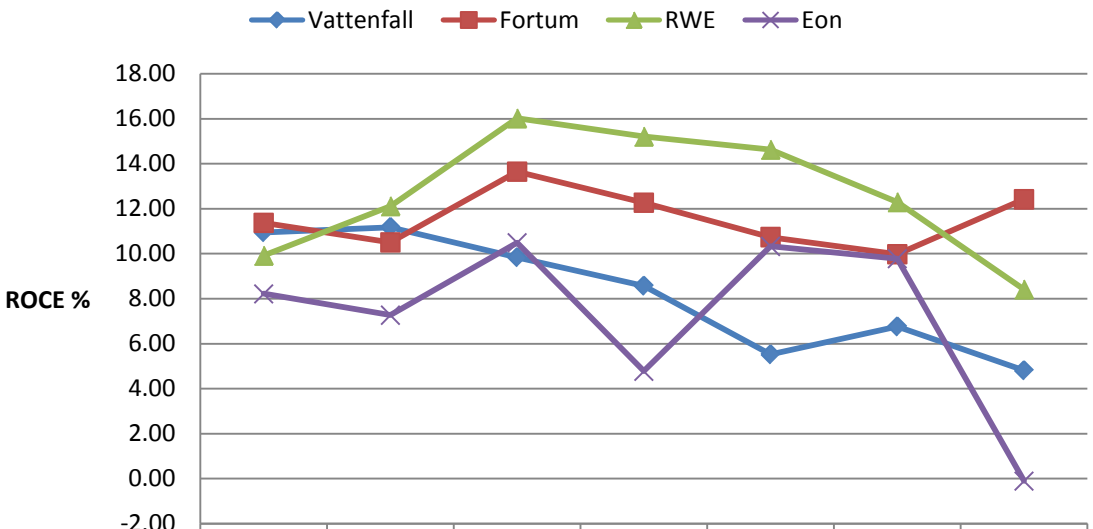
- Nuclear Phase out
- Use of technical expertise from industry
- Support from Municipal companies and citizens cooperatives

Germany – Ownership structure of RE (2010, 53GW)

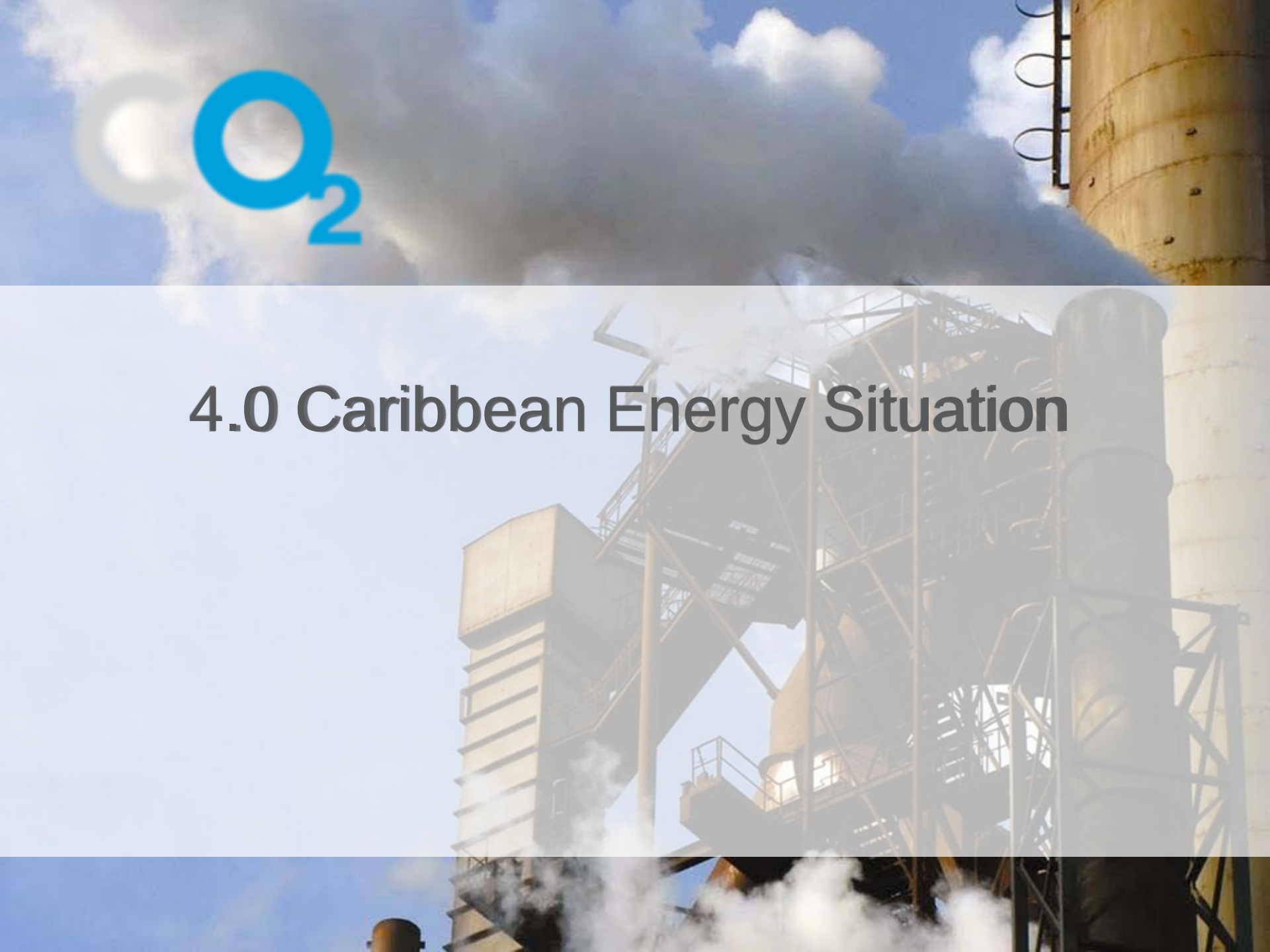
(Source – Oxford Institute for Energy Studies, The Energiewende, David Buchan, June 2012)



Performance Of German Major Utilities



	2005	2006	2007	2008	2009	2010	2011
Vattenfall	10.95	11.18	9.84	8.57	5.52	6.76	4.81
Fortum	11.37	10.51	13.65	12.27	10.74	9.98	12.42
RWE	9.92	12.12	16.02	15.21	14.63	12.30	8.42
Eon	8.22	7.27	10.49	4.78	10.33	9.78	-0.10



4.0 Caribbean Energy Situation

Country	Population (2009)	GDP Per Capita US$	GDP US$000	Public Debt / GDP ratio (%)	Cost of Energy US$/kWh (EDL 2013)
Aruba	107,000	$24,625	$2,623	46.3	$0.25
Bahamas	342,000	$20,710	$7.077	51	$0.40
Barbados	256,000	$14,050	$3,695	117	$0.36
Bermuda	65,000	$101,345	$6,574	21	30
Guyana	763,000	$2,683	$2,046	66	$0.32
Jamaica	2,719,000	$4,566	$12,414	145	$0.38
Trinidad and Tobago	1,339,000	$15,781	$21,125	47	$0.06
Dominican Republic	**10,090,000**	**$4,618**	**$46,598**	**40**	**$0.29**
OECS					
Grenada	104,000	$6,117	$636	110	$0.35
St. Lucia	172,000	$5,504	$948	77	$0.33
St. Vincent & the Grenadines	109,000	$5,188	$567	68	$0.36
Dominica	67,000	$5,668	$378	70	$0.36
St. Kitts/ Nevis	52,000	$10,541	$545	144	$0.34
Antigua & Barbuda	88,000	$12,918	$1,132	130	$0.38
Cuba	**11,204,000**	**$5,437**	**$60,917**	**35**	?

Energy and the Caribbean

Why is there a need for Energy Efficiency?

- EE is the “low hanging fruit” on the “energy tree” in comparison to large investments needed to increase capacity

- EE can be considered an untapped Energy Resource

- A cost effective means and instrument to help meet the continuously growing demand for energy and goal of Sustainable Development

EE assisting RE

- LED Bulbs cost US$ 3/W vs Solar PV – US$ 4/W. But a 5 W LED bulbs can replace a 40 W Incandescent (11 W CFL).
  - PV for 40 W bulb will cost US$ 160
  - PV for 11 W CFL will cost US$ 44
  - PV for 5 W LED – US$ 23 (5 * 4 + 3)
- A/C Energy Recovery (free hot water) can replace solar hot water and provide more roof space for solar PV systems.
- Energy Efficient Appliances Programs (Energy Star).

Energy Efficiency in the Caribbean

- **Energy Efficiency in T&T**
  - T&T is an oil producing nation and as a result has focussed heavily on energy production (Oil and Gas) in comparison to energy efficiency. This is currently changing with the MEEA new programs.

- **EE and RE Policies**
  - **Majority of Caribbean Countries' Energy Policies focus mainly on the Generation of Energy and Renewable Energy there is little focus on Efficiency of Energy Use.**
  - E.g:
    - Barbados
    - Jamaica Energy Policy
    - Bahamas National Energy Policy
    - National Renewable Energy Policy (Jamaica)
    - Dominican Republic

Drivers of Energy Efficiency

The main drivers of Energy Efficiency :

- **Energy Security**
  - Reduce imported energy
  - Increase Reliability
  - Control energy demand growth
- **Economic Development and Competitiveness**
  - Improve industrial competiveness
  - Reduce the cost of production
  - More affordable energy costs for consumers
- **Climate Change**
  - Contribute to global mitigation efforts
  - Meet international obligations under the United Nations Framework Convention on Climate Change (UNFCCC)

Barriers to Energy Efficiency

The main barriers to Energy Efficiency in the wider Caribbean:

- **Financial**
  - Up-front costs and dispersed benefits discourage investors
  - There is a perception of EE investments being complicated and risky with high transaction costs
  - **Lack of awareness of financial benefits on the part of financial institutions (now changing in Jamaica – JDB and others).**
- **Market**
  - Project development costs are high compared to energy savings
  - Market organization and price distortions prevent customers from appraising the true value of EE.

Barriers to Energy Efficiency

- **Regulatory and Institutional**
  - Energy tariffs that discourage EE investment
  - Incentive structures that encourage energy providers to sell energy rather than invest in cost-effective EE
  - **Existing Electrical Utility Monopolies**
- **Technical**
  - **Insufficient capacity to identify, develop, implement and maintain EE projects.**
- **Information and Awareness**
  - Consumers lack sufficient information and understanding to make rational consumption and investment decisions
  - **Policy makers are unaware of technologies and benefits for EE**

Energy Efficiency Best Practises for Caribbean

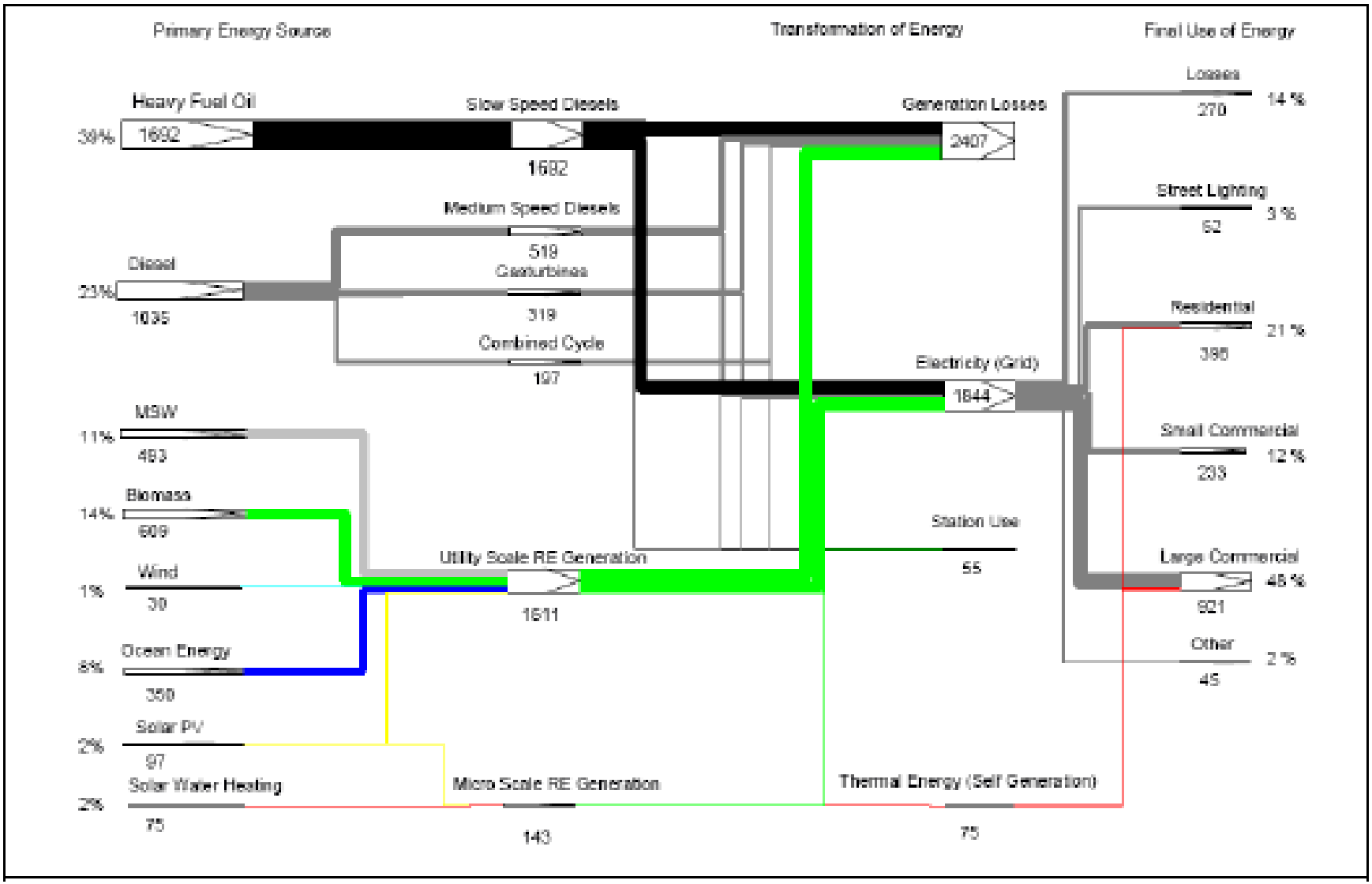
Designing and Developing Energy Efficiency Programs

- **Keep the Caribbean market in mind (What works for others may not be the appropriate choice for our region)**
- Leverage private sector expertise, external funding and financing
- Determine the right incentives ensuring they are at appropriate levels (if financial)
- **Invest in educating and training – engineers, technicians, product suppliers.**
- **Energy Engineering Associations**

5.0 Bahamas National Energy Policy 2010

Bahamas – Sustainable Energy Matrix

- Introducing Renewable Energy Technologies so that RE will become 30% of total power generation by 2030.
- Limit the growth of electricity demand with EE so that demand will remain at present levels, which equates to a 30% reduction against a business as usual scenario by 2030.
- Enhancing the Efficiency of Fossil-Fired generation



Note: "Large Commercial" includes packinghouses, large warehouses with large motors, large plants with large motors, hospitals, auditoriums, large buildings, hotels, etc.

Figure A: Proposed Sustainable Energy Matrix Achievable by 2030 (only BEC area)

Introduce RE Technologies

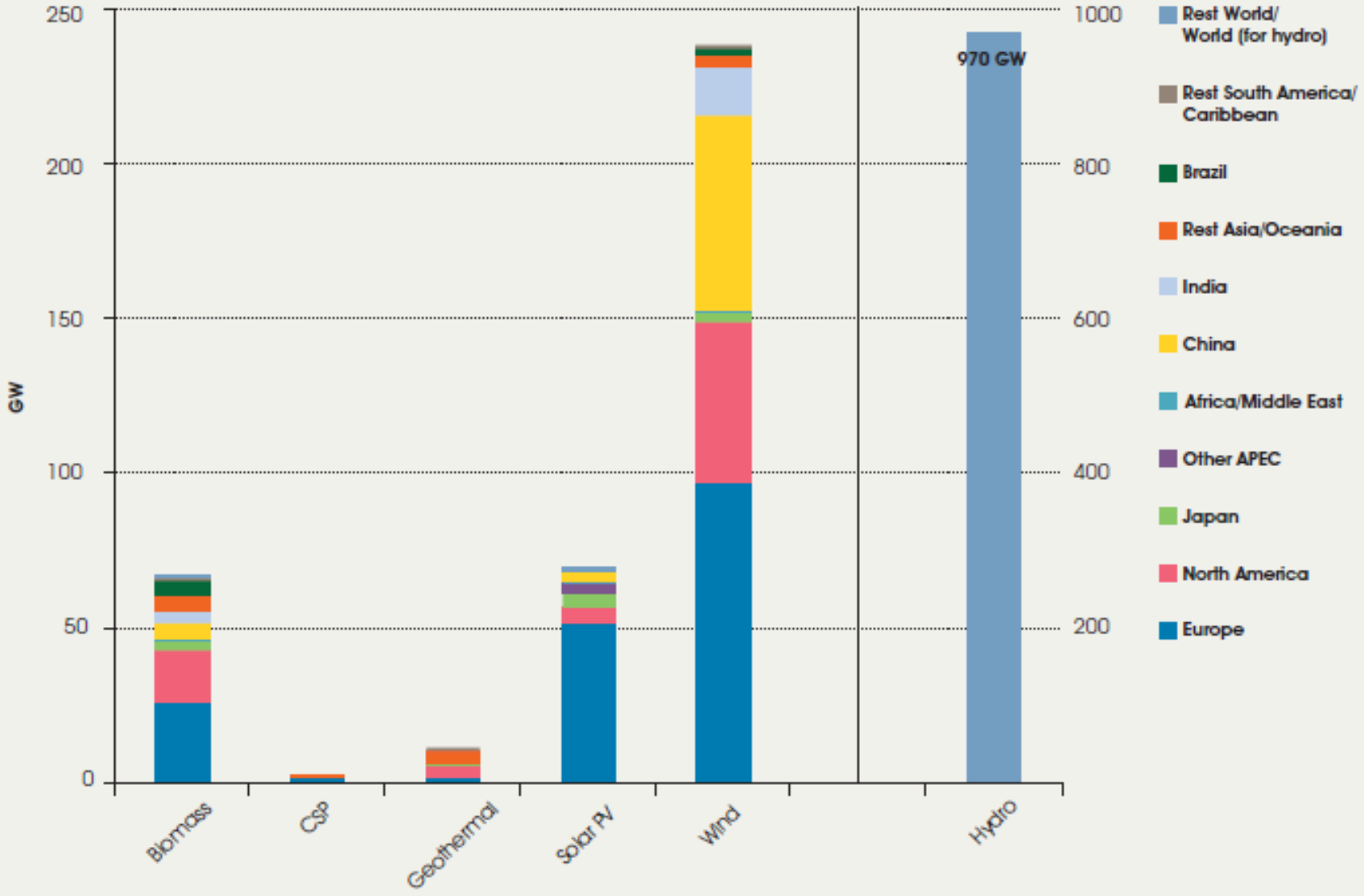


FIGURE 3.1: INSTALLED RENEWABLE POWER GENERATION CAPACITY BY TYPE, END-2011

SOURCE: EPIA, 2012; GWEC, 2012; IHA, 2012; IGA, 2012, PLATTS, 2011; AND REN21, 2012.

RENEWABLE ENERGY COUNTRY PROFILE (CARIBBEAN)

COUNTRY	WIND	SOLAR	HYDRO	BIOMASS	GEOTHERMAL	OCEAN
ANTIGUA AND BARBADOS	H	**H**	U	U	U	L
BAHAMAS	**M**	**H**	**U**	**M**	**U**	**L**
BARBADOS	H	**H**	L	L	U	L
CUBA	M	**H**	H	L	U	L
DOMINICAN REPUBLIC	M	**H**	H	L	U	L
GRENADA	H	**H**	L	L	H	L
HAITI	H	**H**	H	L	U	L
JAMAICA	M-H	**H**	L-M	L	H	L
ST. LUCIA	H	**H**	L	L	H	L
TRINIDAD &TOBAGO	L-M	**H**	L	L	U	L

SOURCE: IRENA

H-HIGH M-MEDIUM L-LOW U-UNKNOWN

Cost of PV Modules

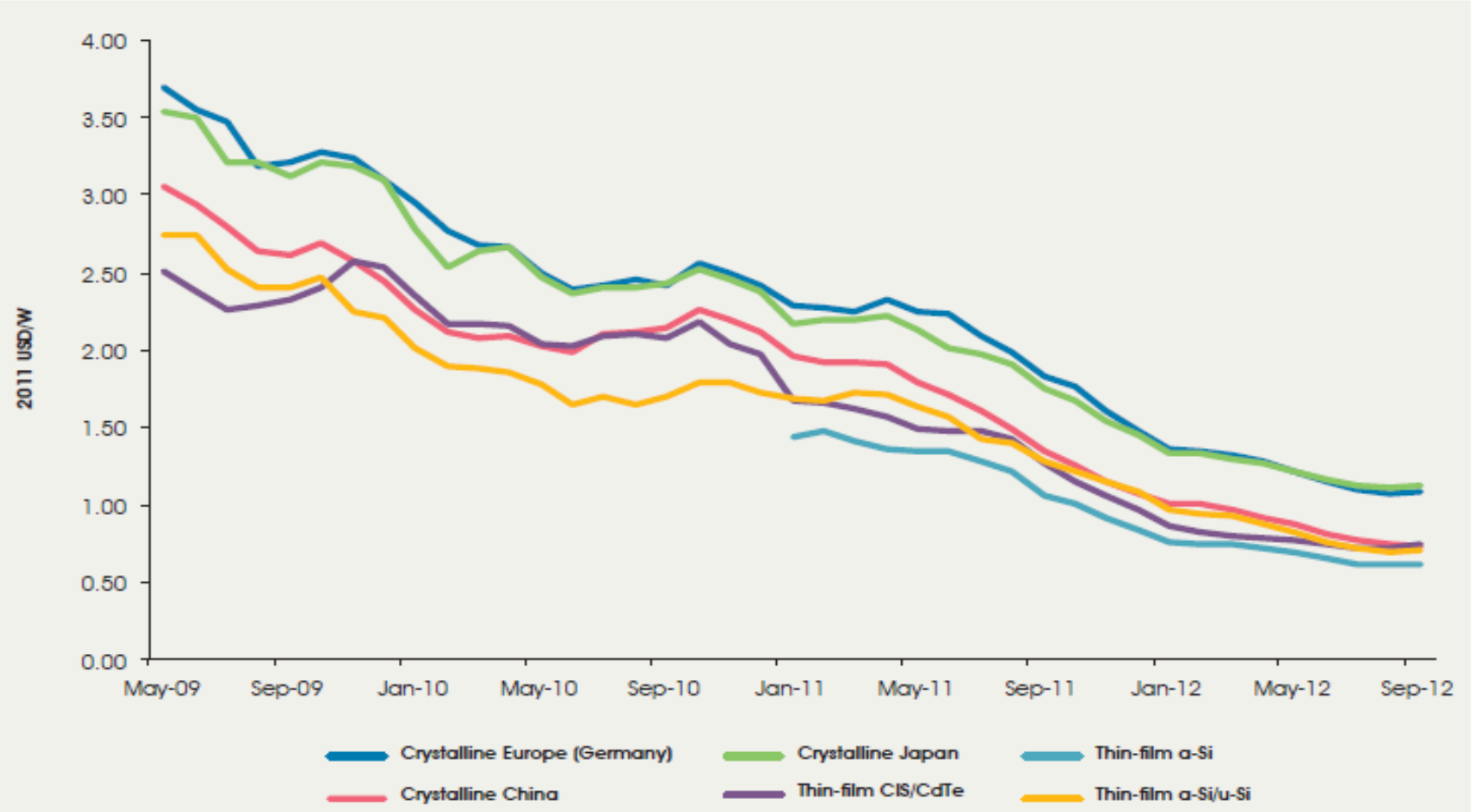


FIGURE 6.1: AVERAGE MONTHLY SOLAR PV MODULE PRICES BY TECHNOLOGY IN EUROPE, 2009 TO 2012

SOURCE: SOLOGICO, 2012.

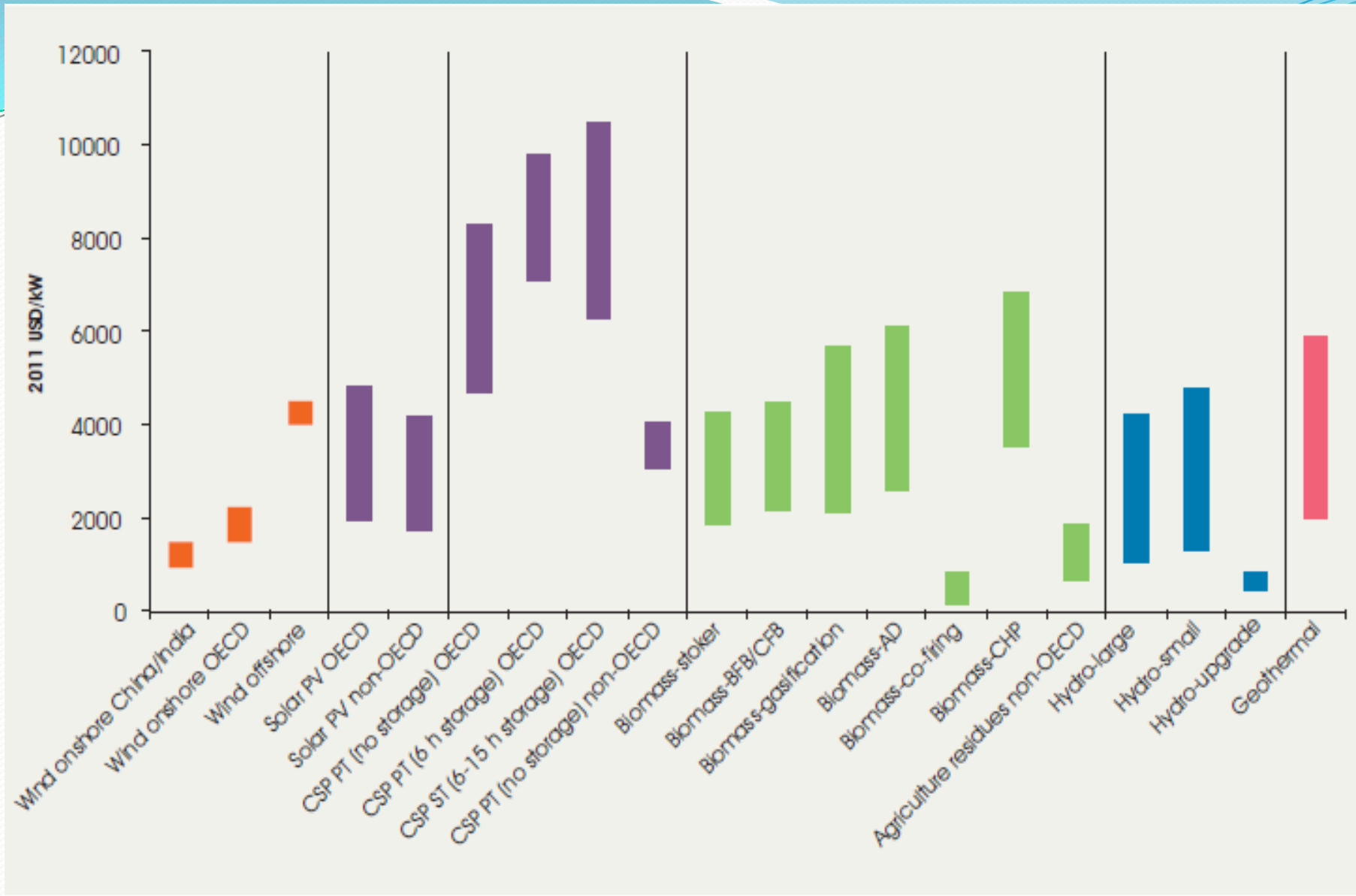
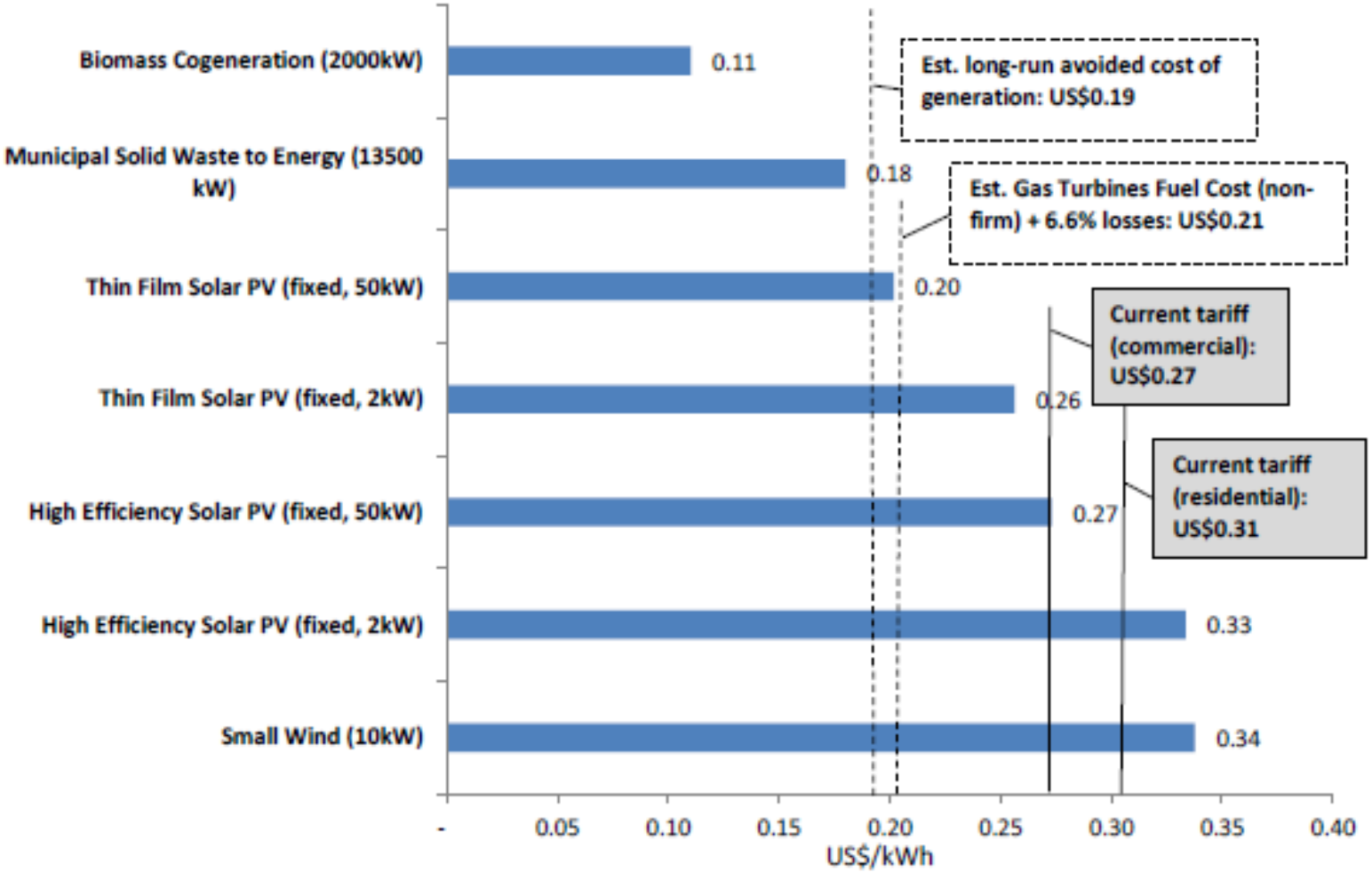


FIGURE 2.2: TYPICAL CAPITAL COST RANGES FOR RENEWABLE POWER GENERATION TECHNOLOGIES, 2012

SOURCE: IRENA RENEWABLE COST DATABASE.

Figure 6. Viability of Renewable DG in Barbados (US$ per kWh)



Note: Discount rates: 5% for small-scale DG; 12% for commercial-scale DG and conventional generation.

Source: IDB, 2010.

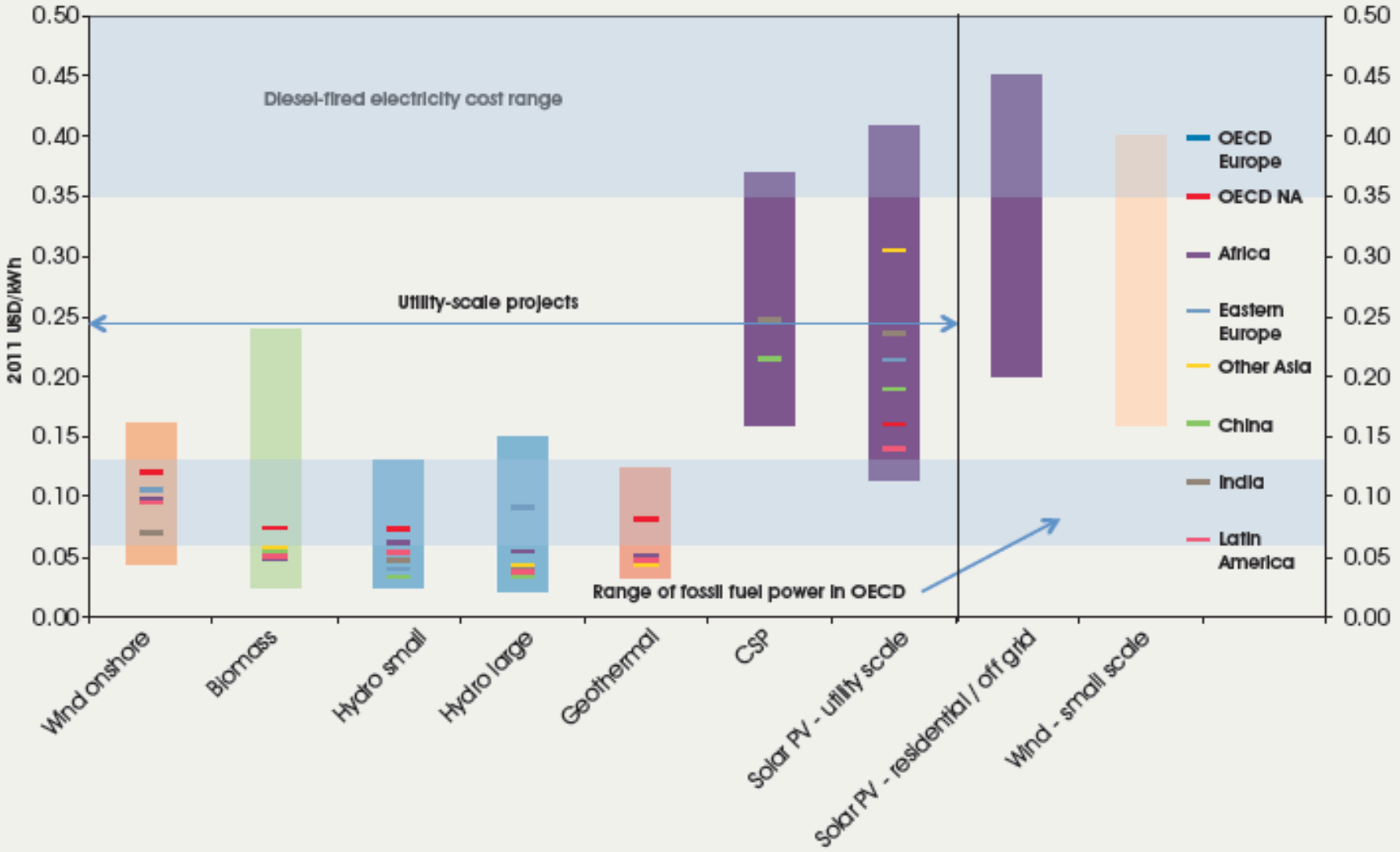


FIGURE 2.1: TYPICAL LCOE RANGES AND WEIGHTED AVERAGES BY REGION FOR RENEWABLE POWER GENERATION TECHNOLOGIES, 2012

Note: *All LCOE data assume a 10% cost of capital. The large coloured bars represent the typical LCOE range by technology and the coloured horizontal lines the weighted average LCOE by country/region if enough individual project data are available.*

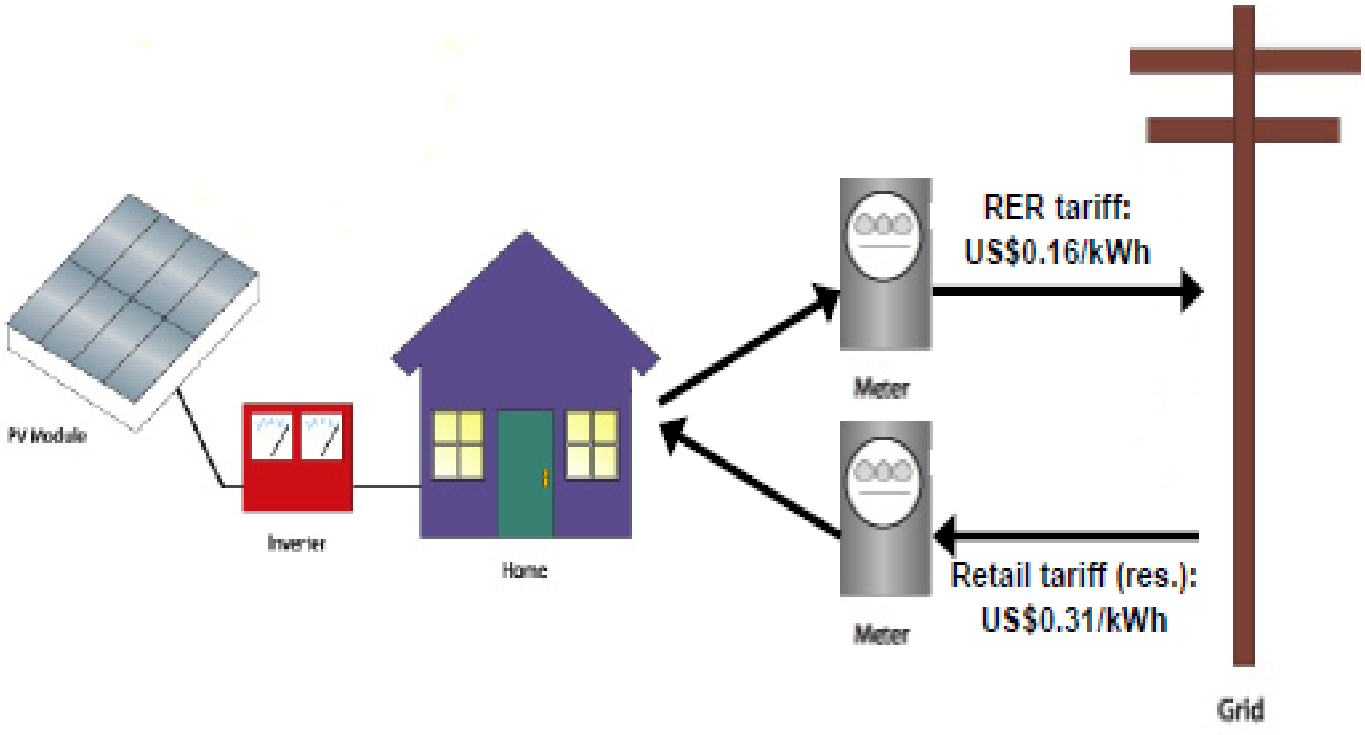
SOURCE: IRENA RENEWABLE COST DATABASE.

OUR Jamaica – 115 MW - 2013

RE Resource	Purchase price US$ / kWh
Bagasse	0.16
Hydro	0.1113
Utility Scale Solar	0.2673
Wind	0.1336
Waste to Energy	0.1488

Legalize Distributed Generation

Figure 7. Functioning of Barbados' Standard Offer Contract



Inter-American
Development Bank

Capital Markets and
Financial Institutions
Division in
collaboration with the
Energy Division

DISCUSSION PAPER

No. IDB-DP-208

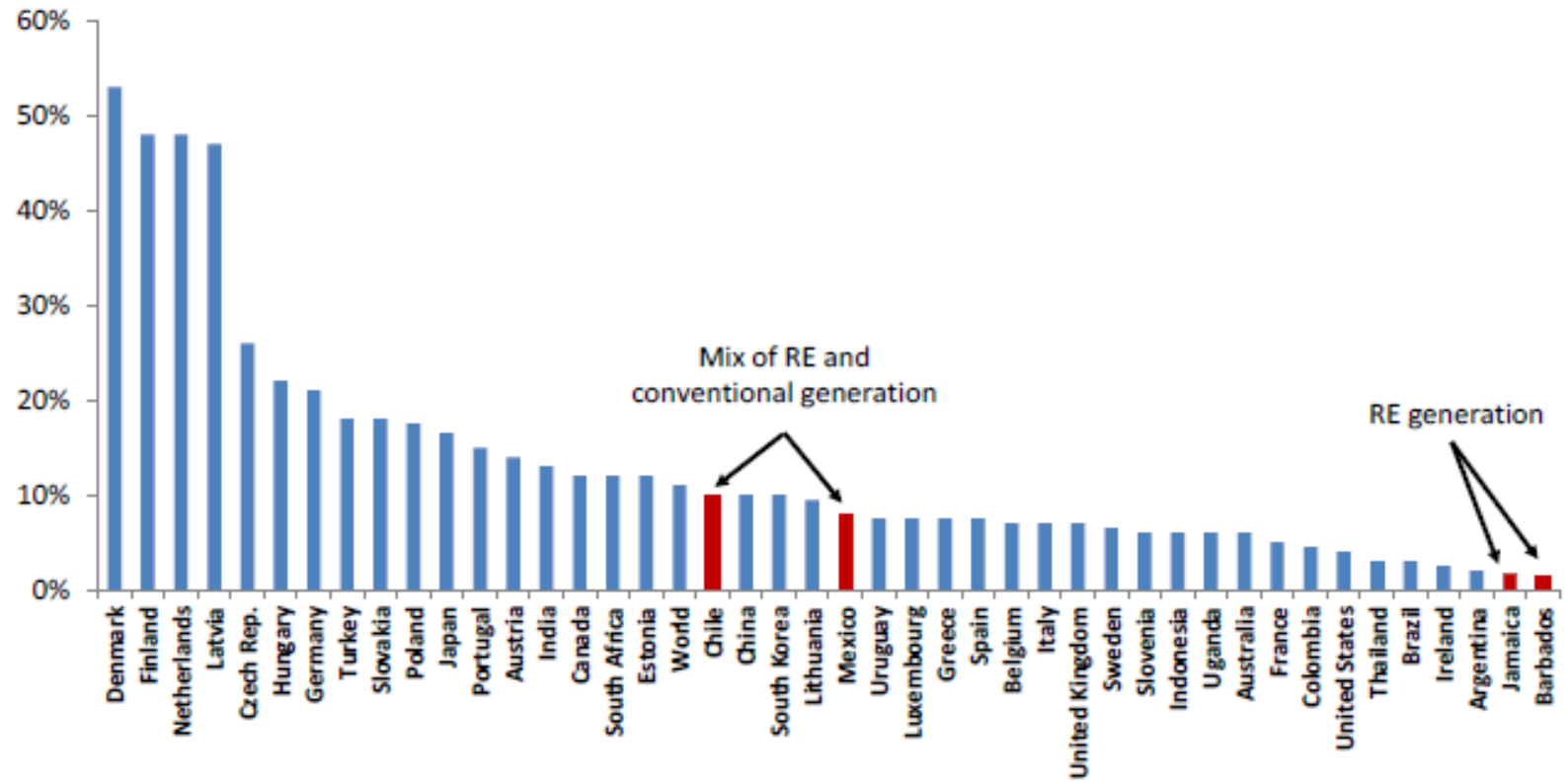
Perspectives for Distributed Generation with Renewable Energy in Latin America and the Caribbean

Analysis of Case Studies for Jamaica, Barbados, Mexico, and Chile

Christiaan Gischler
Nils Janson

November 2011

Share of DG as part of Total Generation



Sources: Jamaica: Ministry of Energy and Mining, 2008.[3]

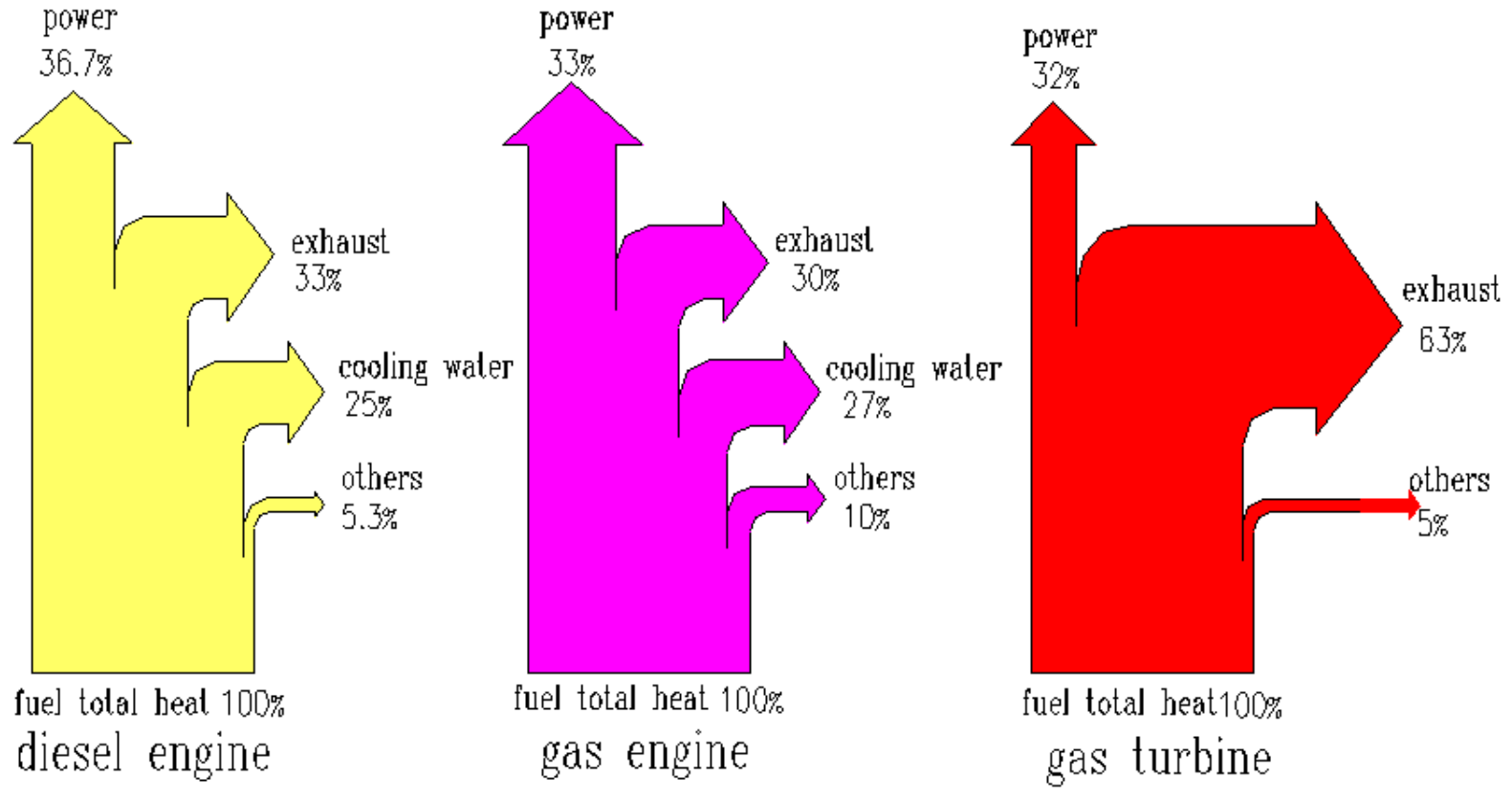
Barbados: CIRP, 2007; BL&P, 2010b.[4]

Other countries: authors' elaboration of: World Alliance for Decentralized Energy (WADE), 2006.

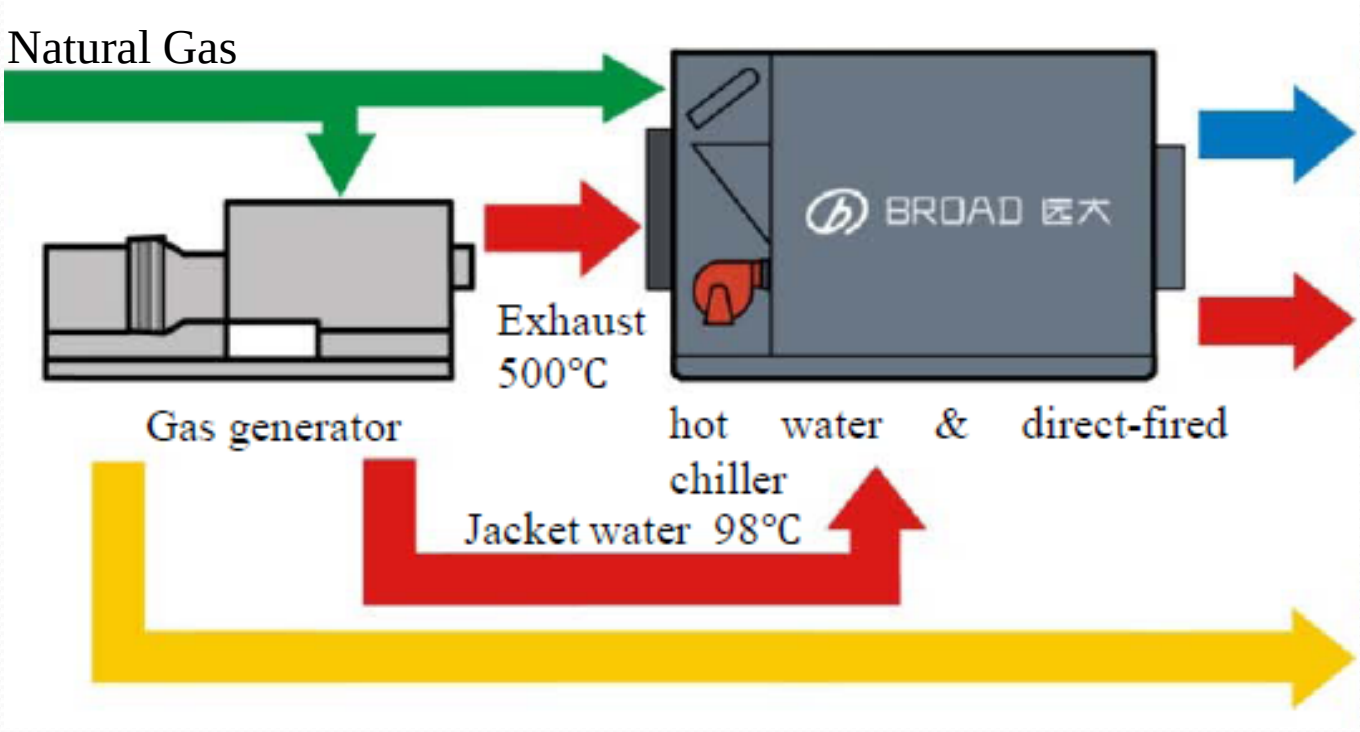
Energy Efficiency :-

CCHP – Combined Cooling Heating & Power

CCHP - Efficiency of different types of Generators



Energy Efficiency & CCHP
Energy + Cooling + Heating



BROAD DFA COOLING CYCLE

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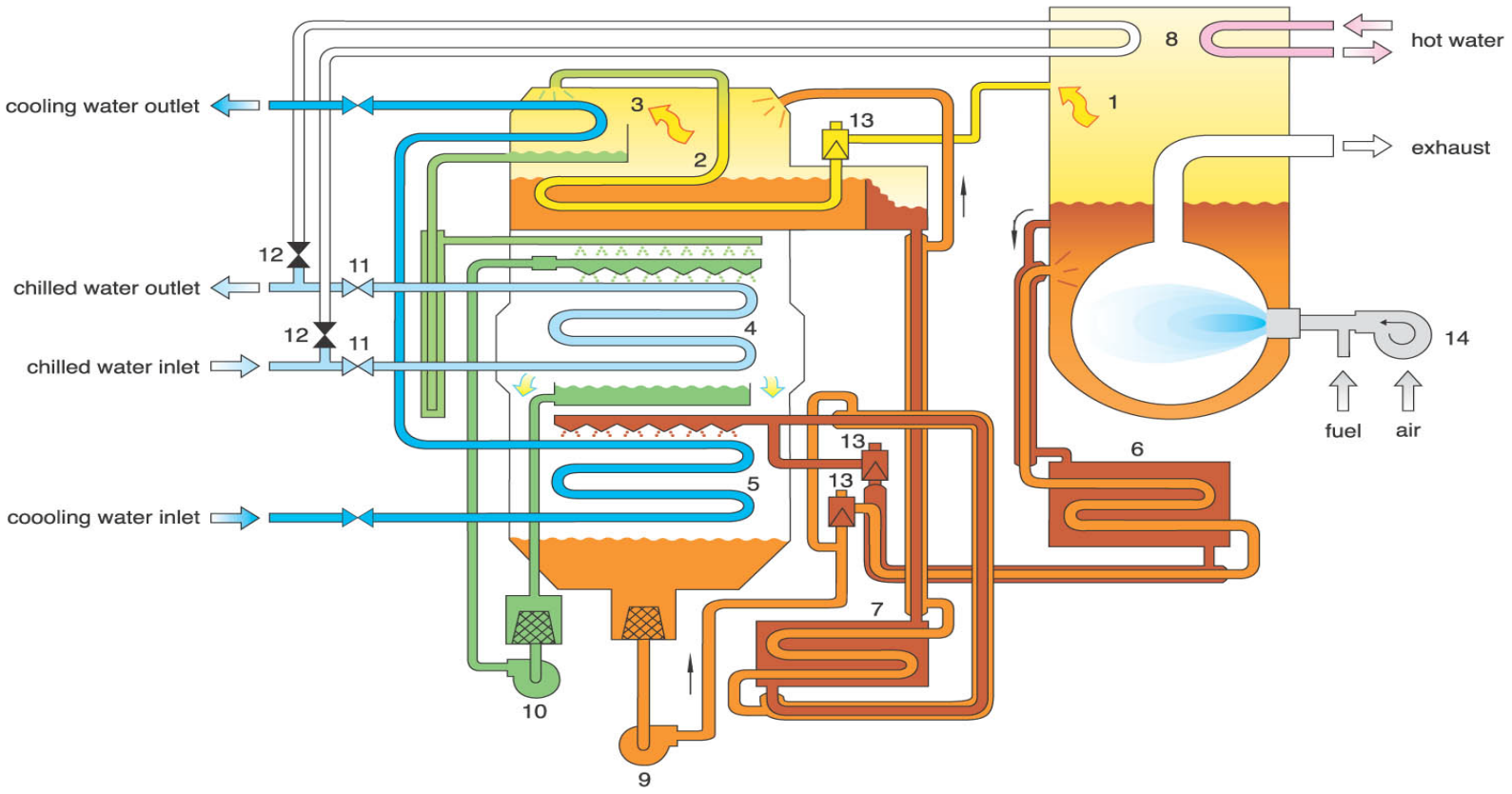
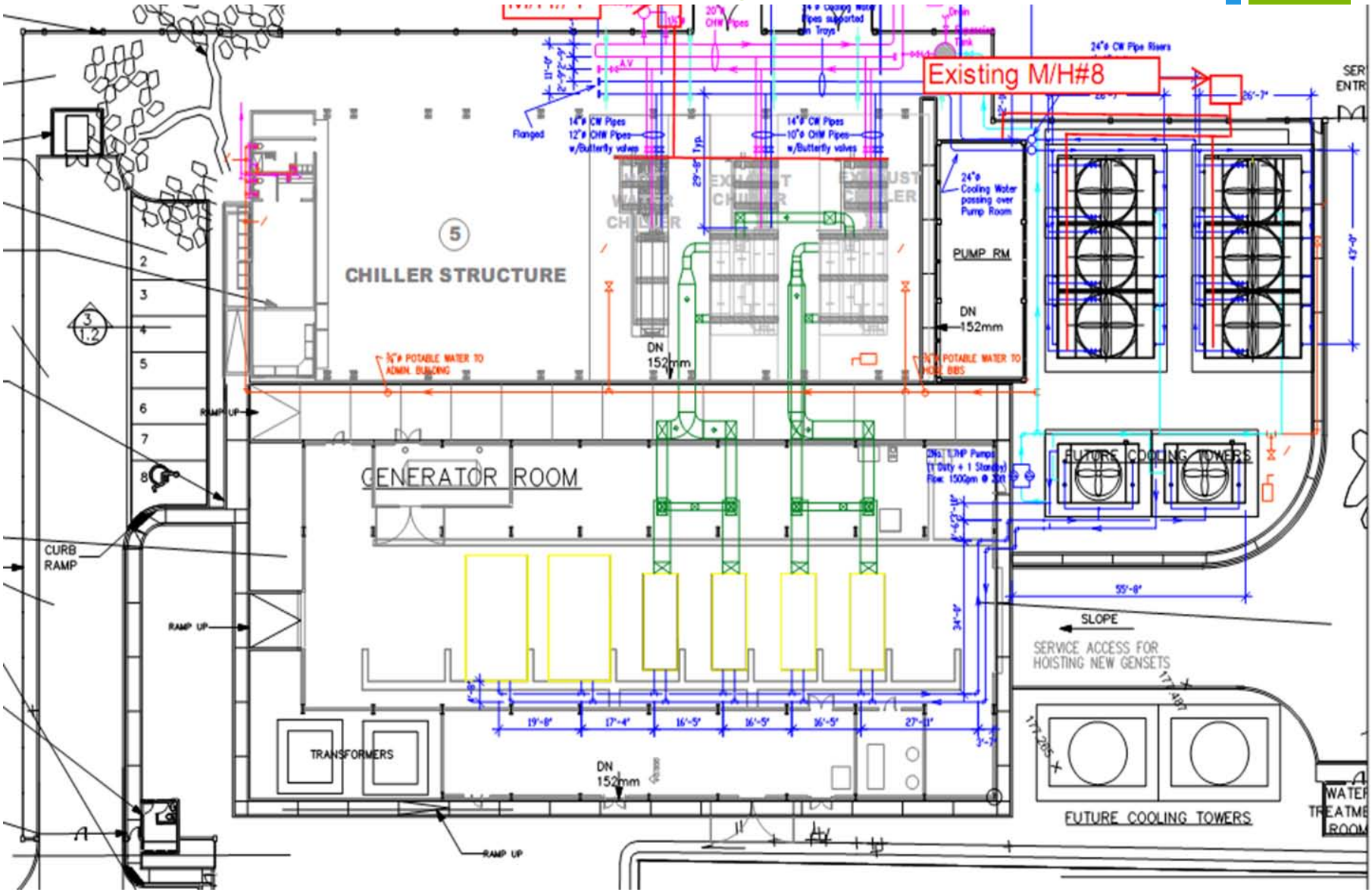


- concentrated solution
- diluted solution
- refrigerant vapor
- refrigerant water
- cooling water
- chilled water

1. high-stage generator(HSG)
2. low-stage generator(LSG)
3. condenser
4. evaporator
5. absorber
6. high temp. heat exchanger(HTHE)
7. low temp. heat exchanger(LTHE)
8. water heater
9. solution pump
10. refrigerant pump
11. chilled water valve(open)
12. heating water valve(close)
13. cooling/heating switch valve(open)
14. burner

CCHP – UWI Mona Campus - Jamaica

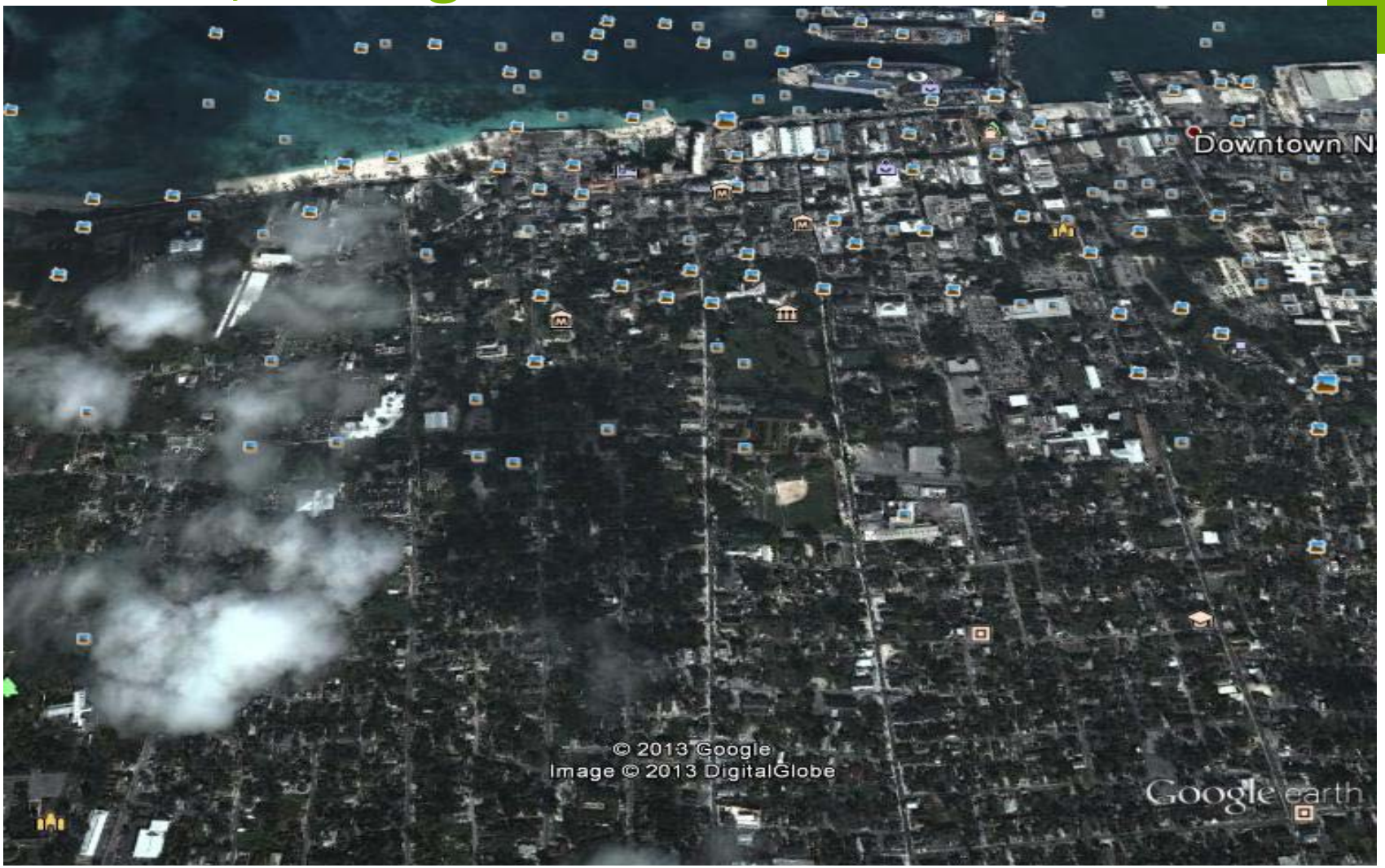


QUAD Generation - CCCHP

- Power
- Cooling
- Heating (hot water)
- Carbon Dioxide (carbon capture from exhaust gas – industry and food grade CO_2

CEPM - Punta Cana - Macao

CCHP – BEC Plant, Parliament House, College & British Colonial Hilton



5.0 Conclusion

- Caribbean Governments need to place additional emphasis on EE
- Need institutions to focus on training of professionals - engineers, technicians, sales associates.
- Practice of Energy Efficiency Application Engineering by Private Organizations
- Testing, Research and Development
- Development of EE Plans and Programs with specific targets
- Create an EE Market within the Caribbean

THANK YOU