

# Vulnerability of Caribbean SIDS

Presentation to

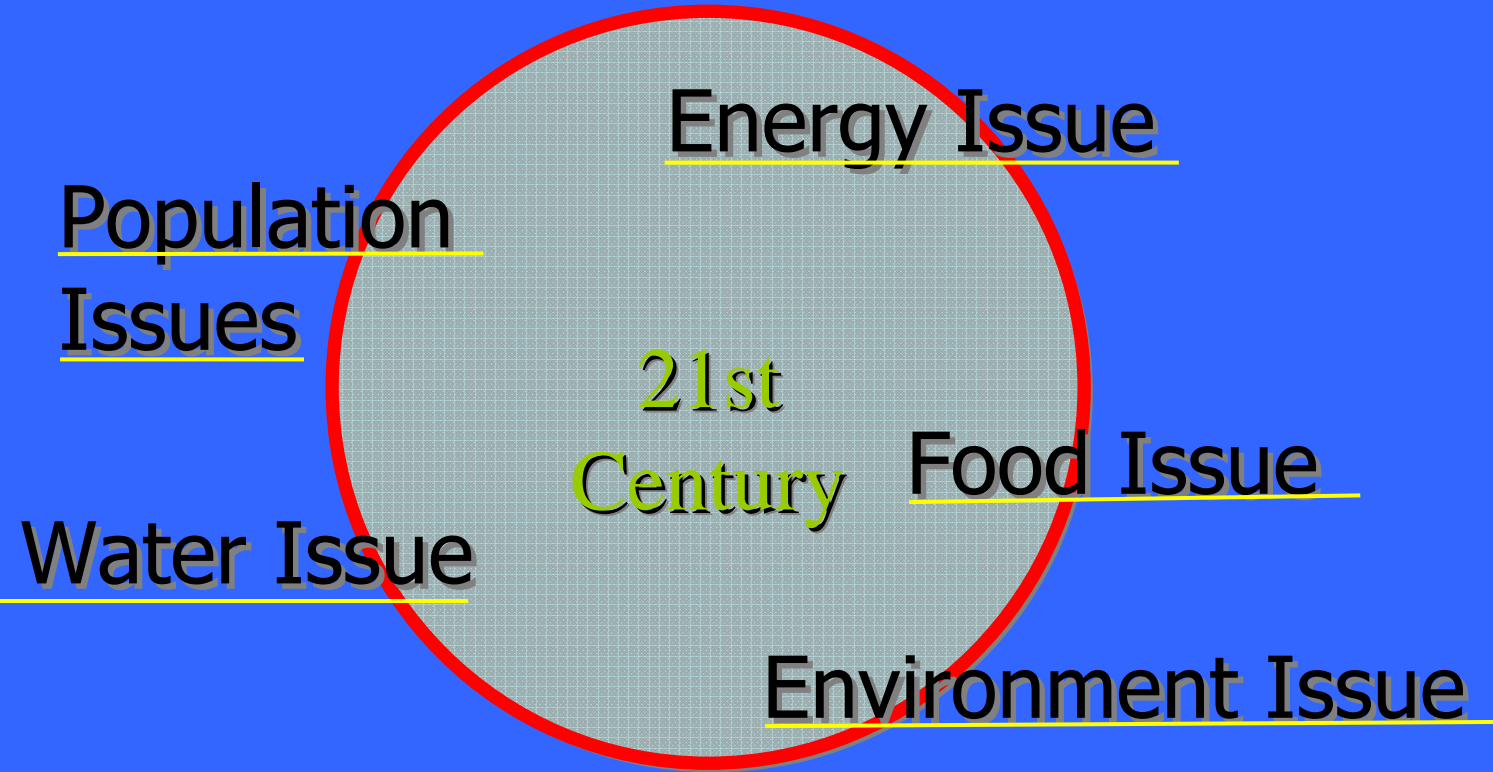
High Level Roundtable on International Cooperation For  
Sustainable Development in Caribbean Small Island  
States

By

Al Binger

Barbados, 26-27 March, 2008

# Sustainable Development Issues

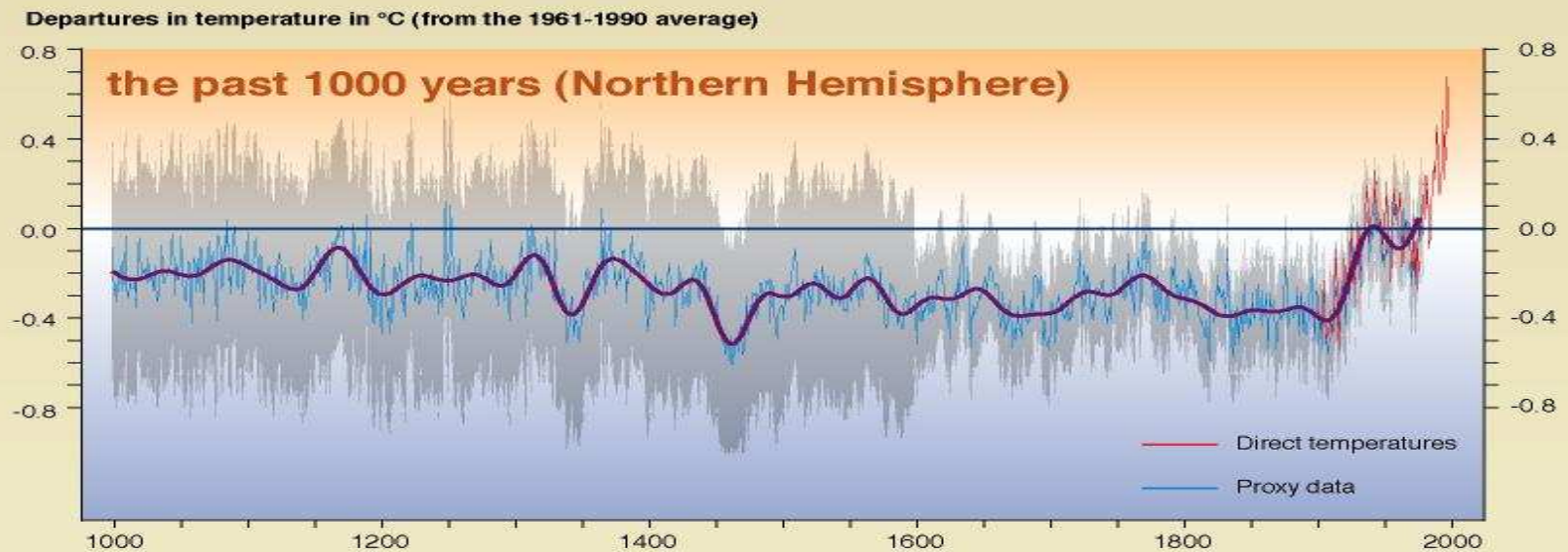
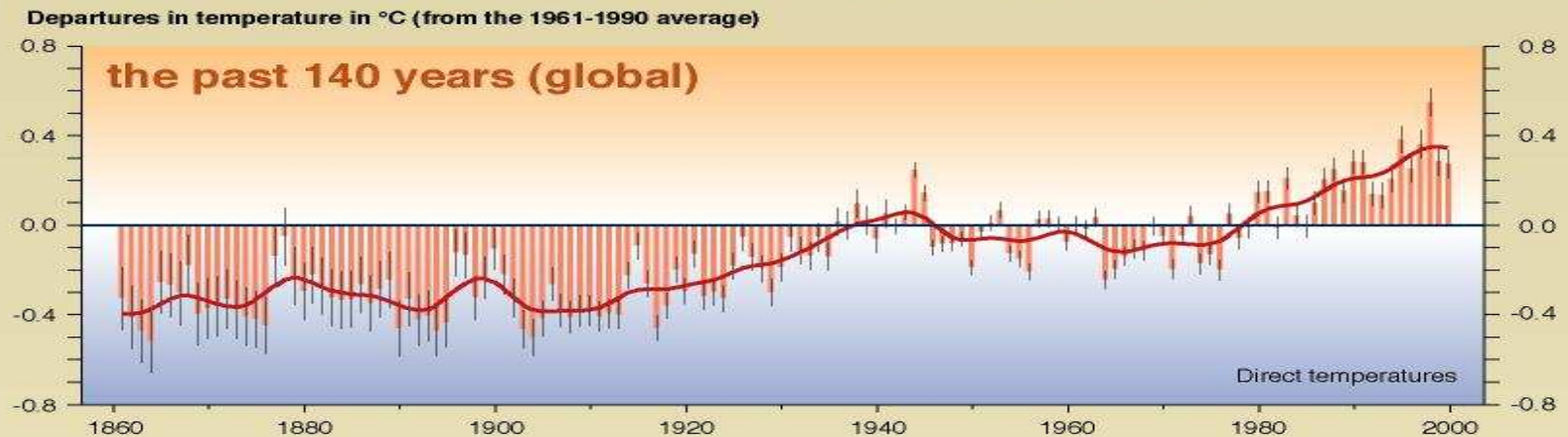


# Environmental Vulnerability

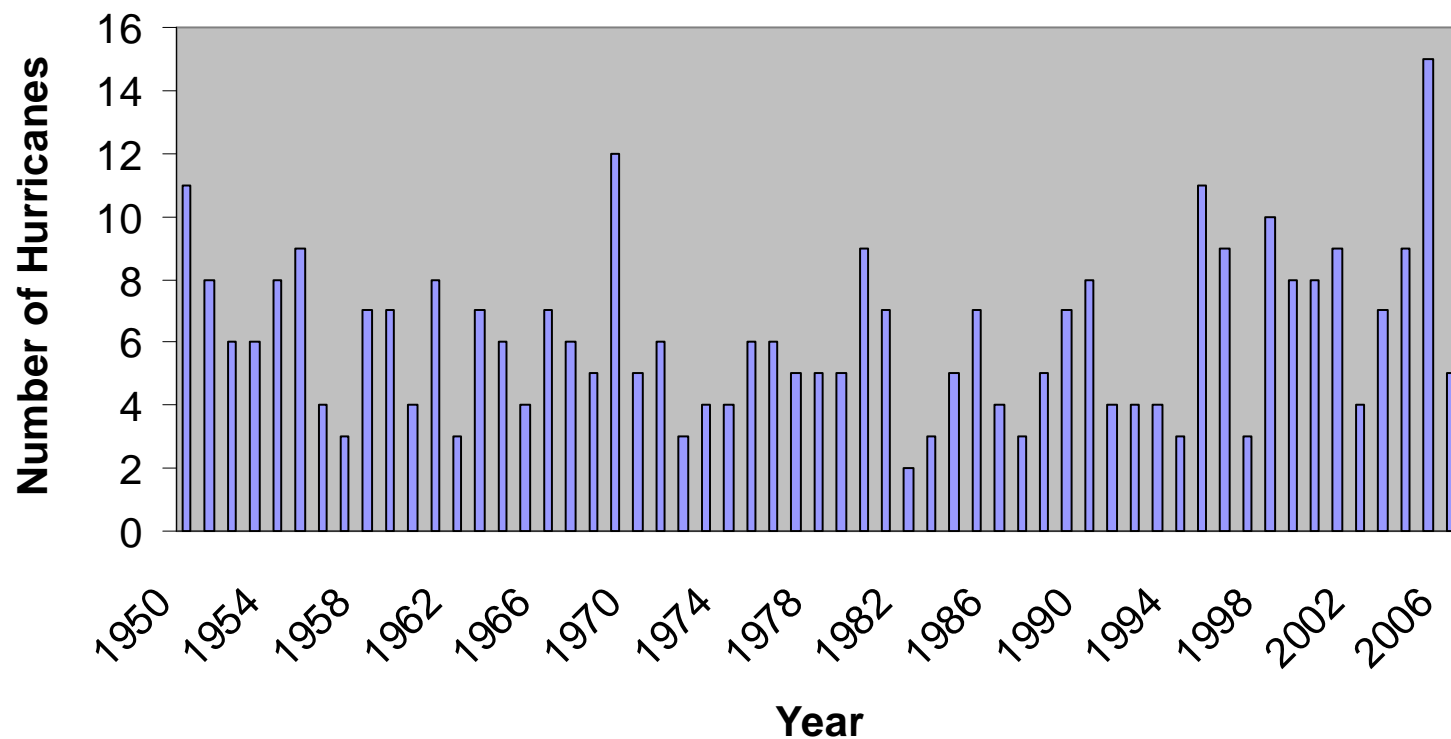
- Climate Change
- Very Fragile Ecosystems
- Coastal Based Economy and Population Concentration
- Vulnerability to Hydro-meteorological Events

# Global mean surface temperatures have increased

## Variations of the Earth's surface temperature for...



## North Atlantic Hurricanes 1950-2006



## Economic Impact of the 2004 Hurricane season in the Small Island States of the Caribbean

<b>Country</b>	<b>Natural Event</b>	<b>Economic Impact (US \$ Million)</b>
<b>The Bahamas</b>	Hurricanes Frances and Jeanne	551
<b>The Cayman Islands</b>	Hurricane Ivan	1,620
<b>The Dominican Republic</b>	Tropical Storm Jeanne	296
<b>Grenada</b>	Hurricane Ivan	889
<b>Haiti</b>	Hurricane Jeanne	296
<b>Jamaica</b>	Hurricane Ivan,	595
<b>Total</b>		<b>4,247</b>

# Social Vulnerability

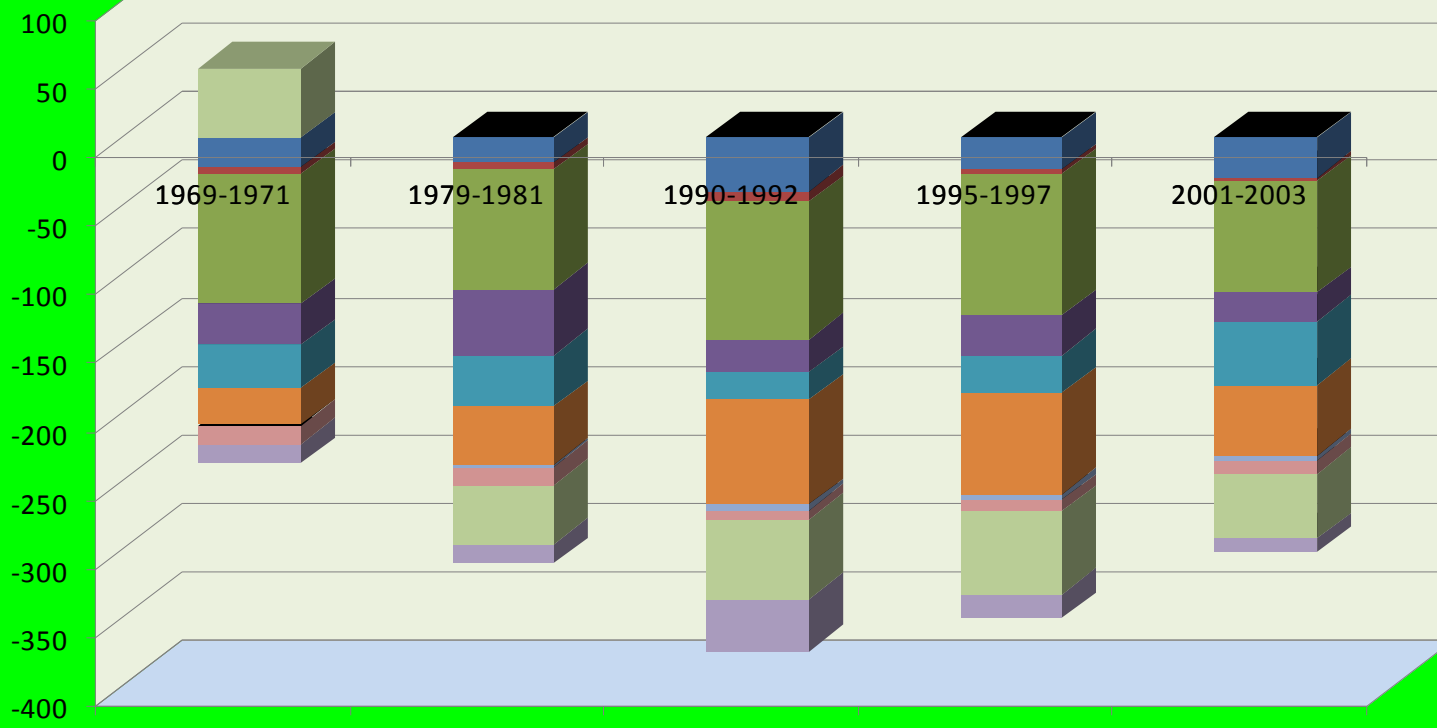
- Development of Children
  - Food Deficiency
    - HIV/AIDS
      - Crime

# Development of Children

“.... the Caribbean was plagued with unacceptable levels of violence which afflict children and adolescence in their homes and in their schools, where the character of violence has its own gender dimension. He noted that the region also ranks first when it comes to murder rates of homicides among 15 and 17 year olds...” Nils Kasteberg, UNICEF Regional Director, Startbroek News, Tuesday, March 18, 2008



### Food Balance - Antigua

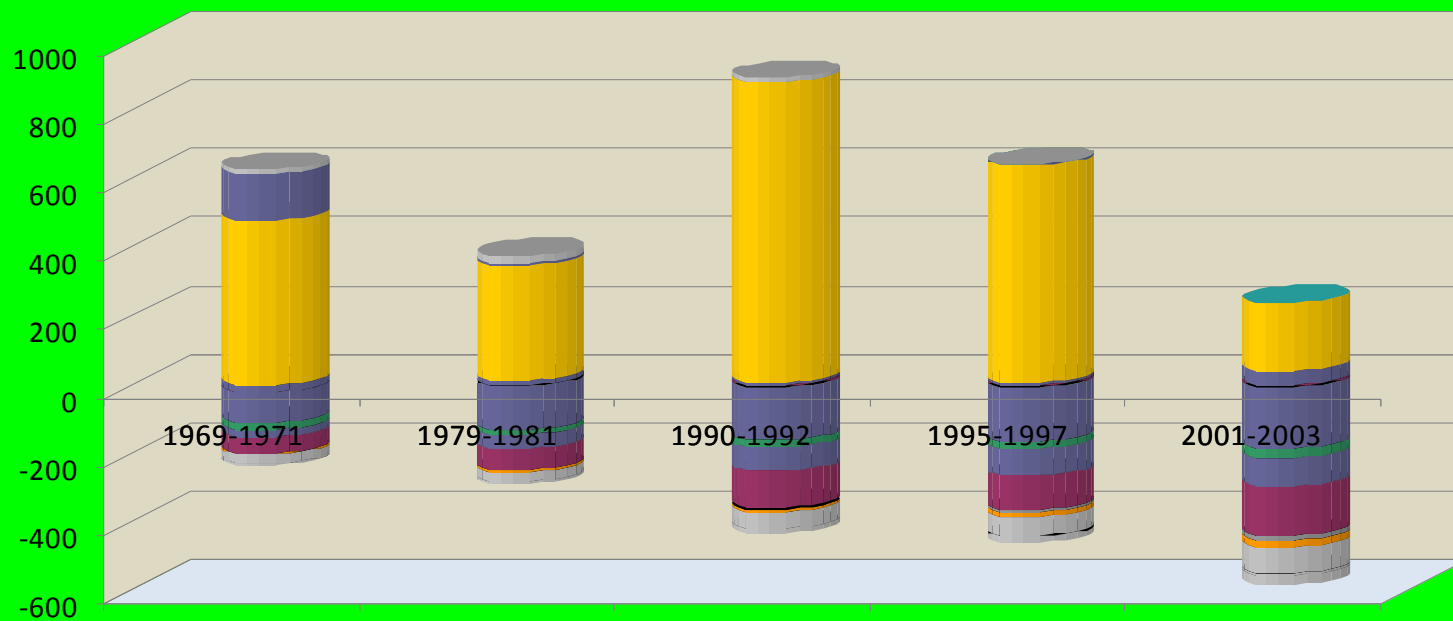


- Alcohol (incl beer&wine)
- Animal fats & products
- Cereals &prod. excl beer
- Fish, seafood & prod.
- Fruits &prod. (excl. wine)
- Meat (slaughtered) & prod.
- Pulses & products
- Starchy roots & products
- Sugar & Sweeteners
- Vegetables & products





### Food Balance - St. Lucia



- Alcohol (incl beer&wine)
- Cereals &prod. excl beer
- Meat (slaughtered) & prod.
- Oilcrops (excl. prod.)
- Sugar & Sweeteners
- Vegetables & products
- Animal fats & products
- Fish, seafood & prod.
- Milk & products
- Spices
- Treenuts & products
- Beverage crops
- Fruits &prod. (excl. wine)
- Offals edible
- Starchy roots & products
- Vegetable oils & prod.

**Warming seas, disease take toll on coral reefs**  
**Ocean's 'forests' are being lost much more quickly than trees on land**



Scientists from the Australian Institute of Marine Science survey the Great Barrier Reef for white syndrome

# Economic Vulnerability

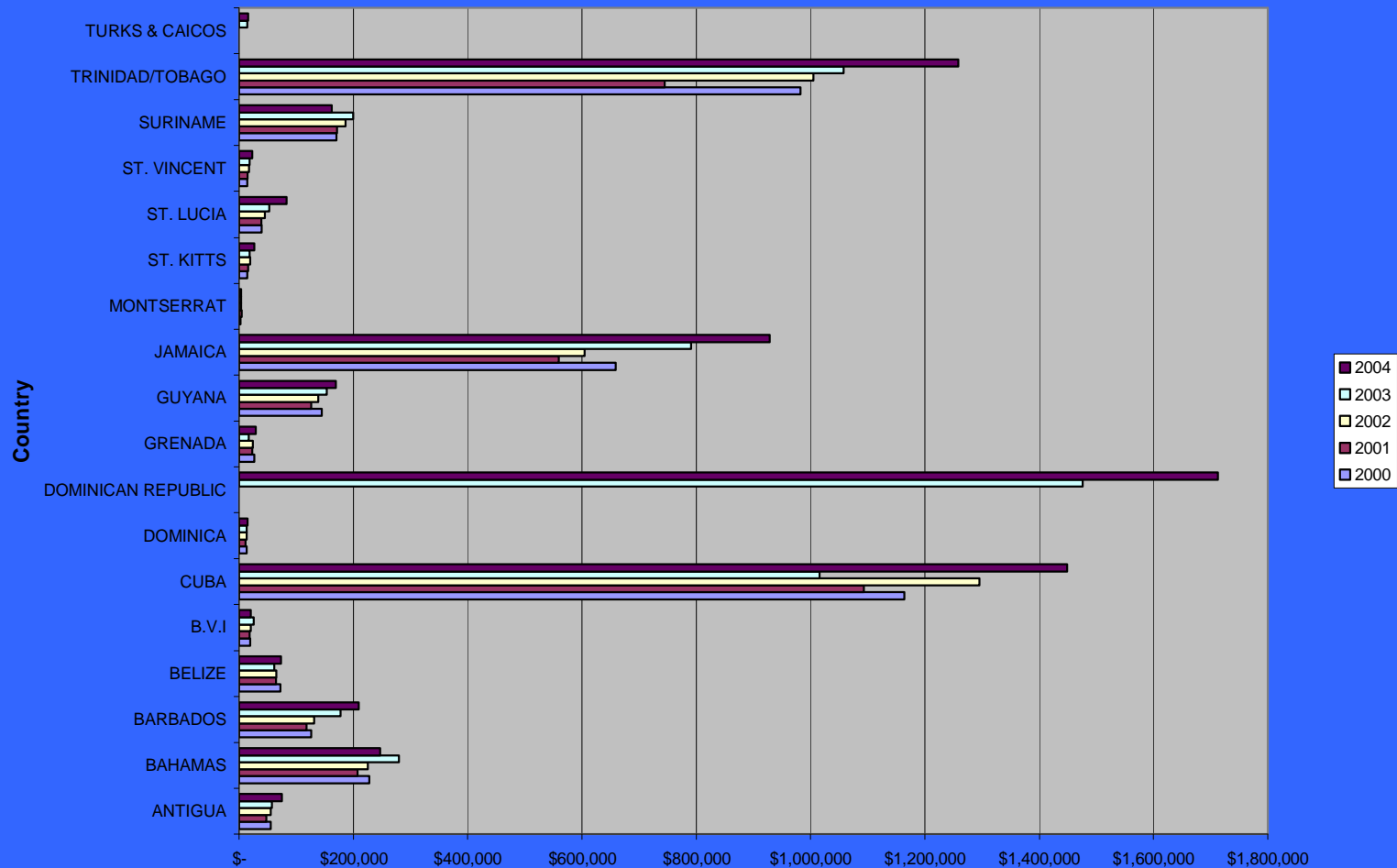
- Limited Number of Economic Activities
- High Dependence on Imported Petroleum .. **the quality of life of a society is directly proportional to the availability of energy resources and efficiency in which its is converted to goods and services**
- High Dependence on Remittance
- Emigration – Brain Drain

# Energy Imports for the Caribbean 1985 -2004 .

YEAR	1985	1990	1995	2000	2001	2002	2003	2004
TOTAL Million barrels	116.60	107.52	91.11	126.20	122.18	138.2	165.33	163.29

# Cost of Liquid Petroleum Imports

Cost of All Petroleum Products 2000-2004 (US\$ '000)



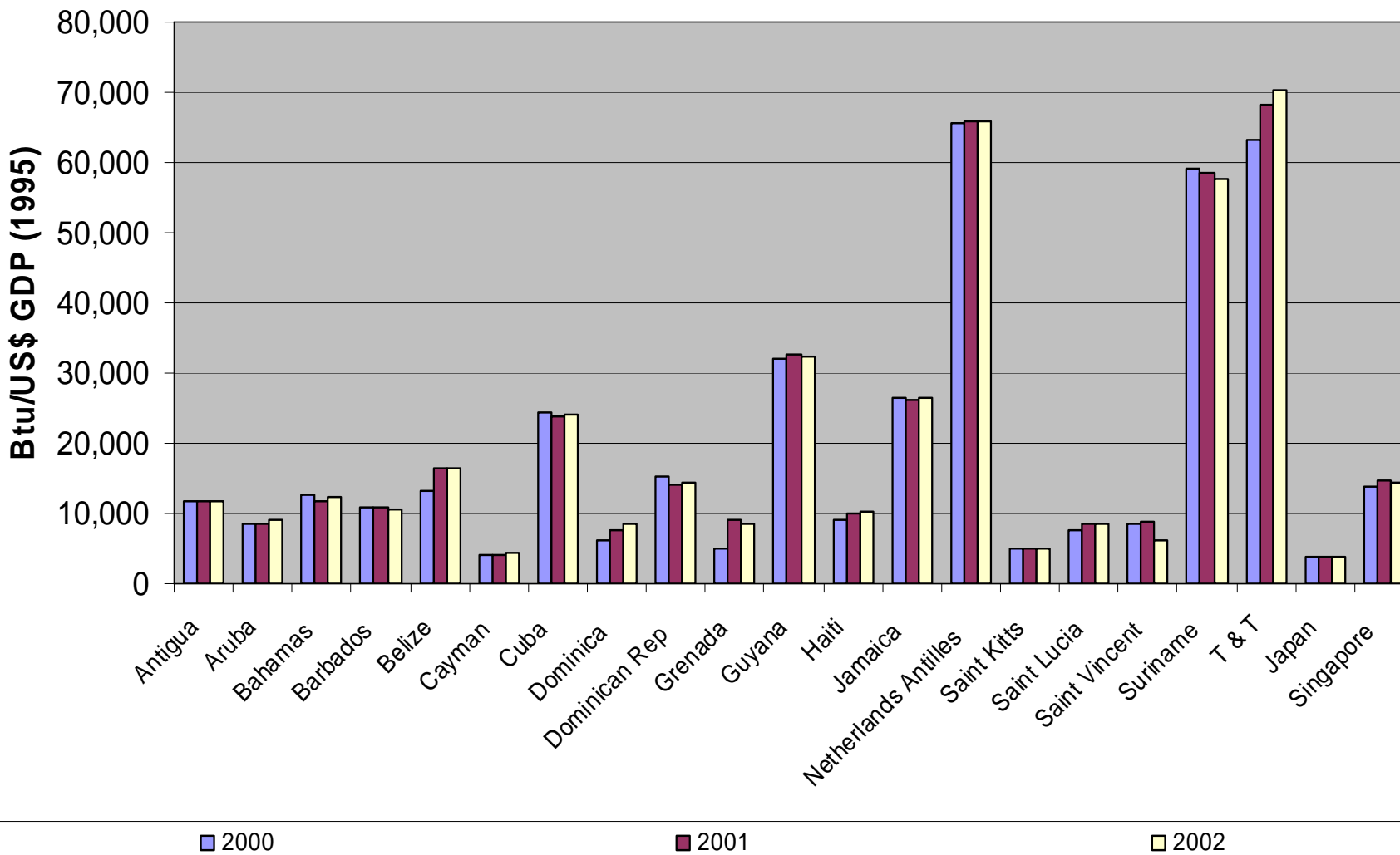


### Electricity and Water Usage in Select Caribbean Countries<sup>11</sup>

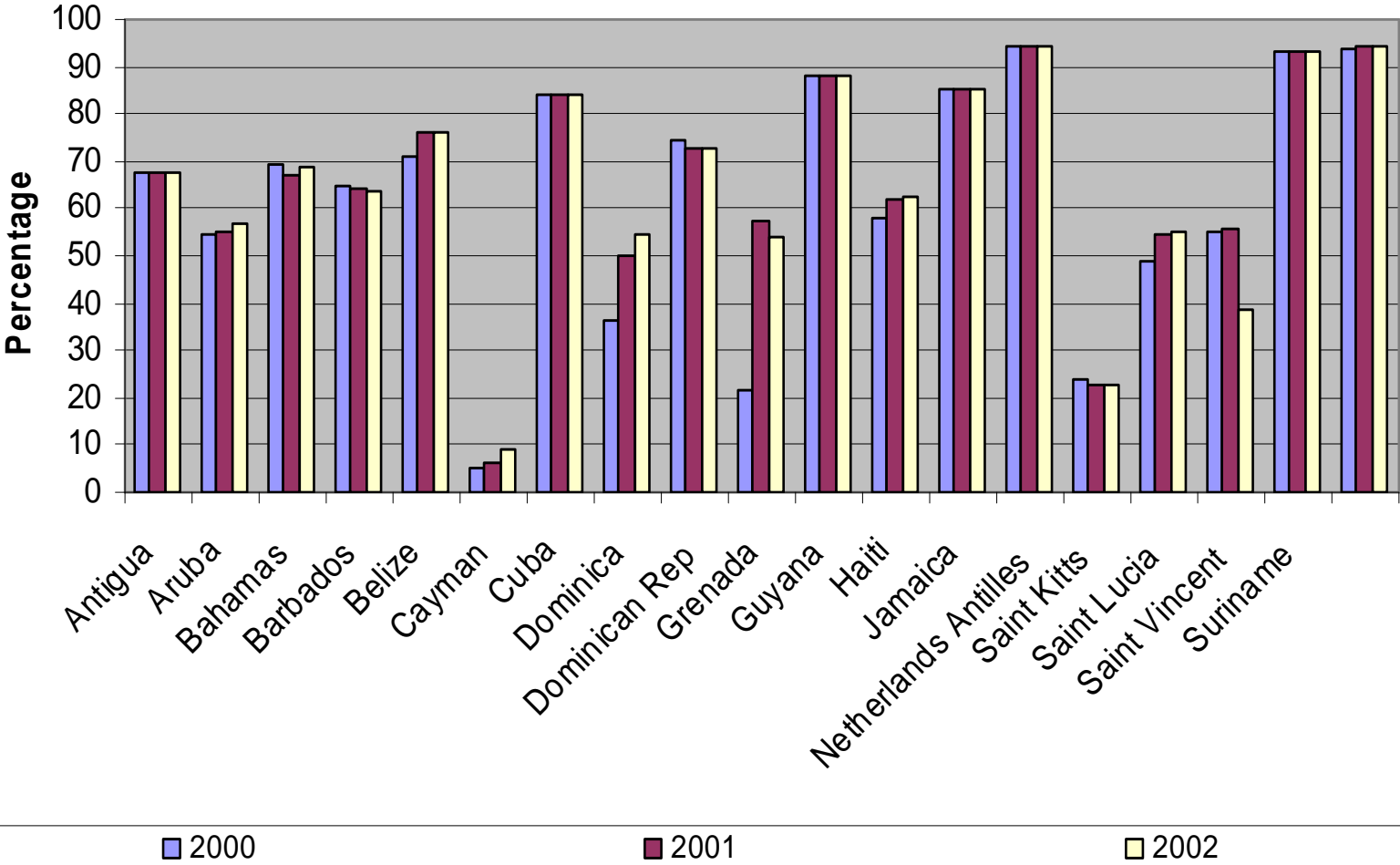
Country	Peak Demand for Power (MW)	Installed Power Generation Capacity (MW) and price of electricity per kwh	Fresh Water consumption and price of water (US\$)
Antigua and Barbuda	54.3	34.8 >US\$0.25	>40,000 m <sup>3</sup> /day
Barbados	154.2	239.1 > US\$0.25	163,640 m <sup>3</sup> /day \$0.675/m <sup>3</sup>
Grenada	24.8	50.0 >US\$0.25	
Jamaica	600	850 >US\$0.25	>250,000 m <sup>3</sup> /day
St. Kitts and Nevis	25	47.4 >US\$0.30	
St. Lucia	49.2	67 >US\$0.25	
St. Vincent	14.93	27.7 >US\$0.30	
Trinidad and Tobago	1070	1395 US\$0.04	

<sup>11</sup> Electricity Data from CARILEC

## Primary Energy Intensity



# Energy Efficiency Potential



# Reducing Vulnerability

SIDS vulnerable arises from the following factors:-

- (i) natural features such as the demographic structure, the scarcity of economically exploitable and arable land, their vulnerability to natural disasters, geographical dispersion, **failure to effectively exploit their largest resource**, and food and energy dependent
- (ii) economic characteristics such as their small internal market, problems of realizing economies of scale because of the small size of firms, high infrastructure costs, heavy dependence on a few commodities and a few overseas markets and consequent instability of export earnings, high transport costs due to distance and small volume of goods transported and constraints in economic diversification;
- (iii) heavy reliance on international trade and high dependence on trade taxes for revenue, limited domestic savings capacity and difficulties in attracting FDI, high per capita costs in establishing basic infrastructure and shortage of “critical mass” in the economy;
- (iv) heavy dependence on preferential trade arrangements to partly compensate their comparative disadvantages and the imminent risks of losing these preferences.

# Sustainable Development Challenges of Caribbean SIDS

- Small Economies – dependent on few goods and services – tourism
- Accessing Financial Resources.. High interest rates
- Human Resources – brain drain
- High Energy Cost – negatively impact ability to compete
- Food Dependent - 90 percent imports
- Limited Fresh Water Resources – a number of SIDS already having to do desalination
- Very Vulnerable Ecosystems – effective management

# Reducing Vulnerability

## Sustainable Development

- Barbados Programme of Action
  - MDG
- Mauritius Implementation Strategy

# Major Energy Challenges

- Limited human capacity (technological as well as entrepreneurial in SIDS especially within the energy sector)
- Attitude of the financial institutions (both local and foreign)
- Energy policies and sometimes tax policies
  - Private Power Production
- National Development Planning Process

### GDP Caribbean Countries 2006

Country	GDP (current US\$)	GDP Growth (%)
Antigua & Barbuda	961.9 million	8.0
Barbados	5.53 billion	4.0
Belize	1.2 billion	4.0
Dominica	299.8 million	4.1
Dominican Republic	30.6 billion	10.7
Grenada	519.3 million	6.5
Guyana	896.2 million	4.8
Haiti	5.0 billion	2.3
Jamaica	10.5 billion	2.7
St. Kitts & Nevis	486.7 million	4.6
St. Lucia	906.0 million	4.9
St. Vincent & The Grenadines	465.9 million	4.1
Suriname	1.6 billion	5.8
Trinidad & Tobago	19.9 billion	12.5
Total	78.87 billion	

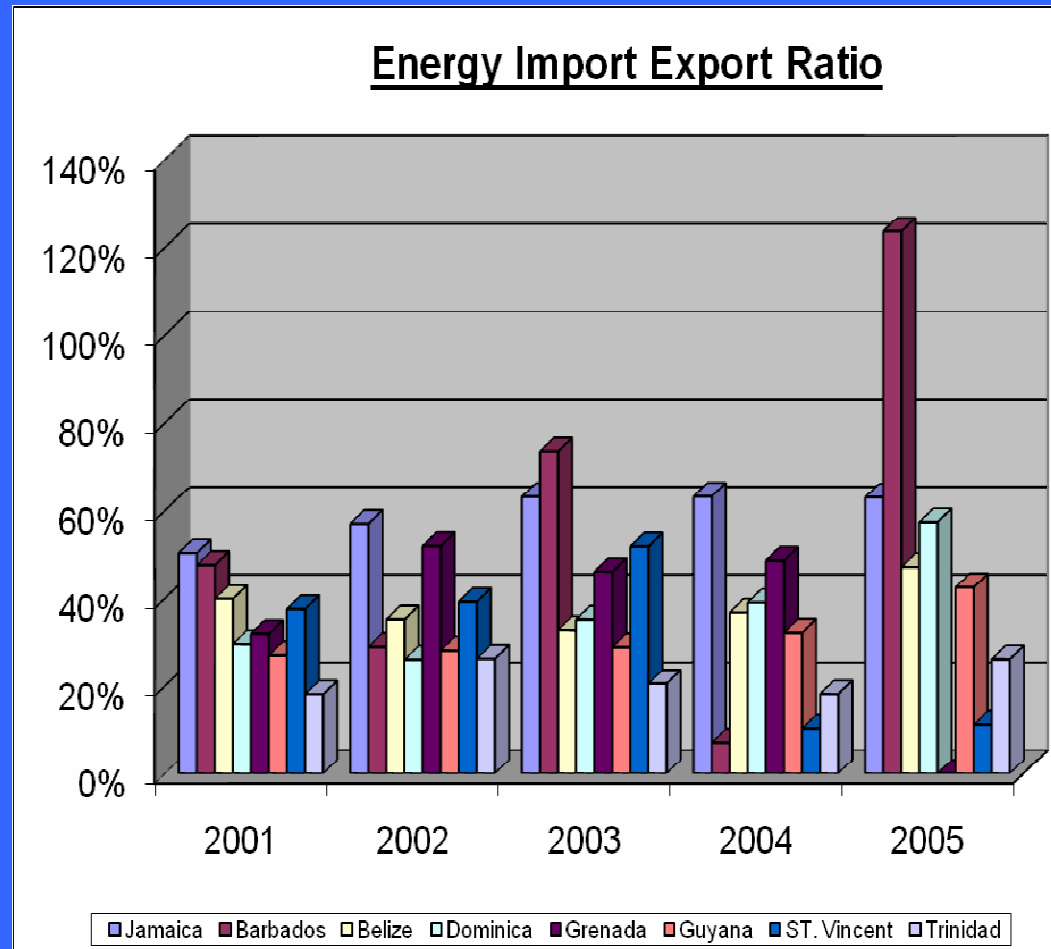
The World Bank (2006). *Key Development Data & Statistics – Country Profiles*.

<http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>

The World Factbook, CIA: <https://www.cia.gov/library/publications/the-world-factbook/print/bb.html>



# Energy Imports/Exports Earnings



# Availability and Cost of Petroleum Fuels in the Future

**ExxonMobil's** ([XOM](#), [news](#), [msgs](#)) presentation to analysts in New York City in early March. Halfway through the three-hour meeting, Exxon management flashed a chart that showed the company's worldwide oil production staying flat through 2012.

Ponder that for a minute. Exxon is the largest publicly traded company in the energy business. In fact, it's the most profitable company in the history of capitalism, earning a record \$40.6 billion last year on sales of \$404 billion.

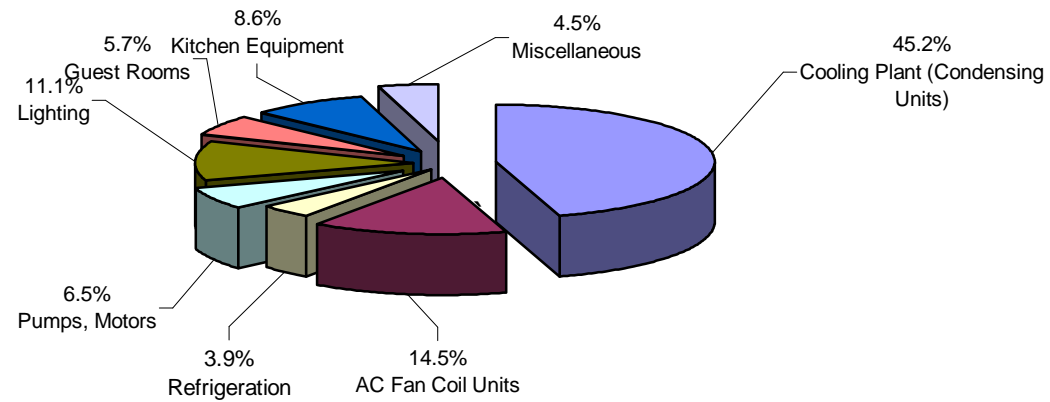
Yet even with crude oil prices near all-time highs, Exxon isn't planning on producing any more oil four years from now than it did last year. That means the company's oil output won't even keep pace with its own projections of worldwide oil demand growth of 1.3% a year.

# A Different Energy Paradigm – Sustainable Energy

- Based on the concept of Energy Services rather than energy supply
- Use Energy Resources Efficiently
- Minimizes the dependence on imported Petroleum and maximizes the use of renewable energy resources
- Has synergy with other sectors --- water, waste, agriculture, tourism .....

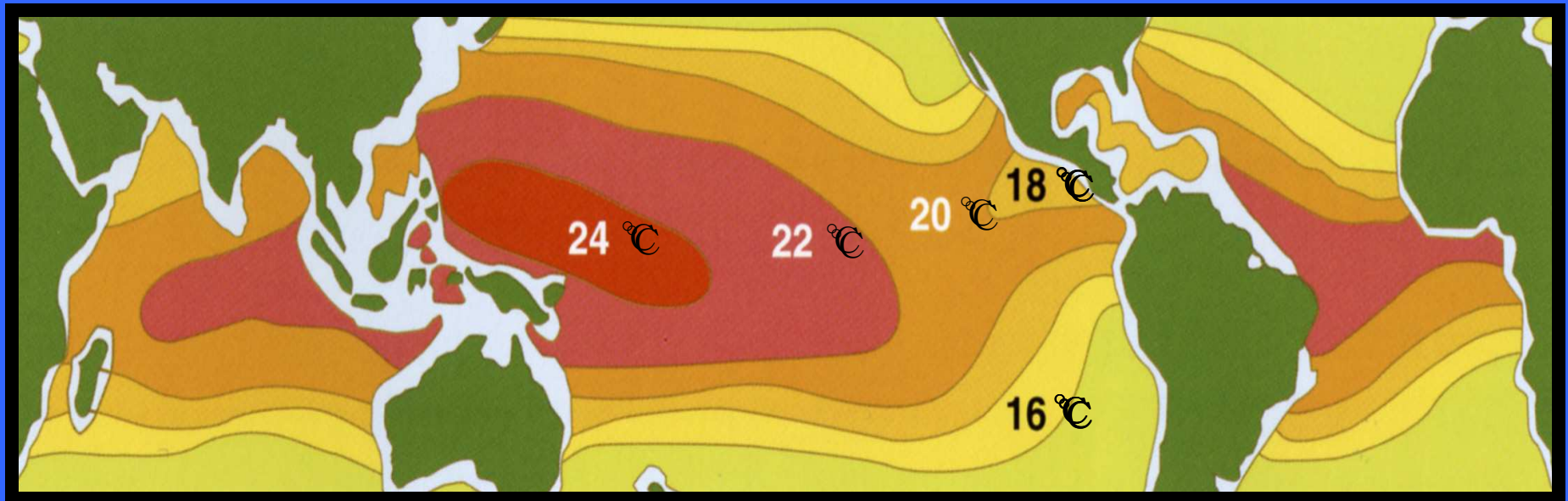
# Energy Use

## ENERGY USE IN HOTELS



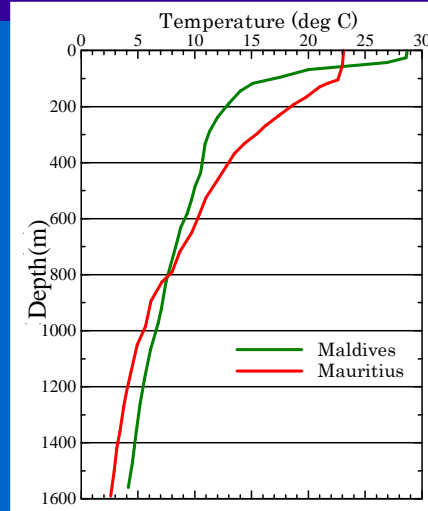
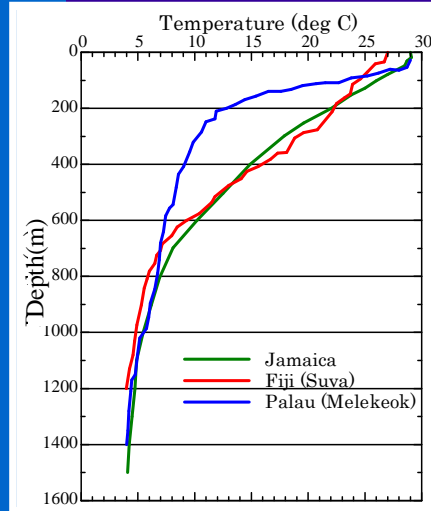
# Potential Area for OTEC

Small Island States have the Best Site



Temperature Difference between Surface and 1000m Depth

# Temperature Profile



# Water Production Cost by Hybrid OTEC Plant

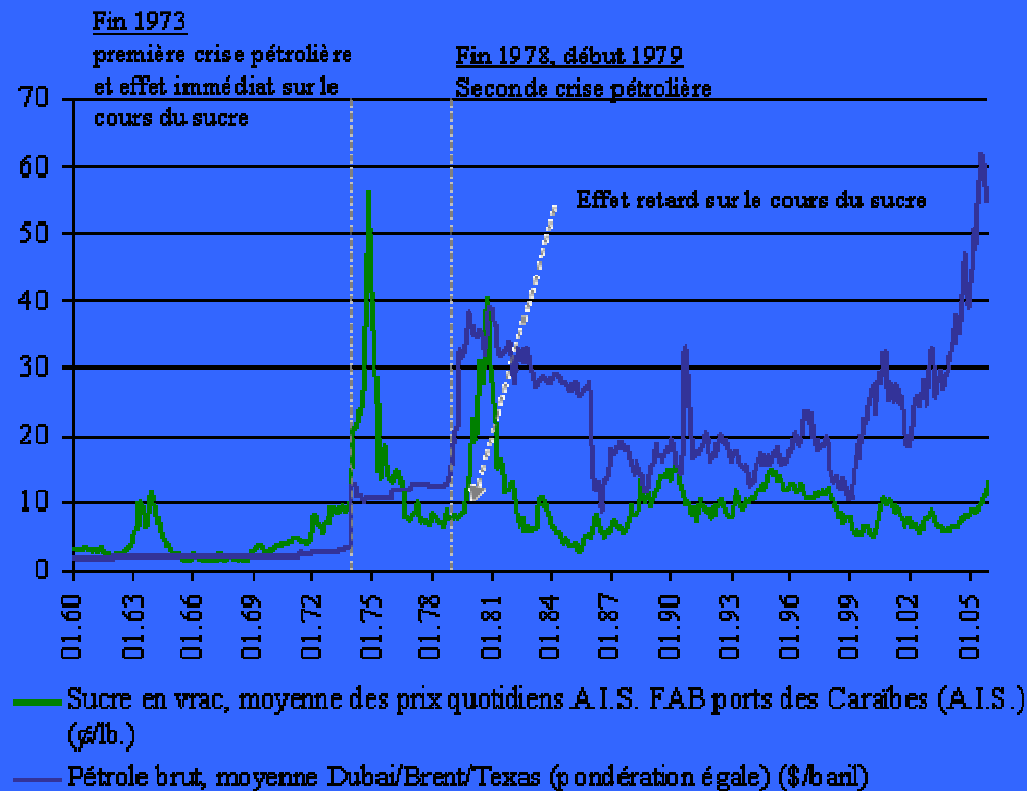
OTEC size		1MW	10WM	100MW
Unit price of power generation	US\$/kWh	0.189	0.089	0.068
<b>Scale of water production</b>	<b>m<sup>3</sup>/day</b>	<b>1,200</b>	<b>12,000</b>	<b>120,000</b>
Flow rate of raw water (surface warm water)	m <sup>3</sup> /h	4,000	40,000	400,000
Flow rate of cold water (deep sea cold water after OTEC use)	m <sup>3</sup> /h	4,000	40,000	400,000
Temperature difference for seawater desalination	°C	15		
Required electric power	kW	230	2,300	23,000
Annual operating ratio	Day	335 (continuous operation on 24 hours)		
Annual amount of gross water production	x 10 <sup>3</sup> m <sup>3</sup>	402	4,020	40,200
Annual amount of power consumption	MWh	1,850	18,500	185,000
Construction cost	Million yen	650	4,100	26,000
Period of amortization	Year	20		
Residual value (10%)	Million yen	▲65	▲410	▲26,000
Annual amortization cost	Million yen	29	185	1,170
Annual running cost	Million yen	39	185	1,480
Annual cost	Million yen	78	370	2,650
<b>Water production cost</b>	<b>US\$/m<sup>3</sup></b>	<b>1.75</b>	<b>0.82</b>	<b>0.51</b>

# Comparison of CO2 Emission per 1kWh by LCA Method

Method	Kg-CO2/kWh
Coal fired power plant	0.916
Thermal power plant	0.756
LNG power plant	0.563
Hydro-electric power plant	0.017
<b>OTEC – 2.5 MW</b>	<b>0.119</b>
<b>OTEC – 100MW</b>	<b>0.014</b>
Solar Cell	0.153



# Sugar prices versus Oil prices 1960 – 2005

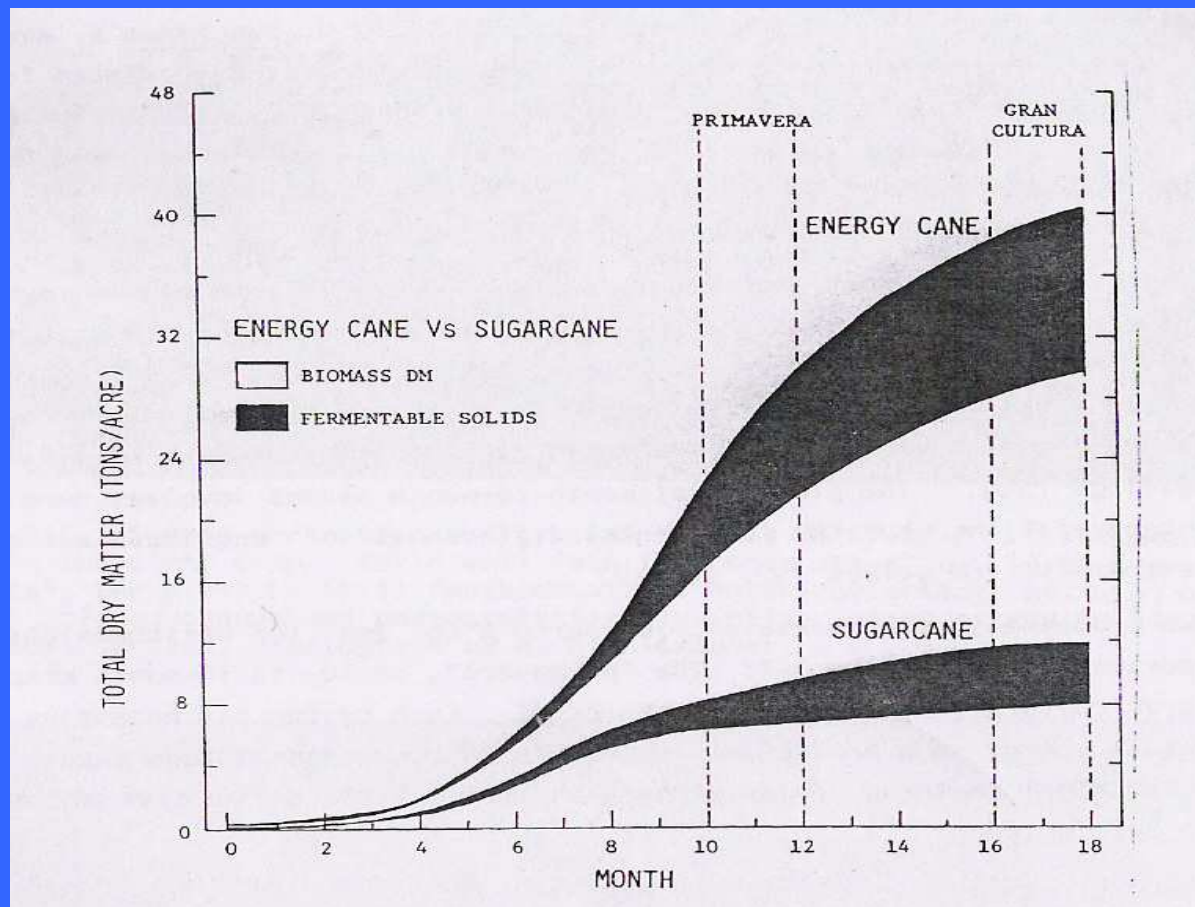


Source : Secrétariat de la CNUCED

## Value of 2005 sugarcane crop as a mix of sugar, ethanol and electricity .

SUGAR & ELECTRICITY (US\$ million)			SUGAR, ETHANOL & ELEC (US\$ million)		
		Crude oil @ 70 US\$/barrel		Crude oil @ 70 US\$/barrel	Crude oil @ 100 US\$/barrel
electricity	Electricity	1,526	Electricity	1,526	2,180
Sugar	Sugar	824	Sugar	412	412
Molasses	Molasses	69	Molasses	34	34
TOTAL	TOTAL	2,418	Ethanol	770	1,100
US\$/tc	US\$/tc	63	TOTAL	2742	3726
			US\$/tc	72	98
ETHANOL & ELECTRICITY (US\$ million)					
		Crude oil @ 70 US\$/barrel		Crude oil @ 100 US\$/barrel	
electricity		1,526		2,180	
Ethanol		1,540		2,200	
TOTAL		3,066		4,380	
US\$/tc		80		115	

# Comparative Growth of Sugarcane and Energycane



# Wild cane



# Conclusions (1)

Sustainable Development is not an option for Caribbean SIDS – it's a requirement for survival

- Caribbean SIDS must act collectively to develop the vast renewable energy resources (wind, geothermal, solar, ocean, biomass) the development of these are a prerequisite to SD
  - Attitude of our leadership need to change (energy is equivalent to oil)

# Conclusion (2)

Policy changes:

- Integration of the energy sector in the economy – linkages with Agriculture for fuel production and environmental protection
- Waste management – resources for energy and Agriculture and to protect fragile coastal ecosystems.
- Development of Vast Ocean Resources – for enhanced Energy and Food Security
- Integrated planning replacing sector planning in order to pursue SD as well as adaptation to CC
- Develop the Institutional Capacity to take control and effectively manage our energy sector.