Ministry of Planning
and Sustainable Development

Organization of
American States

blueSpace
Caribbean Network for Urban and Land Management

SUSTAINABLE CITIES COURSE, 2ND EDITION
THE NORMANDIE HOTEL AND CONFERENCE CENTRE
PORT OF SPAIN, TRINIDAD
DECEMBER 1-5, 2014

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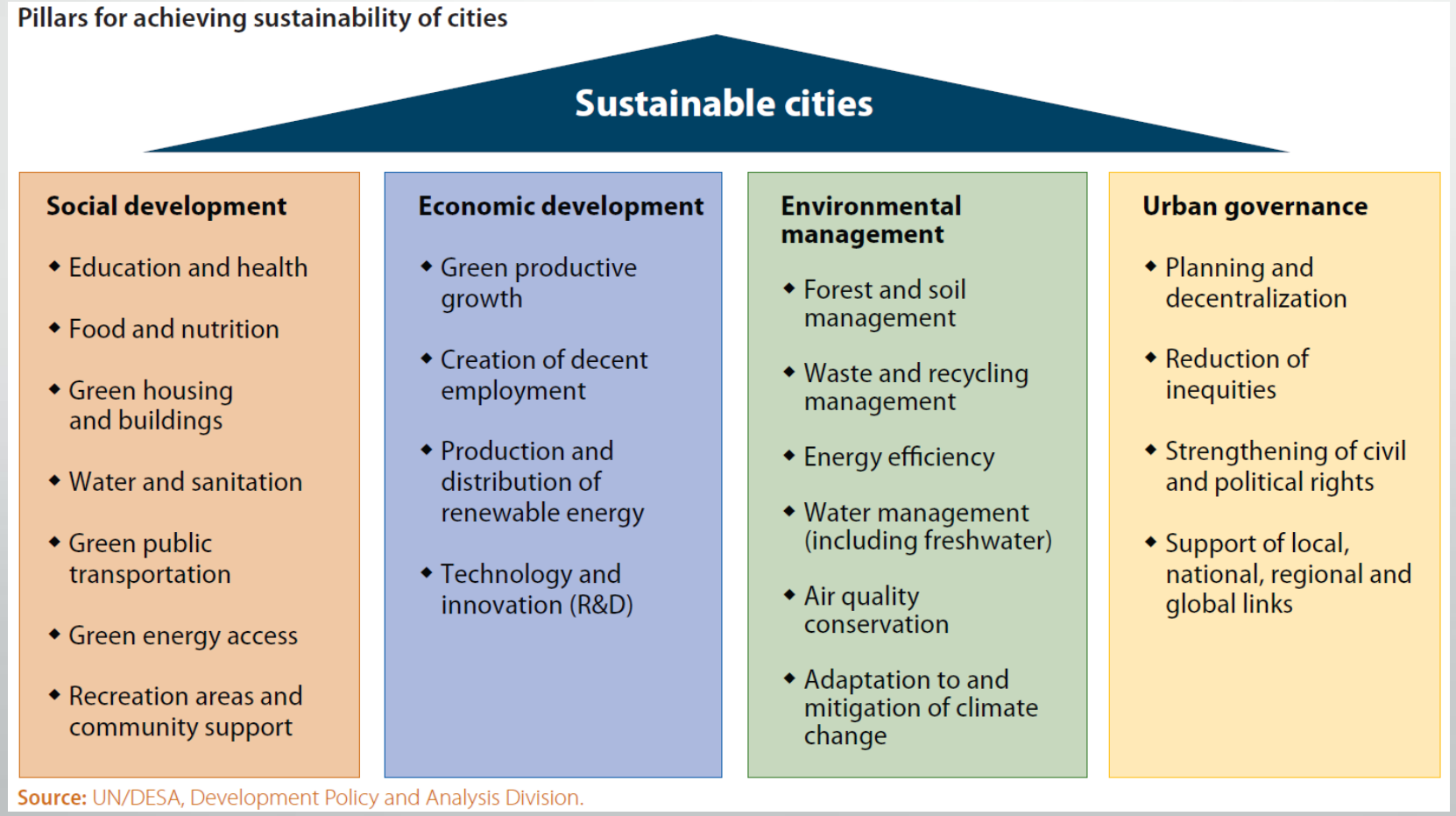
PRESENTATION OUTLINE

- Pillars for sustainable cities
- Renewable Energy options
  - ✓ Solar Thermal and PV
  - ✓ Wind Energy
- Smart Grid
- Smart Cities
  - ✓ Oil and Gas countries
  - ✓ Trinidad and Tobago
  - ✓ Regional Initiatives
- Conclusion

DEVELOPING RENEWABLE ENERGY TECHNOLOGIES



SMART AND SUSTAINABLE CITIES

- **PROFILE:**

  Smart cities can be identified and ranked along six main parameters:

  - Smart Economy
  - Smart Mobility
  - Smart Environment
  - Smart People
  - Smart Living, and
  - Smart Governance

THE SIX PARAMETERS

- These connect with traditional regional and neoclassical theories of urban growth and development

- They are based on theories of regional competitiveness, transport and ICT economics, natural resources, human and social capital, quality of life, and participation of citizens in the governance of cities.

RENEWABLE ENERGY OPTIONS

- Solar - Thermal and Photovoltaics
- Biomass
- Hydropower
- OTEC
- Wave Energy
- Fuel cells
- Wind Energy
- Geothermal

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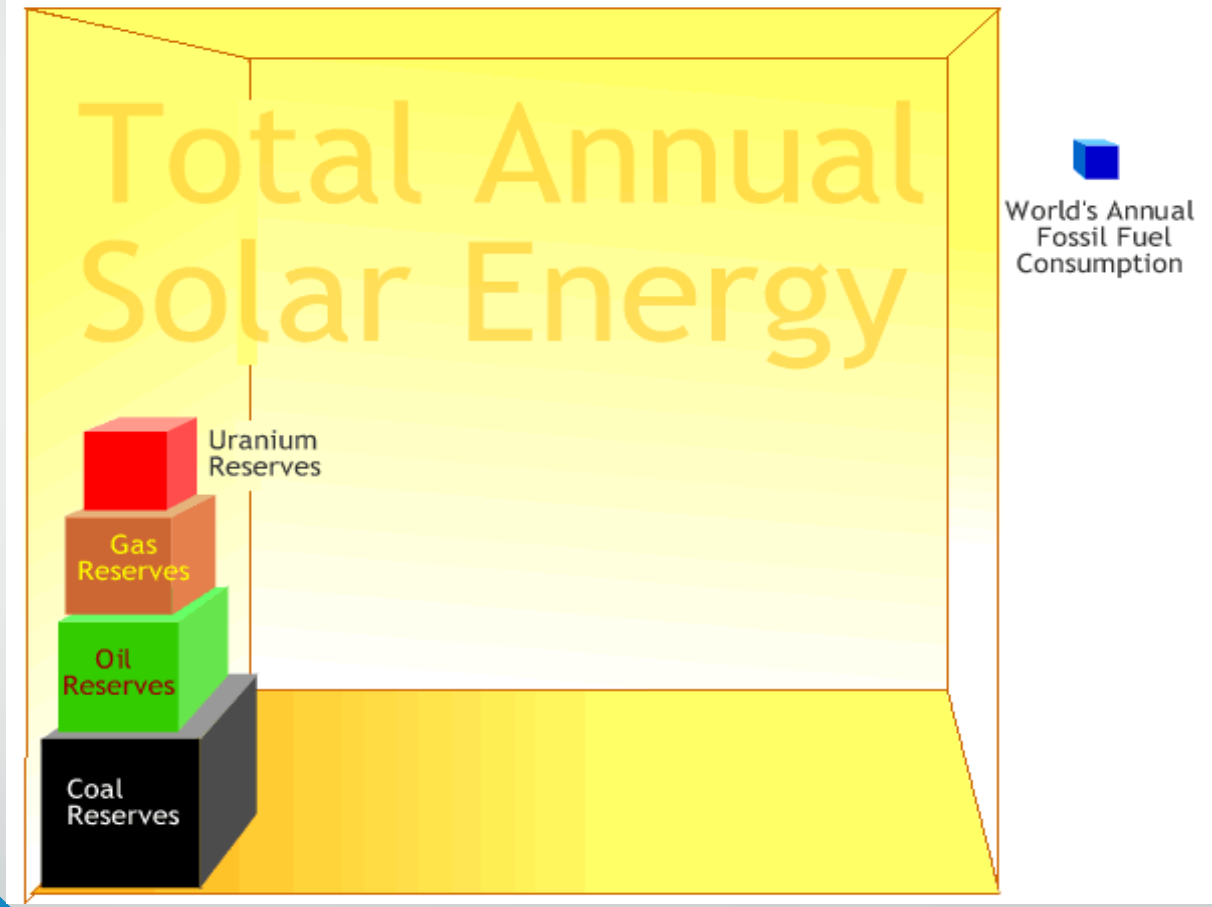
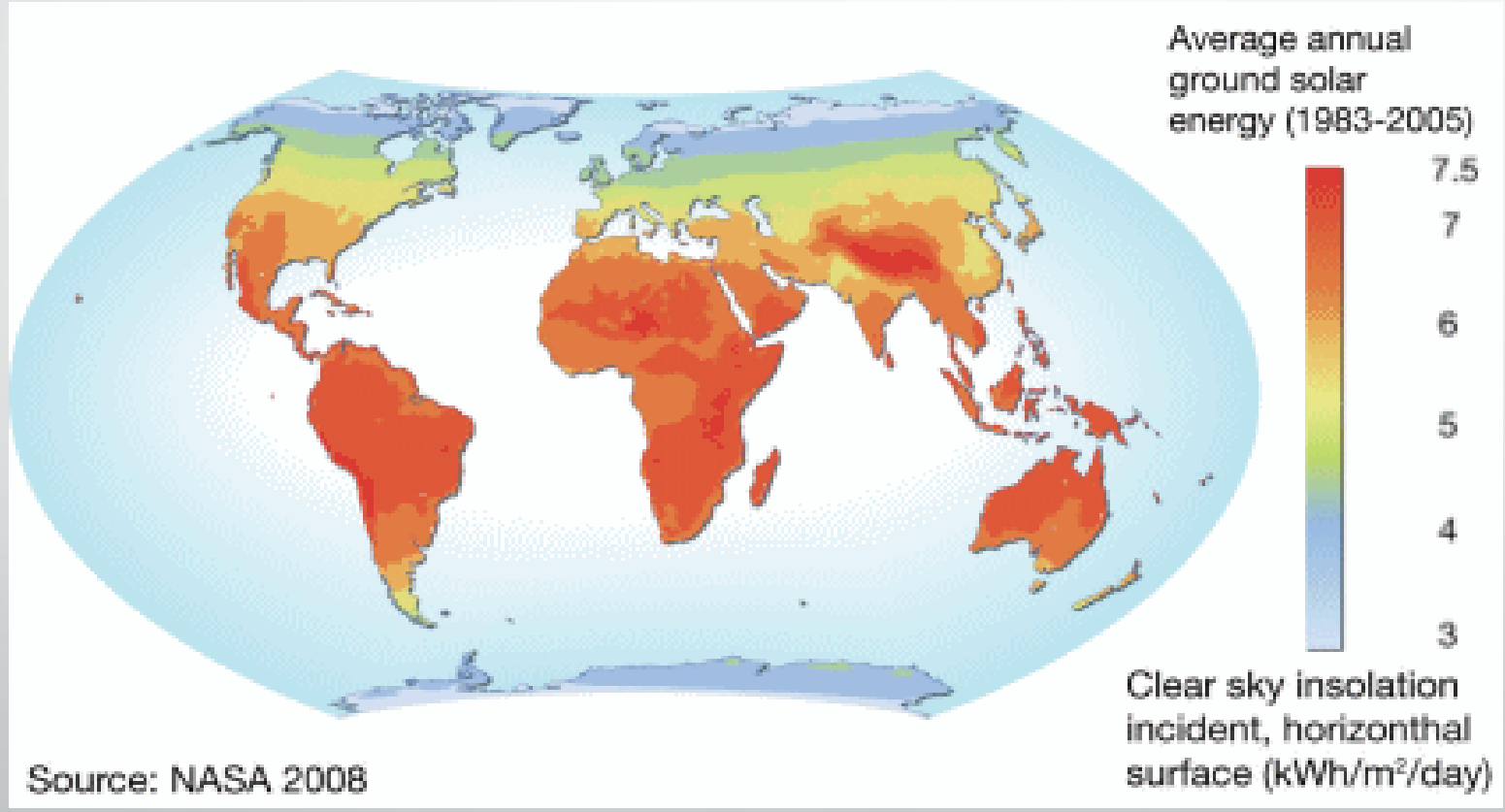
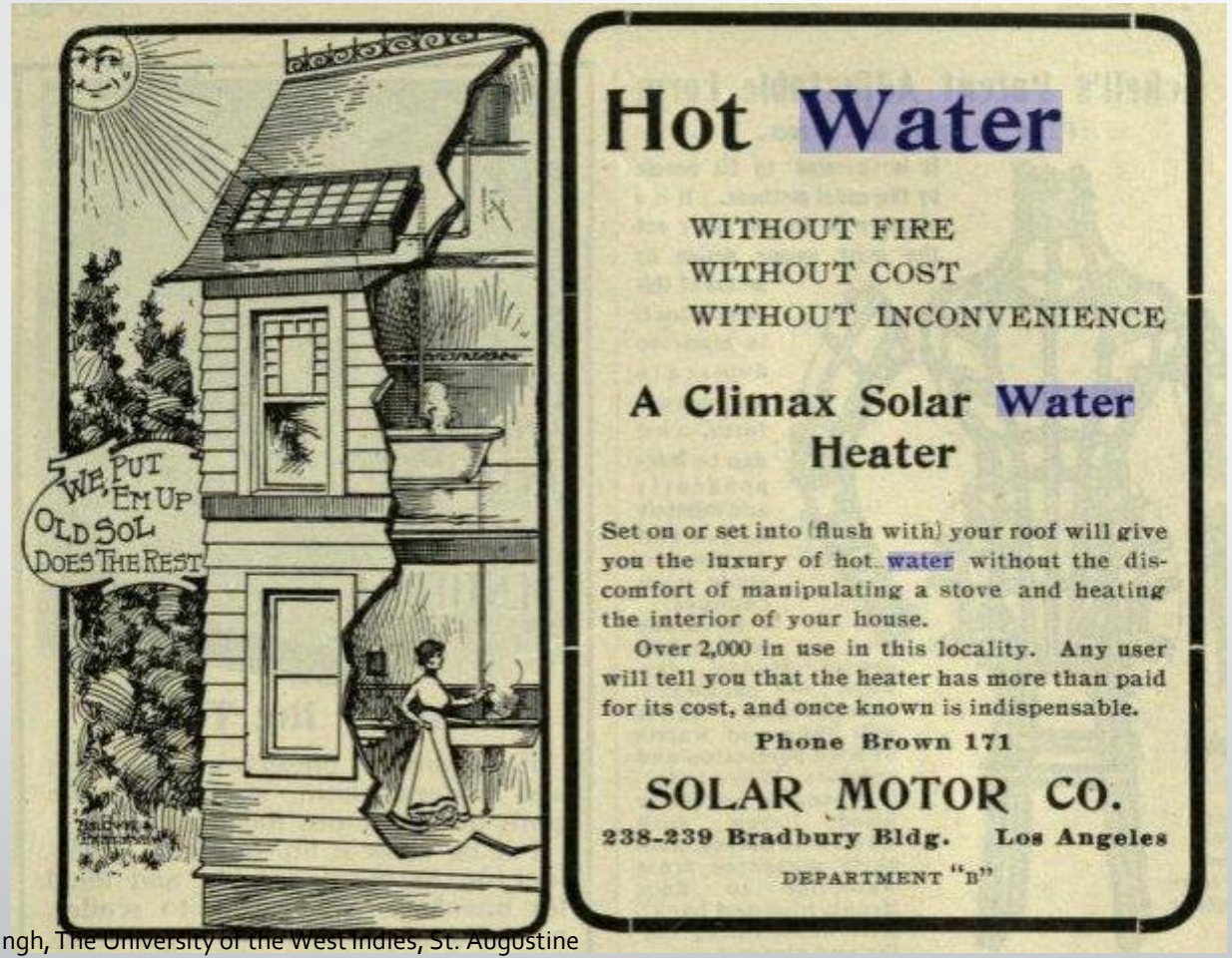
SOLAR RESOURCE



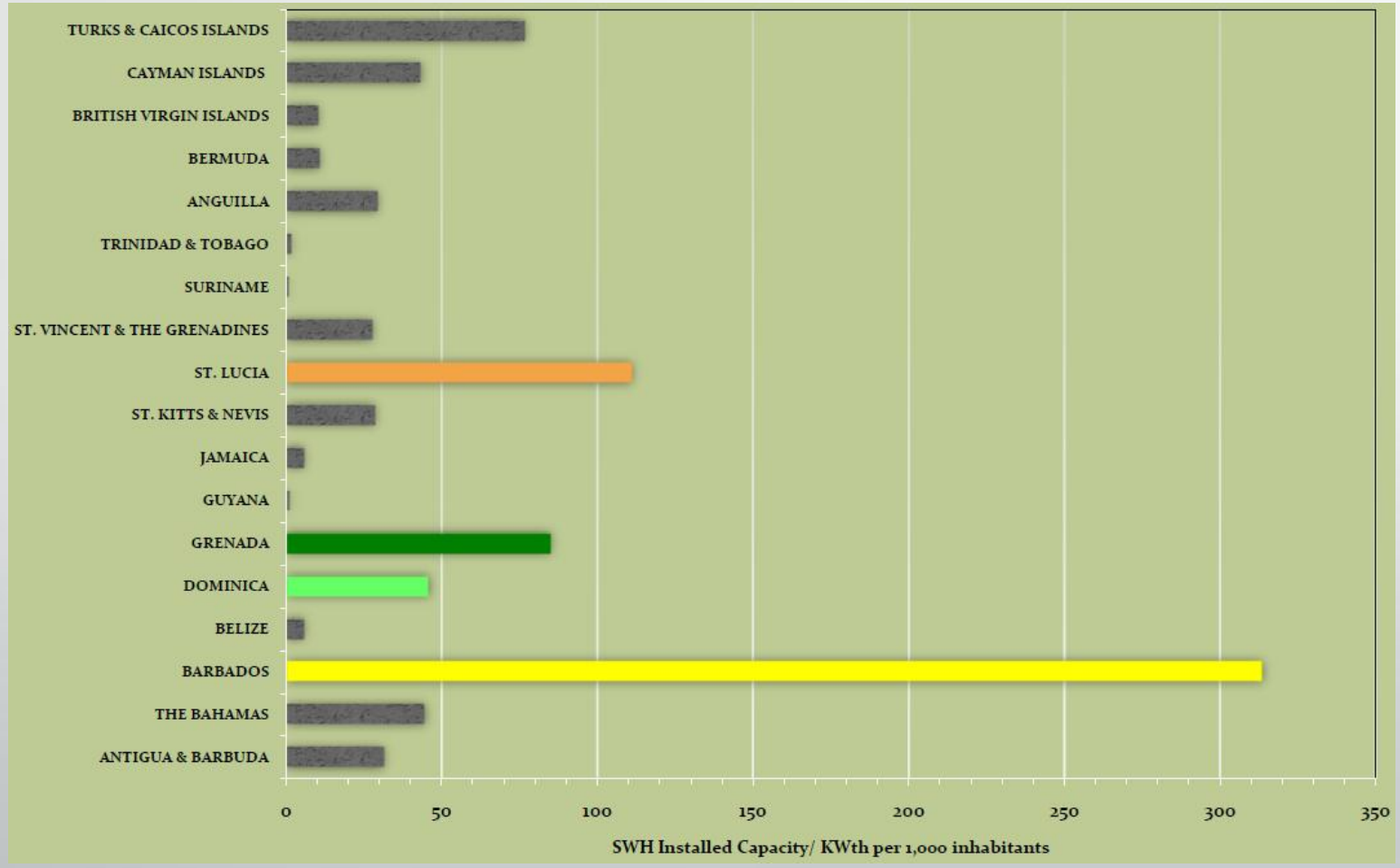
World Map of Potential Solar Power
(Solar Insolation in kWh/m²/day)



Solar Water Heater Advert - Out West (1902)



SOLAR WATER HEATING PENETRATION IN CARICOM STATES



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Source: Gardner, 2012

SOLAR WATER HEATERS

Solar water heaters are used for:

- **Domestic hot water**
- **Pool heating**
- **Space heating needs**
- **Heat source for solar cooling systems**

TECHNOLOGY FOR SOLAR WATER HEATERS

There are two types of solar collectors:

- **Flat-plate**
- **Concentrating**

- In a flat plate collector the area used for intercepting the solar radiation is the same area used for absorbing the radiant energy.

- A concentrating collector however usually has a concave reflecting surface to intercept and focus the direct radiation of the sun to a smaller receiving area, thus increasing the radiation flux.

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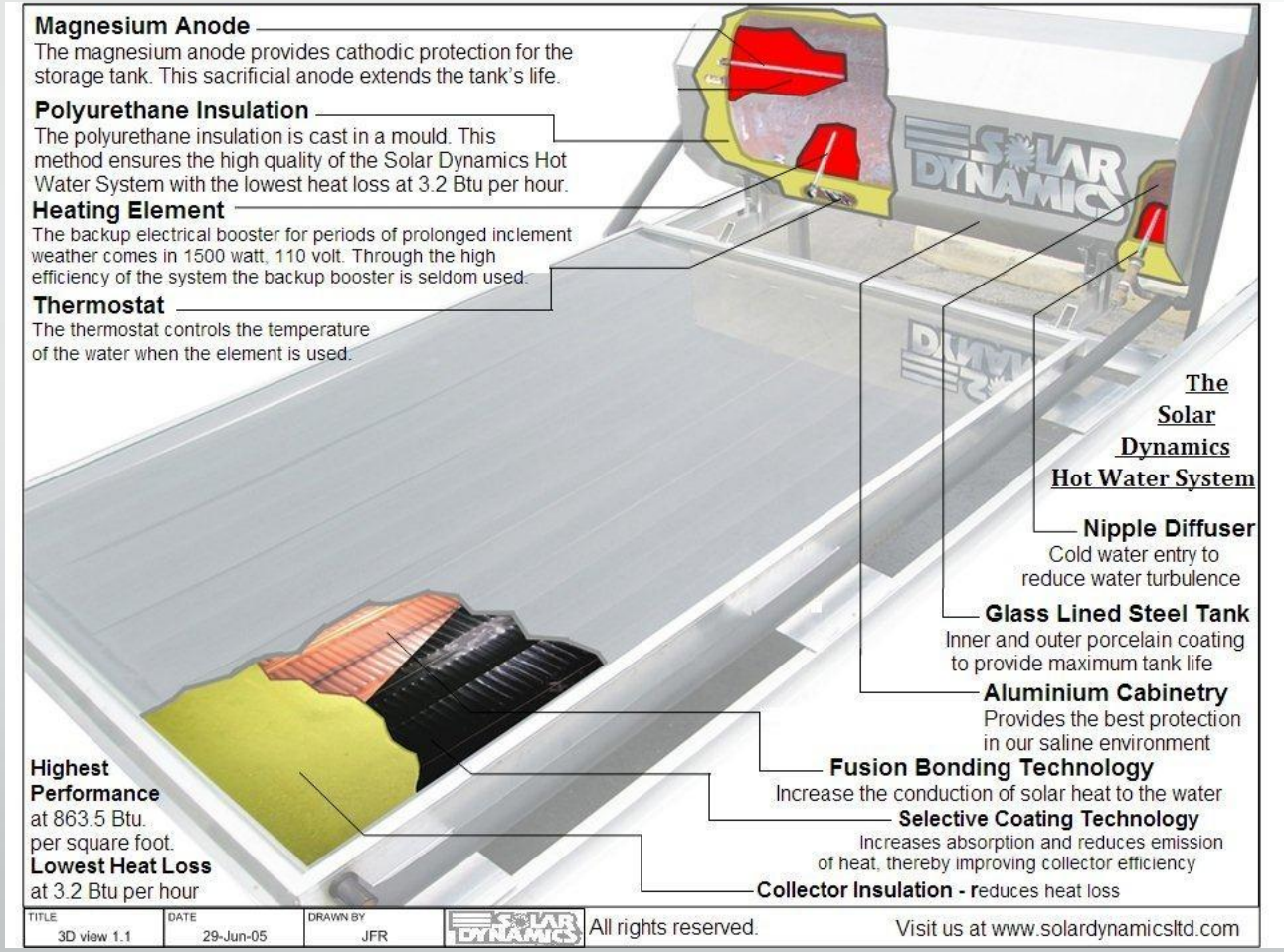
FLAT-PLATE COLLECTOR

Solar radiation passes through the transparent cover(s), is incident on the blackened absorber plate which becomes heated, and transfers some of its energy to the transport medium to be carried away as useful energy.

HEAT LOSS REDUCTION

- The sides and base of the collector are well insulated to reduce conduction losses.
- Convection losses from the absorber plate are reduced by use of the transparent cover.
- Radiation losses from the collector are also minimized because the spectral properties of the glass allow the short-wave radiation from the sun to be transmitted through the glass to the interior but inhibit the passage of the long-wave thermal radiation from the interior through the glass to outside.

ONE SYSTEM MANUFACTURED IN THE CARIBBEAN



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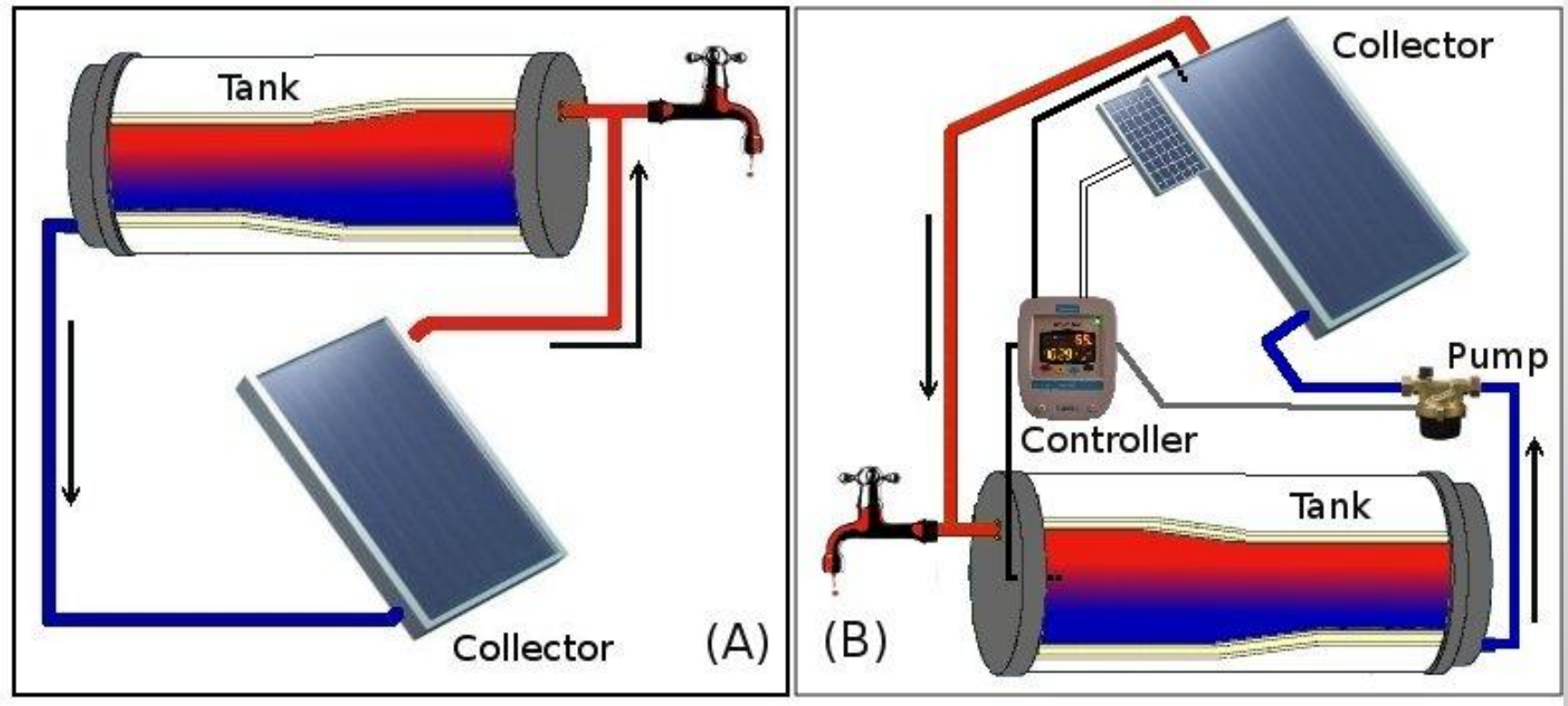
Solar Water Heaters

- Solar water heaters come in a variety of configurations.
- Each differs in design, cost, performance, and level of complexity.
- Most systems have back-up water heating such as electricity or gas.

DIRECT SYSTEMS

(A) Passive CHS system with tank above collector
(B) Active system with pump and controller driven by PV

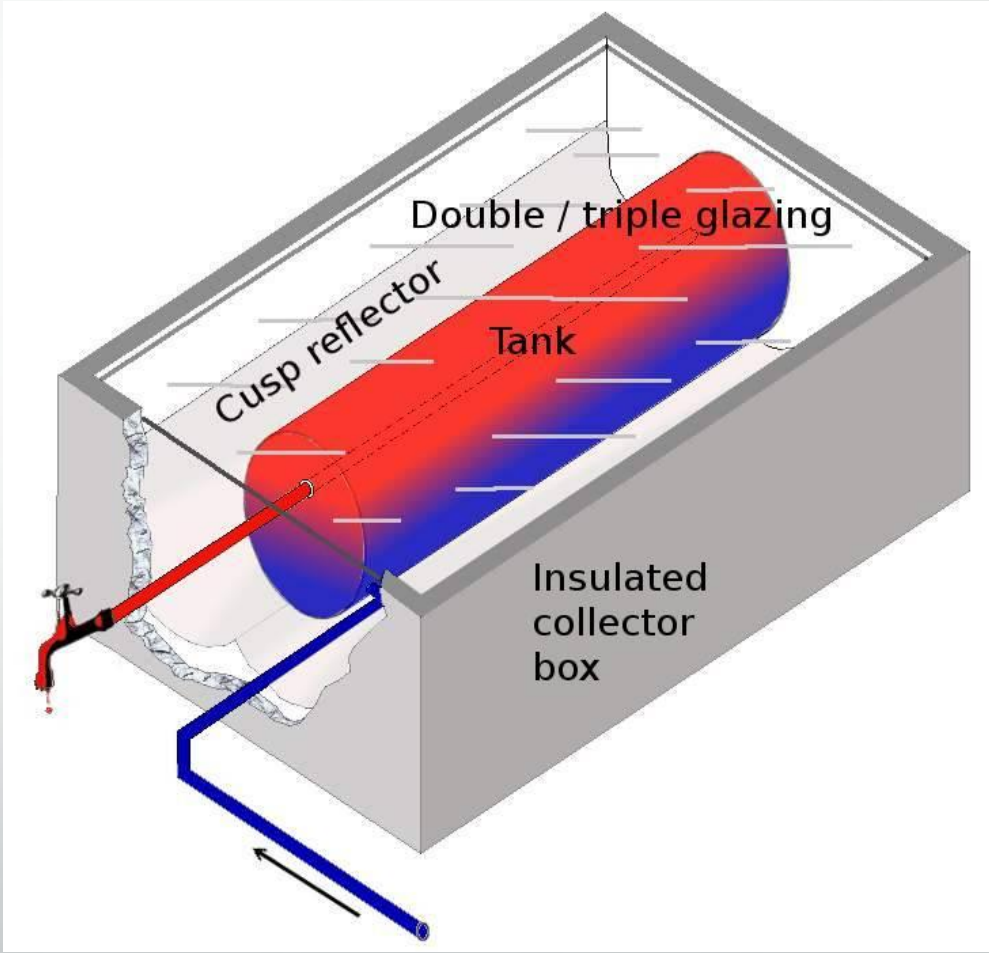


THERMOSIPHON SYSTEMS - ACTIVE

- While passive solar water heating systems are less expensive, their efficiency is significantly lower than that of active systems.
- If the tank is placed below the collector, e.g. at ground level or in a basement, it requires the use of a pump for the circulation of the water and is therefore termed an "active" system.
- Water pressure from the mains needs to be high enough to transport water from the ground onto the roof
- The distance between tank and consumption point needs to be sufficiently high so that the hot water can reach its final destination by gravity flow, without the use of a pump.

INTEGRATED COLLECTOR STORAGE SYSTEM

- The Integrated Collector Storage system (ICS or Batch Heater)
- The system uses a tank that acts as both storage and solar collector.
- This is a passive direct system with rectilinear tanks having a glass side facing the sun at noon.
- They are simple and less costly than the flat plate and evacuated tube collectors.
- However, these have the disadvantage of significant heat loss at night since the side facing the sun is uninsulated.
- Another limitation is that they are only suitable in moderate climates.



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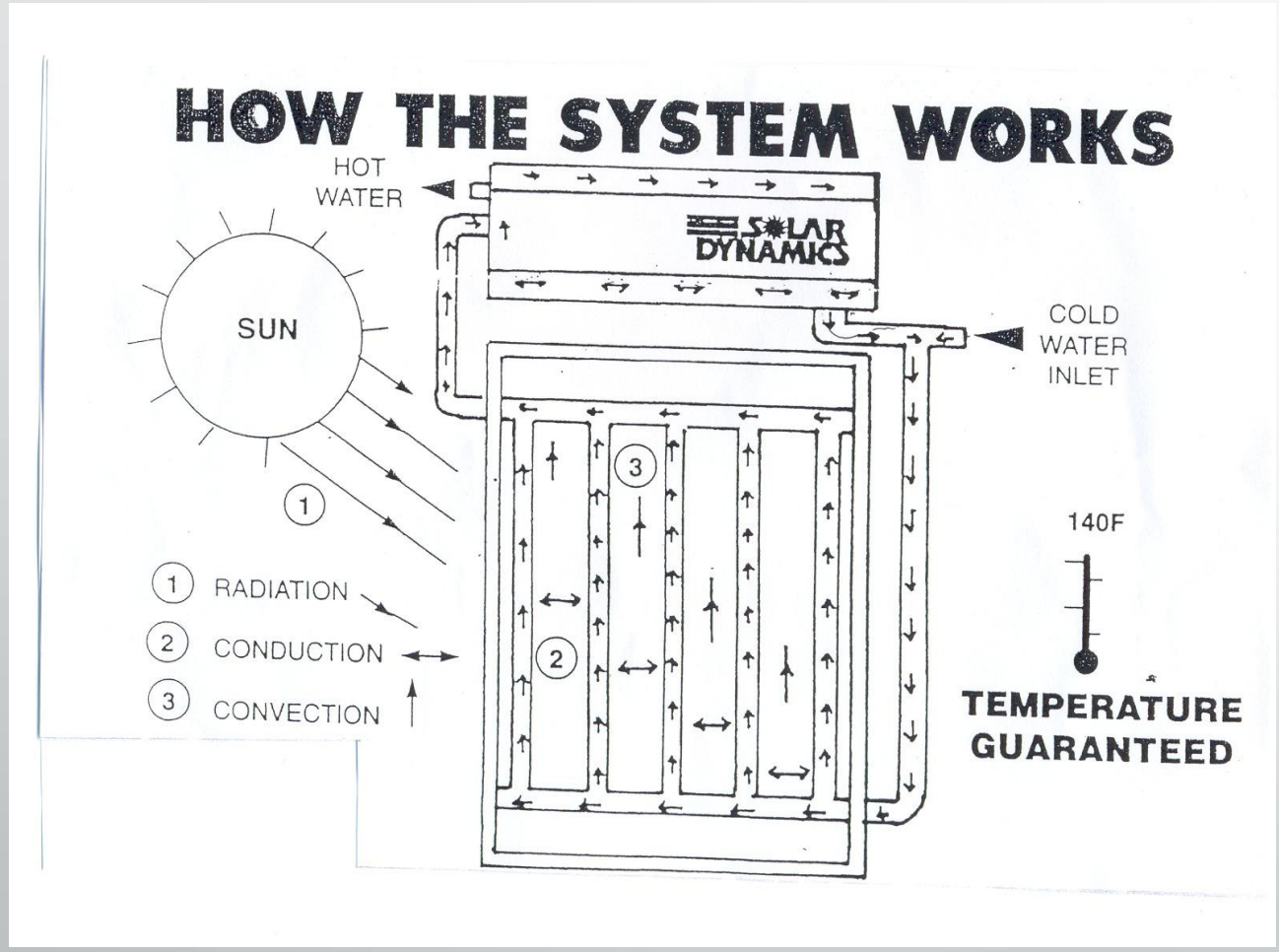
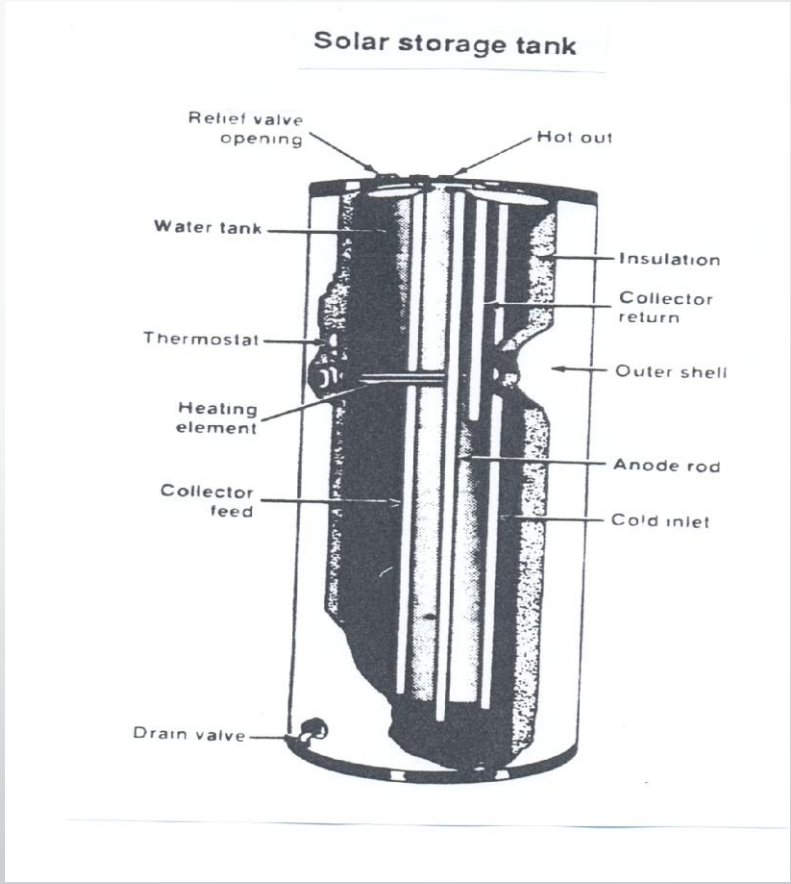

HOW THE SYSTEM WORKS
HOT WATER
SOLAR DYNAMICS
SUN
COLD WATER INLET
140F
1 RADIATION
2 CONDUCTION
3 CONVECTION
TEMPERATURE GUARANTEED


Solar storage tank
Relief valve opening
Hot out
Water tank
Insulation
Collector return
Thermostat
Outer shell
Heating element
Anode rod
Collector feed
Cold inlet
Drain valve

ENCLOSED INSULATED WATER STORAGE TANK

- Stores the hot water circulated from the collector.
- Auxiliary heating element housed inside tank.
- Thermostat housed in enclosure of tank.
- Magnesium anode housed inside tank.
- Most popular tanks are glass lined. These have an outer shell of steel that must be protected from galvanic corrosion
- An aluminum or magnesium anode is installed in the tank
- The rod attracts corrosion and therefore "sacrifices' itself

LAUNDROMAT APPLICATION

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LONDON BOURNE TOWERS
ARCHITECT: MAURICE CLARKE

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LARGE-SCALE APPLICATIONS OF SWHS

SWHs on a hotel in Barbados

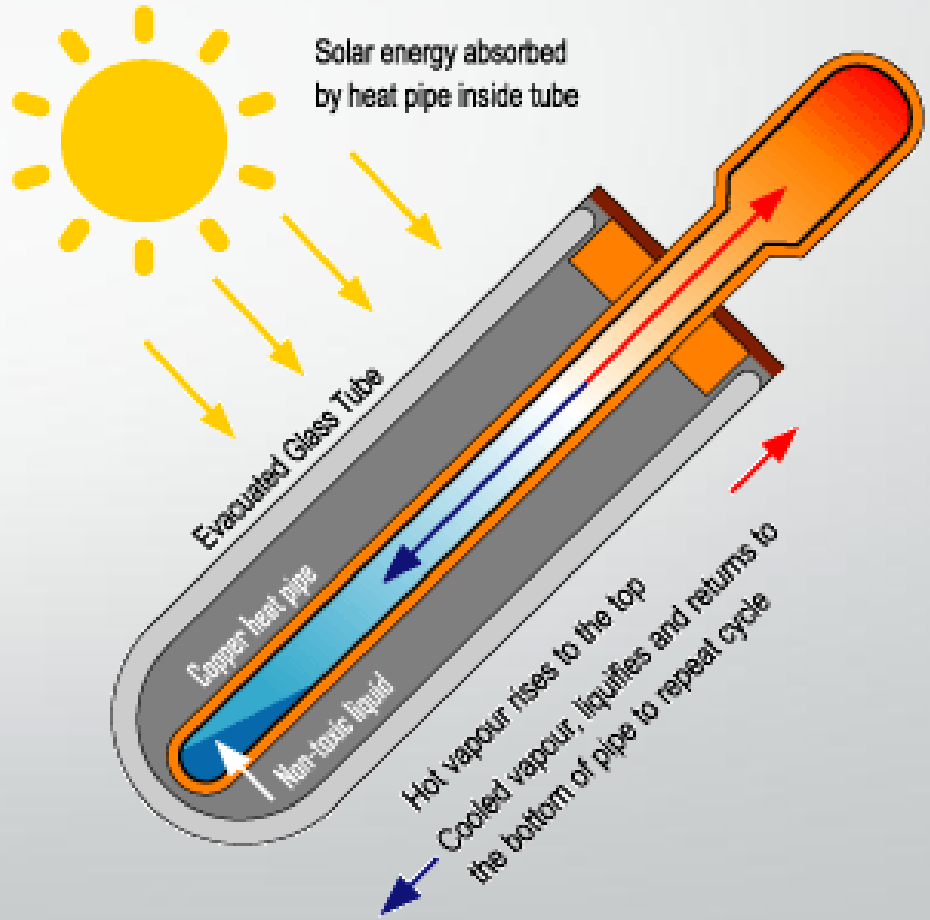
SWHs on a housing complex in Trinidad

Evacuated Tube Collector

- Evacuated tube collectors produce higher temperature water and are more complex than flat plate collectors.
- Evacuated tube collectors consist of a series of tubes that contain a heat pipe to absorb solar energy and transfer it to a liquid medium.
- The tubes are evacuated (vacuum) so that there is very little heat loss from the tube.

EVACUATED TUBE COLLECTORS

- **Heat Pipe**
- Operating efficiencies of well over 90%.
- That means that more than 90% of the sun's energy landing on a surface is converted into heat which can be used to heat water.
- This is also one of the cheapest renewables.



ADVANTAGES

- The advantage of using **Evacuated Tubes** is that they will work even during the coldest winter months unlike the **Flat Plate Solar Collectors**.

- The vacuum prevents the heat tube from being cooled much by the ambient temperature which can be well below freezing, and so winter sun can easily heat water to 50+ degrees, even in the depths of the coldest season.

- Even if it is very cloudy and very cold, enough sunlight gets through to keep the tubes well above freezing and so they will be still be pre-heating the water which can then be heated further by conventional methods.

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SOLAR WATER HEATERS AT UWI

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SIZING FOR SWHS

NO. OF PERSONS IN HOUSEHOLD	RECOMMENDED STORAGE TANK SIZE GALLONS (LITRES)	Recommended Collector Area Squared Feet (SQUARED METRES)
1-2	60 gallons (227 Litres)	30 sq ft ($2.8m^2$)
3-4	80 gallons (303 Litres)	40 sq ft ($3.7m^2$)
5-7	120 gallons (454 Litres)	60 sq ft ($5.6m^2$)

N.B *the specifications given in this table are based on a hot water temperature range of 50 – 60 ^{0} C minimum at the outlet of the storage tank.*

ECONOMIC ANALYSIS

- An average family of four can use approximately 12 kWh of electricity per day for water heating
- Using an average cost of 6 US-ct/kWh in T&T (2009 tariff), the annual cost is US$ 263 (TT$ 1682), as opposed to US$ 1,605 in Barbados.
- At an average cost of $2200 US for an 80-gallon capacity standard thermosiphon SHW, this would indicate that the payback period is approximately eight (8) years.
- With the tax credit of 25% on the cost of a SWH, up to a maximum of $10,000 TT offered by the Government of Trinidad and Tobago, the payback period would be reduced to six (6) years.
- In Barbados the systems will pay back for themselves after only 1.5 years.
- Well-designed and manufactured SWHs will operate for more than 15 years without major problems, adding further support for their viability.

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ENVIRONMENTAL BENEFITS

- Depending on the size, a domestic SWH substitutes between 2,000 and 3,600 kWh electricity annually and consequently offsets 1.4 to 2.5 tons CO_2 under T&T conditions.
- With a medium value of 2.0 tons CO_2 and an assumed coverage of 30% of all households (equivalent to about 110,000 households), the use of SWH systems in the residential sector would mitigate CO_2 emissions by about 200,000 tons annually.
- While globally Trinidad and Tobago emits only a small percentage of greenhouse gases, on the Caribbean front it is by far the largest emitter of GHGs.
- Therefore through the use of SWHs, T&T can take its first steps to reduction of dangerous GHG emissions and take its responsibility to the region seriously.

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SWH'S CONTRIBUTION TO CLIMATE PROTECTION

- The Kyoto Protocol established the Clean Development Mechanism (CDM) to enable trade in certified greenhouse gas emission reductions between developing and industrialised nations
- Solar Water heating can help developing nations leverage new resources via carbon markets to support environmental protection and economic development
- Water heating represents a high % of energy consumption in homes and businesses, *more than 30% in some cases*
- SWHs can supplement or replace conventional heaters, *displacing some conventional fuel*
- Solar water heating –a cost effective way of reducing greenhouse gases
- SWHs can help in the abatement of carbon emissions

CARBON ABATEMENT FROM SOLAR WATER HEATING IN SELECTED COUNTRIES

Country	Data source	Retail cost per liter	Number of liters in average system	Average cost of system	Tons CO2 abated /100L/ yr	Tons CO2 abated/ system/ yr
Barbados	Government	$6.00	300	$1,800	1.07	3.20
Brazil	Vitae Civilis; Econergy	$4.20	200	$840	0.46	0.92
China	Hua	$1.45	180	$261	0.45	0.81
China	Hua	$2.17	150	$326	0.45	0.68
India	MNES	$3.50	100	$350	1.50	1.50
Mexico	Quintanilla	$6.65	300	$1,995	0.59	1.77
Mexico	Davila	$5.66	265	$1,500	0.90	2.39
South Africa	SSN	$5.63	150	$844	0.96	1.44

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CURRENT FISCAL INCENTIVES

- 25% Tax Credit on SWH (up to a maximum of TT$ 10,000.00 acquired for use by households)
- 0% VAT on SWHs
- 150% Wear and Tear allowance for SWHs SWH plant, machinery and equipment
- Conditional duty exemptions for SWH manufacturers.

RECOMMENDATIONS

- In order to make a significant impact in terms of avoided cost for electricity for water heating and also in terms of CO_2 emissions, a penetration of about 10,000 SWH systems in the first instance would need to be realised. This could take approximately two years to materialise.

GOVERNMENT PROGRAMME

Market introduction of SWHs should include different elements:

- incentives
- capacity building
- sensitisation programmes
- standards
- testing, etc

SUPPORT NEEDED FOR FURTHER MARKET STIMULATION

- An enabling environment for SWH penetration must be created by the Government. This must ensure long-term fiscal and regulatory framework for both manufacturers and consumers.
- 100% Tax Credit on Solar Water Heaters (up to a maximum of $12,000.00 TT acquired for use by households) for the first five (5) years of its implementation to jump-start the industry.
- Government can work by setting example: In the short-to-medium term, all new Government housing complexes and public buildings (such as hospitals, clinics and school laboratories) that utilize a significant volume of hot water should be equipped with SWHs for all the hot water needs of the establishment.

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FURTHER SUPPORT

- Older Government social housing establishments should be retrofitted with SWHs
- Mandatory requirement of SWH installation for all those establishments with a high consumption of hot water, such as hotels, restaurants, hospitals etc.; for new constructed buildings effective immediately, for existing buildings after a grace period.
- Dedicated efforts towards public education should be given priority.
- Established NGOs and champions for SWHs should be allowed a greater level of prominence through public forums for sensitising the public at large.
- Choice of manufacturing options must be done largely by ascertaining quality products over and beyond other factors.
- Government must work with manufacturers to ensure that high quality products, certified and labeled by the Trinidad and Tobago Bureau of Standards (TTBS), are developed

Ways Government can assist

- Government must encourage innovation through competitions with attractive prizes.
- Higher taxes/penalties for electric water heaters must be imposed to make SWH prices and benefits more attractive to the consumer; investment in SWHs would then become more attractive.
- Carbon trading could be considered as a further incentive to stimulate the penetration of SWHs.
- The average man on the street is unaware of energy efficiency and greenhouse gas emissions. Government can assist by providing sensitisation programmes to the public through collaboration with specialists and experts in these areas.
- Continuous R&D are important for competitiveness of the industry. Both, government and private sector, can work with academic institutions to further develop new technologies/designs that support GHG emissions reduction.

CAPACITY BUILDING

- One of the major problems in T&T regarding solar water heating is lack of trained personnel to service the industry.
- There are only a couple of companies who have technicians trained in installing and servicing the SWH industry.
- This underlines the urgent need for training and capacity building programmes in Trinidad and Tobago at different professional levels.
- The UWI has conducted limited training workshops in solar water heating technology. However, there is need to widen the target group to prepare the workforce for a possible expansion of the SWH industry.
- In particular, training needs to be conducted for various categories/groups of personnel who would be in the SWH manufacturing and installation industry.
- Training at different levels must be directed to managers, consumers, financiers, technicians, teachers, policy makers, government officials dealing with SWHs, customs officers, and others.

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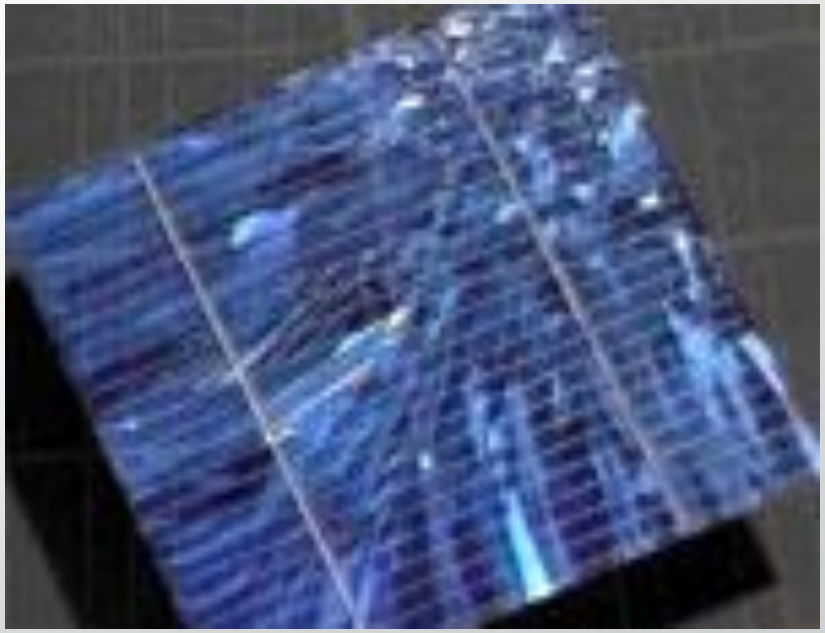
PHOTOVOLTAICS: WHY PV?

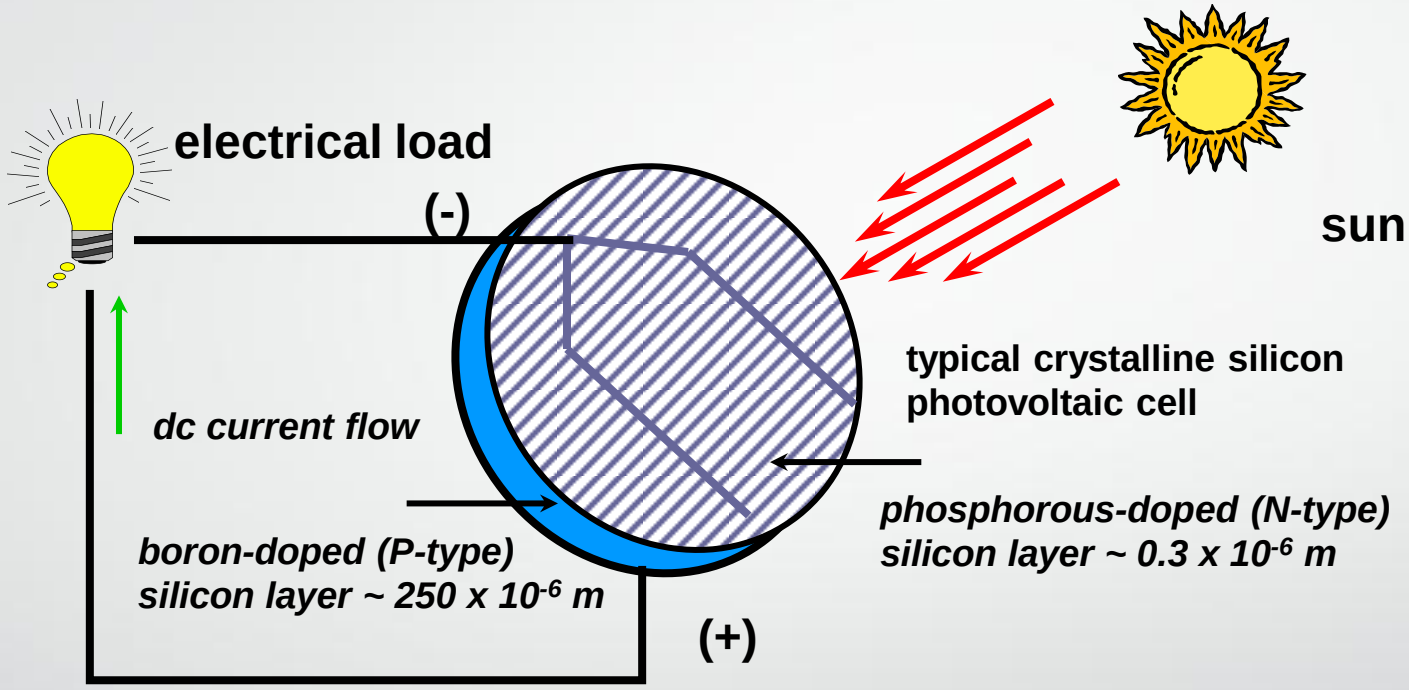
- For power-generation PV has little impact on the environment.
- It doesn't require liquid or gaseous fuels to be transported or combusted.
- As a domestic source of electricity, it contributes to the nation's energy security.
- As a relatively young, high-tech industry, it helps to create jobs and strengthen the economy.
- As it costs increasingly less to produce and use, it becomes more affordable and available.

THE PHOTOVOLTAIC CELL

- *Solar cells*, individual PV cells are electricity-producing devices made of semi-conductive device which converts the sun's energy directly into electricity.
- The conversion is done by a physical phenomenon known as *the Photovoltaic Effect.*
- PV cells come in many sizes and shapes — from smaller than a postage stamp to several inches across.

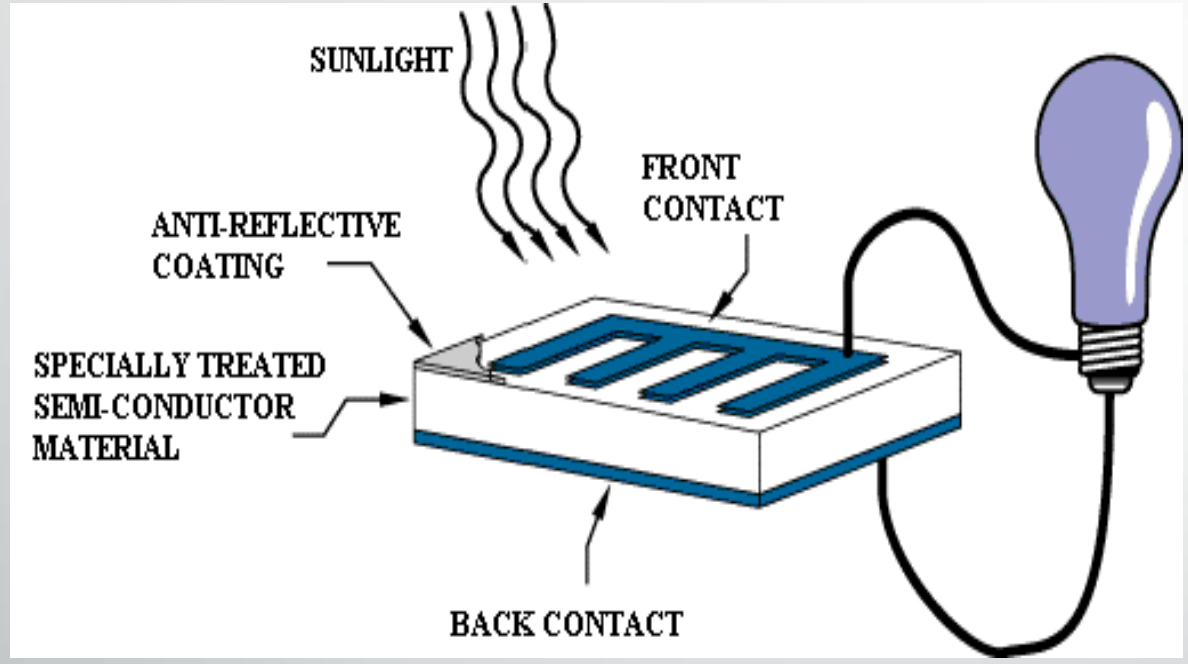


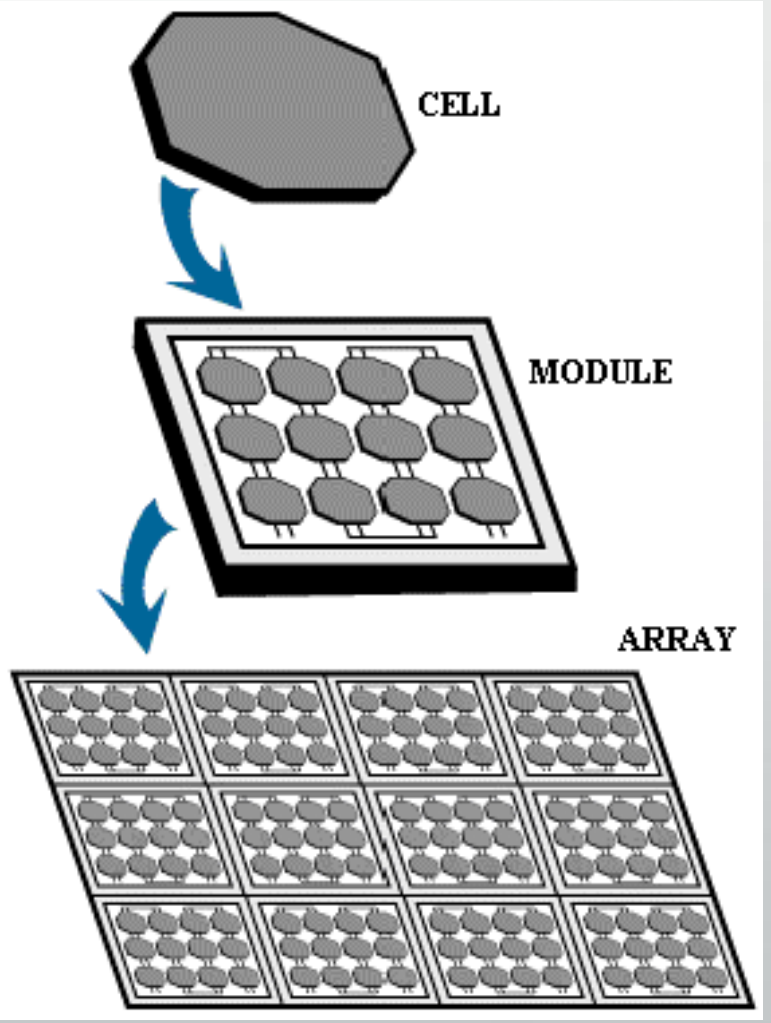
SOLAR CELL



The basic photovoltaic device that generates dc electricity when exposed to light. A typical silicon solar cell produces about 0.5 volt and up to 6 amps and 3 watts for larger area cells.

How does it work?





PV AT UWI

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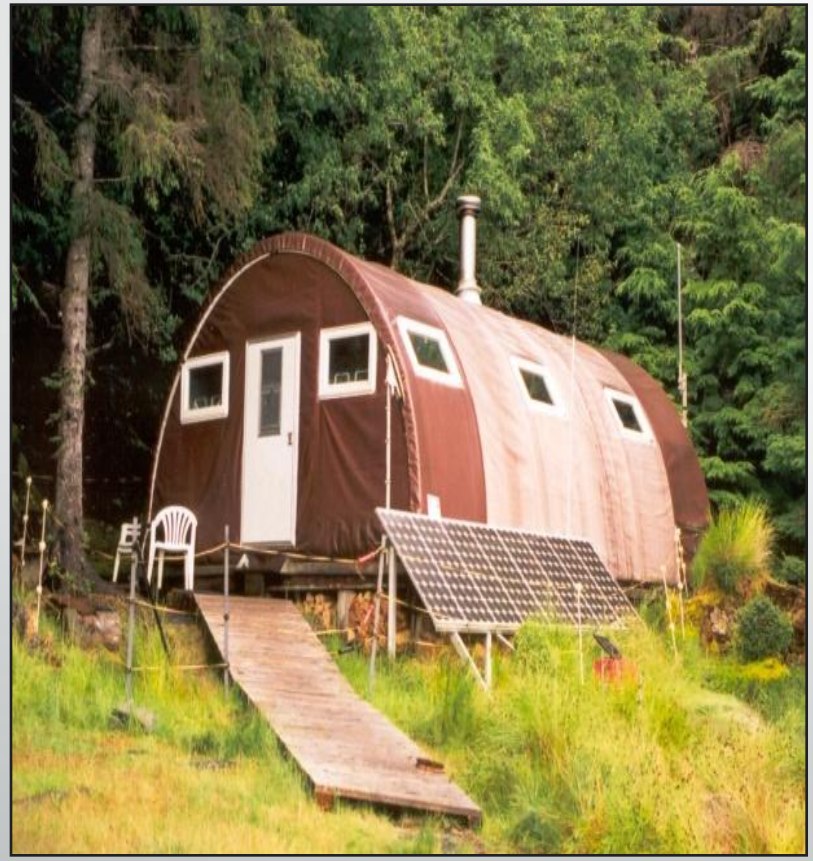
SOLAR LIGHTING

ENERGY SECURITY APPLICATIONS

HOME PV SYSTEMS



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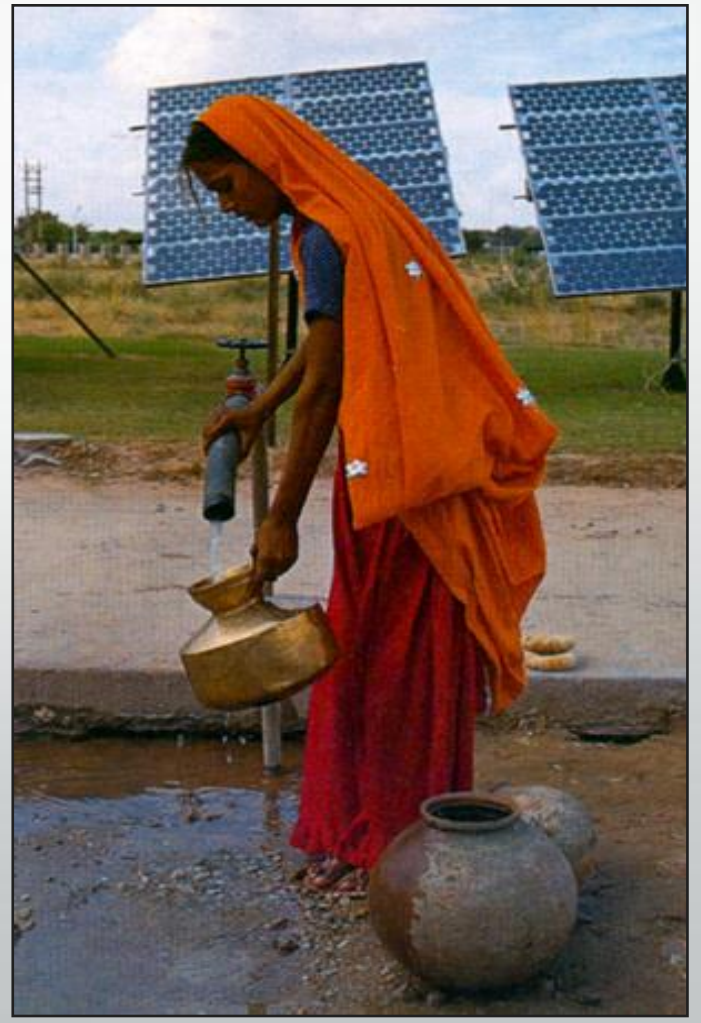
Village Home PV Electrification in Nepal

Water Pumping PV Systems

- Cost-effective when off-grid
- Load correlation
  - Storage in water tank
  - Seasonal load correlation
- Improved water quality
- Convenient
- Reliable
- Simple
- More than 10,000 PV powered water pumps are successfully operating throughout the world.



ROOFING MATERIAL

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COMPLETED PROJECTS - T&T

- The Piarco International Airport solar powered LED airfield lights project
  - 50 000 USD spent to replace the airfield lights with Carmanah solar-powered LED airfield lights. The fleet included:
    - Runway edge lights
    - Approach lights
    - Threshold lights
    - Taxiway lights

INDUSTRIAL APPLICATIONS

- **Telecommunications**
  - TSTT uses PV systems to power some of their SR500 sites
    - In 1990-1991 TSTT invested in 1 kW to 2 kW systems
    - In 2000 twelve more systems were purchased
  - Use of beacons powered by PVs
- **Off-shore oil companies**
  - Used to provide platform lighting and power to facilitate the energy requirements of the platforms
  - Some systems use explosion proof materials (9).

INDUSTRIAL APPLICATIONS

- **Navigational needs**
  - Several buoys and beacons used for navigational aids are powered by PV
  - Solar Barge lights are used for Marine navigational purposes
- **Water and Sewage Authority**
  - Some ninety odd sites with solar powered Supervisory Control and Data Acquisition (SCADA) systems
- **National Gas Company**
  - Uses solar powered SCADA systems for pipeline monitoring

PV POWERED TELECOMMUNICATION SITE - TOBAGO

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OIL AND GAS PLATFORM – HAZARDOUS LOCATION RATED

OFFSHORE SOLAR LIGHTING

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PV INSTALLATION IN TRINIDAD

HOUSE LOCATED IN RURAL VILLAGE IN TRINIDAD

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PV-POWERED CHICKEN FARM

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SOLAR POWER SYSTEM IN BERLIN

PV TELECOMMUNICATIONS

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PV FOR SPACE MISSIONS

- Photovoltaic systems were an important power source for the Mariner 5 mission.
- Solar cells have not only enabled America to explore space, the solar system, and the Earth in great detail, they also have enabled the emergence of the telecommunications industry.

(Credit: NASA and NSSDC Photo Gallery)

MARINER 5 IN FLIGHT

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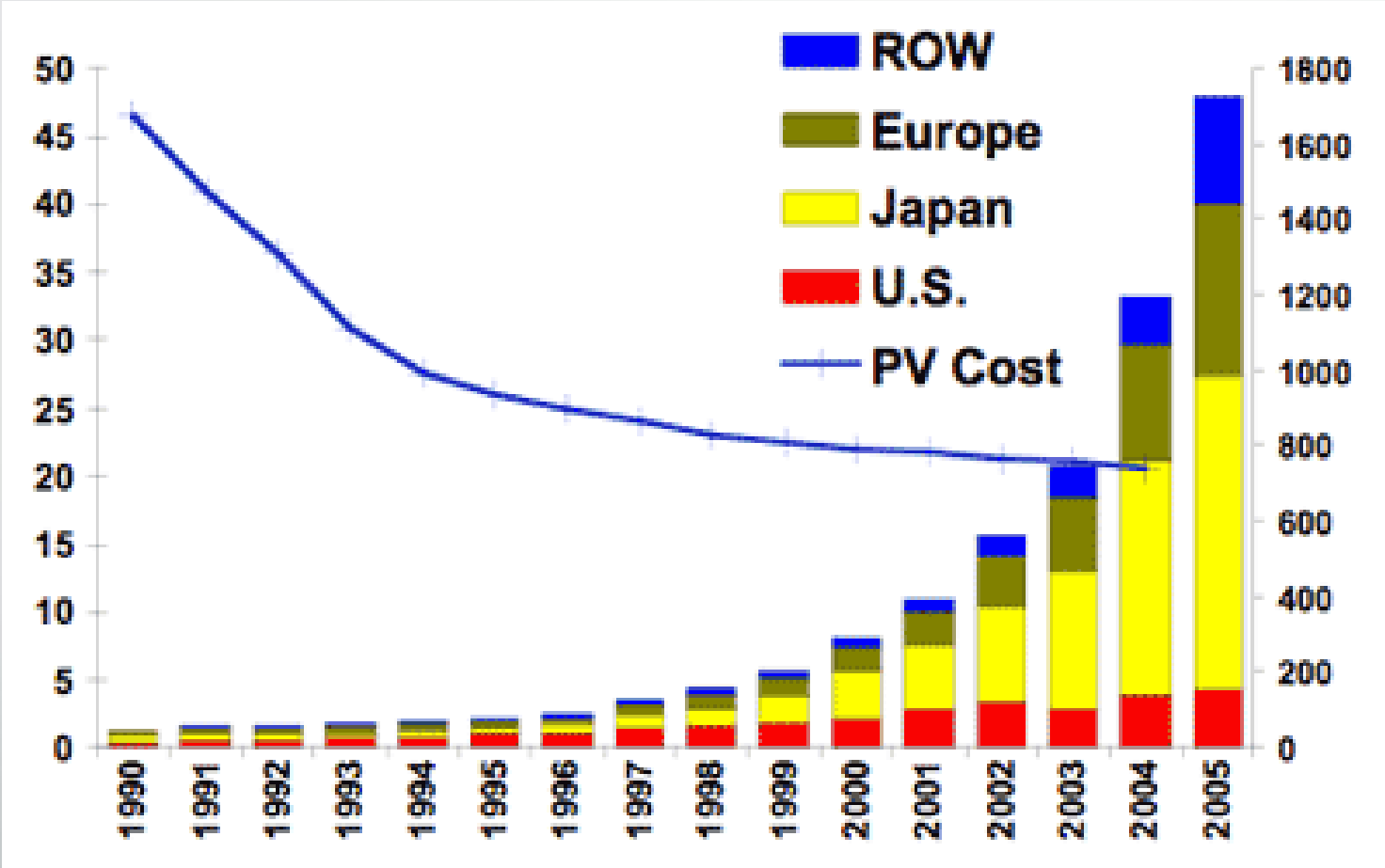
PV FUTURE



PV News, Volume 25, Number 3, March 2006, published by the Prometheus Institute for Sustainable Development

Wind Energy

- Within the past 10 years the global installed capacity has increased more than tenfold
- The Caribbean is ideally suited to wind energy systems since the wind regime is good in these parts

WIND ENERGY

- The potential for off-shore wind turbines is considerable
- Although the installation costs are higher, the output can be up to 40% higher
- Off-shore windparks have a minimal impact on landscape and the environment
- The Caribbean is ideally suited for this technology

Wind Energy - Jamaica

- Success story in the region – 20.7 MW windfarm in Wigton, Jamaica – twenty three 900 kW NEG Micon turbines
- Involved eight years of study by Delta Caribbean and Renewable Energy Systems of the UK
- Completed in July 2004
- Jamaica recently completed a further 20 MW windfarm

WIND ENERGY
ABC DUTCH CARIBBEAN ISLANDS

- Aruba: 30 MW
- Bonaire: 11 MW
- Curacao: 15 MW

Wind Energy – Projects

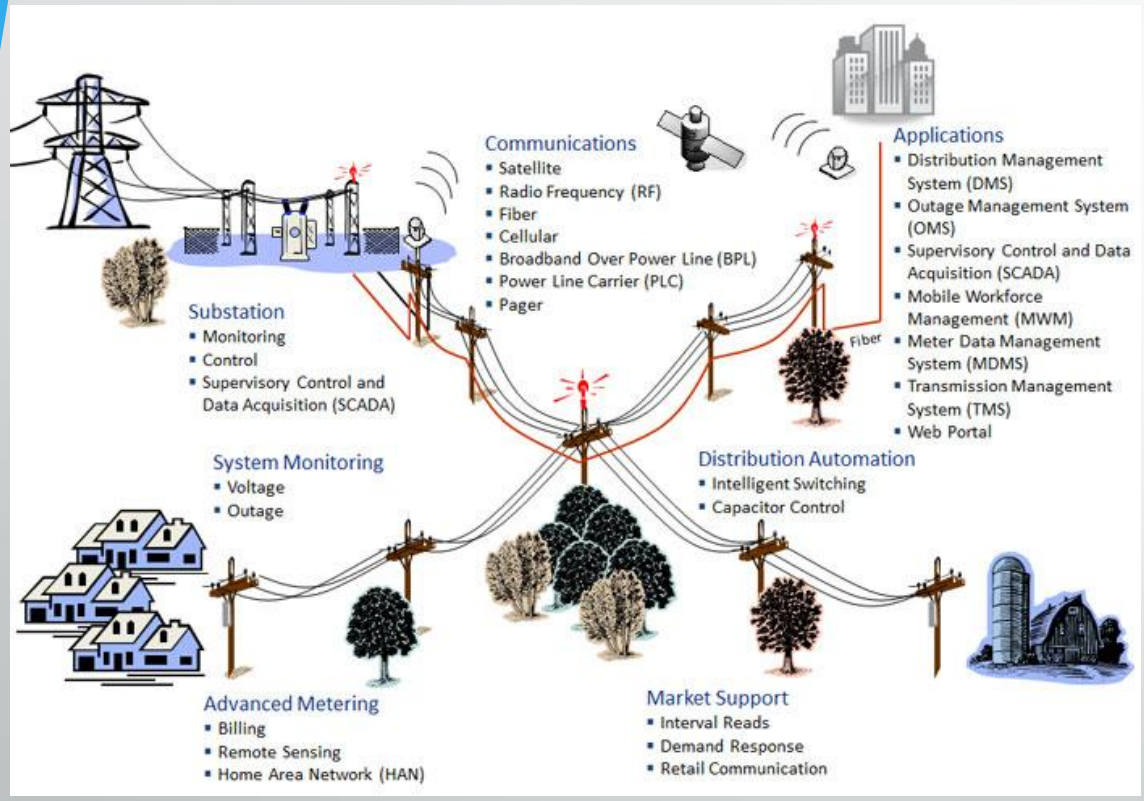
- Guyana has embarked on a 12 MW windfarm project
- Guadeloupe has been operating grid-connected windfarms since 1992 with installed capacity of 18.1 MW
- The French company Vergnet is operating the windfarms both in Guadeloupe and Cuba
- **Trinidad & Tobago is conducting a Wind Resource Assessment Programme (WRAP) – UWI, MEEA & NEC**

SMART GRID

- A **smart grid** is a modernized electrical grid that uses analogue or digital information and communications technology to gather and act on information, such as information about the behaviours of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity (Wikipedia).

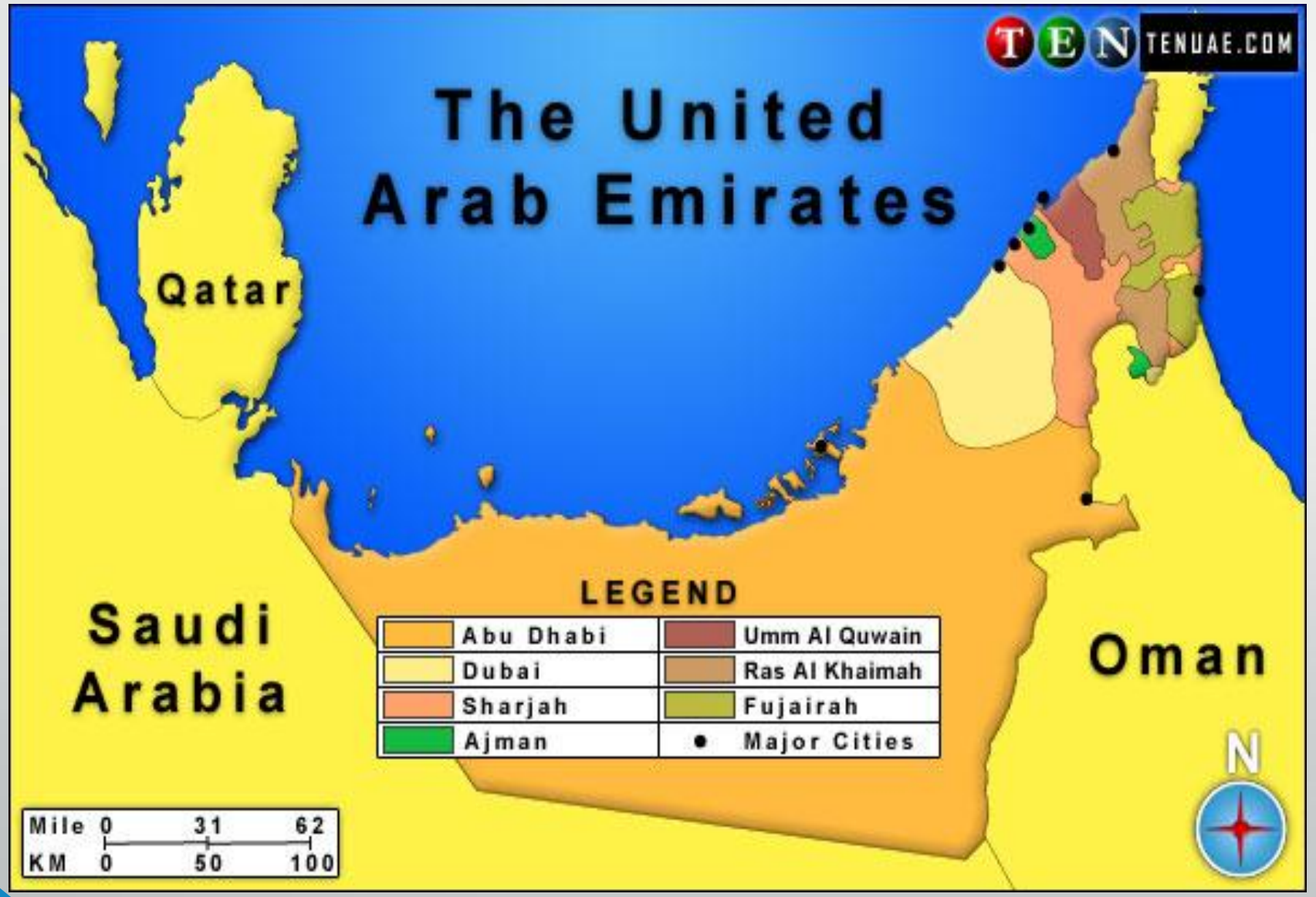
- "**Smart grid**" generally refers to a class of technology people are using to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. These systems are made possible by two-way communication technology and computer processing that has been used for decades in other industries (US DOE).

SMART GRID


Communications
▪ Satellite
▪ Radio Frequency (RF)
▪ Fiber
▪ Cellular
▪ Broadband Over Power Line (BPL)
▪ Power Line Carrier (PLC)
▪ Pager
Applications
▪ Distribution Management System (DMS)
▪ Outage Management System (OMS)
▪ Supervisory Control and Data Acquisition (SCADA)
▪ Mobile Workforce Management (MWM)
▪ Meter Data Management System (MDMS)
▪ Transmission Management System (TMS)
▪ Web Portal
Substation
▪ Monitoring
▪ Control
▪ Supervisory Control and Data Acquisition (SCADA)
Fiber
System Monitoring
▪ Voltage
▪ Outage
Distribution Automation
▪ Intelligent Switching
▪ Capacitor Control
Advanced Metering
▪ Billing
▪ Remote Sensing
▪ Home Area Network (HAN)
Market Support
▪ Interval Reads
▪ Demand Response
▪ Retail Communication


The Smart Grid Can Deliver
Market
BENEFITS
▪ Enhanced energy security
▪ Reduced greenhouse gases
▪ Improved urban air quality
▪ Increased grid asset utilization
"Valley Filling"
(Energy for PHEVs)
PHEV

SMART AND SUSTAINABLE CITIES



MASDAR DEVELOPMENT - UAE

- "Masdar City" a planned carbon-neutral town in Abu Dhabi
- Transforming oil wealth into renewable energy leadership
- Long-term goal of a transition from a 20th Century, carbon-based economy into a 21st Century sustainable economy.

MASDAR INITIATIVE

- The Masdar Initiative is a new 6 million square meter sustainable development that uses the traditional planning principals of a walled city, together with existing technologies, to achieve a zero carbon and zero waste community.
- Masterplanned by Foster + Partners, the initiative has been driven by the Abu Dhabi Future Energy Company.
- Masdar City combines state-of-the-art technologies with the planning principles of traditional Arab settlements to create a desert community that aims to be carbon neutral and zero waste
- Masdar City includes the headquarters for the International Renewable Energy Agency and the recently completed Masdar Institute.

MASDAR CITY

THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE CAMPUS

MASDAR'S RESIDENTIAL BLOCK

MASDAR CITY SKYLIGHT

ABU DHABI

- Home to 8 % of proven global crude oil and hydrocarbon reserves to last 100 years
- Target of 7 % of its total energy needs from RE by 2020
- Dubai – 5 % by 2020.
- Demonstration of what a responsible oil producer can do to create a balance between hydrocarbons and RE to address climate change and energy security.

Saudi Arabia: World's Biggest Solar Thermal Plant

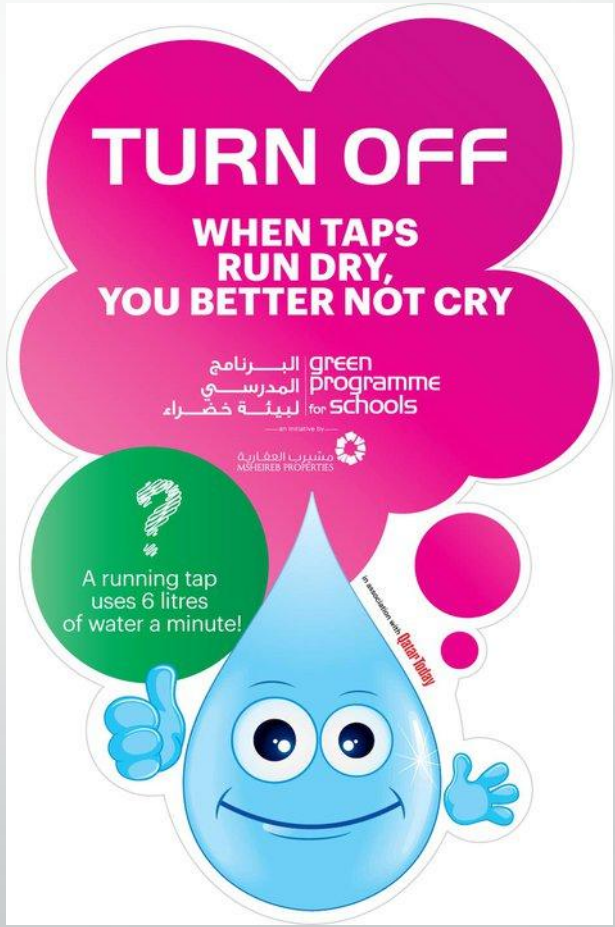
- The world's largest solar thermal plant opened in Riyadh, Saudi Arabia.
- The new plant is almost double the size of what was previously the largest solar thermal facility (located in Denmark) – collector area of 36,000 sq. m.
- It will generate enough power to heat water for the Princess Noura Bint Abdulrahman University for women in Riyadh of 40,000 students and 20,000 female staff
- GREENTecONE, an Austrian solar design company, supplied the solar panels for the project.
- Target of 10 % of energy from solar by 2020.

SAUDI ARABIA'S SOLAR THERMAL PLANT

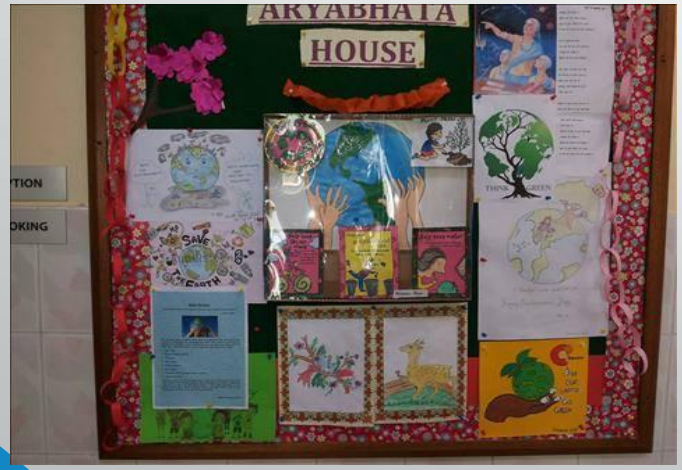
THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE CAMPUS

QUATAR'S SCHOOLS' PROJECT

- Powering Quatari's schools using solar energy
- Project launched on Earth Day
- Driver: Quatar has the highest emission per capita in the world
- Action: Building a strong body of renewable energy resources
- Quatar: A knowledge centre for solar and renewable energies.



QUATAR'S SCHOOLS PROJECT



UNITED ARAB EMIRATES

- Pursued a path of development focusing on social, urban, educational and economic
- Utilising high growth thru hydrocarbon exports to diversify the economy
- Minimising dependence on oil as the main driver
- Increasing contributions of RE in energy mix
- Home of IRENA.

CARICOM ENERGY

- **Caribbean Community (CARICOM) 15 countries**
- **Total Population = 16 M (approx);** ***Haiti 9.3(58%), Jam 2.7 (17%), T&T 1.3 M, OECS***
- **Geographic Area = 465,000 sq km**

- **Annual Fuel Import Bill** = ***US$10 Billion*** *in 2008 c.f. food US$3B*
- **Oil Imports = 93 M BBls/year - 2008**
- Electricity Capacity = 4,800 MW (approx - 2009); 3,800 MW

  -Pk Dmnd

- **Electricity consumption** = 18,000 GWh (2009)
- Oil Production (T&T, Bar, Bel, Sur) = 120,000 Bbls/day (approx)
- Oil Refining capacity = 200,000 Bbls/day (approx); T&T – 160, Jam 35, Sur 7

CARICOM ENERGY CONT'D

- ***Electricity Tariff Range:*** *US$0.04/kwh to US$0.50/kWh (2008);*
- ***Impact of Oil Price Volatility:*** *US$10 rise in the price of oil, increase tariffs of US 3.5 cents /kWh (worst case in 2008)*

- **Renewable Energy Potential = Large!!** *Many multiples the current demand (Hydro, Solar, Wind, Geo, Biomass, Marine)*
- ***% RE in Electricity Sector = 8% approx;***

  % RE in **Total Energy supply < 3%**

- **Persons without access to modern forms of energy 7 M** (approx)

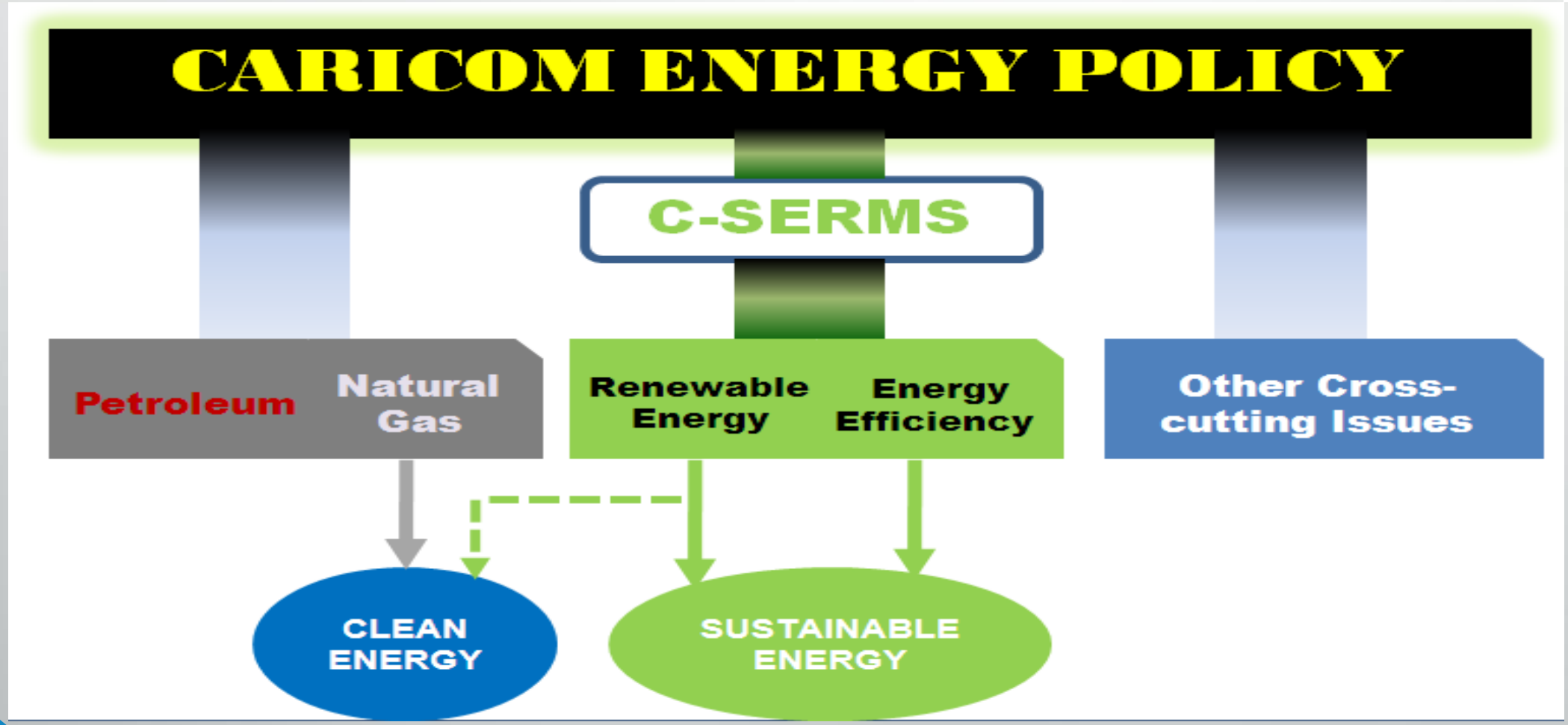
- **Countries with Draft or Approved Energy Policy = 13**
- **Regional Energy Policy : Established**

REGIONAL INITIATIVE: CREDP

- "To reduce barriers to the increased use of renewable energy thus reducing the dependence on fossil fuels while contributing to the reduction of greenhouse gas emissions " .
- CREDP is an initiative of the Energy Ministers of CARICOM region established to change the market environment for Renewable Energy in the Region.
- Its current focus is on Energy Conservation and Energy Efficiency – GIZ - to 2012

NEW INITIATIVES

- Implementation of a Regional Energy Policy
- Caribbean Sustainable Energy Road Map and Strategy (C-SERMS) and Platform
- Caribbean Renewable Energy Capacity Support (CRECS) Project
- Sustainable Energy Technical assistance (SETA-OECS/CDB) Project
- Caribbean Sustainable Energy Program (CSEP)
- CARICOM Energy Awareness Initiatives


CARICOM ENERGY POLICY
C-SERMS
Petroleum
Natural Gas
Renewable Energy
Energy Efficiency
Other Cross-cutting Issues
CLEAN ENERGY
SUSTAINABLE ENERGY

What do we need as a region?

Build human capacity

Executives and other professionals
- Policy makers

Scientists

To manage the more efficient use of energy

To facilitate the uptake rate of renewable energy technologies

Technologists

essential transition to utilizing a more distributed indigenous renewable energy resource.

Energy Security

Sustainable Development

Environment & Climate Change

TRINIDAD & TOBAGO

- The GoTT is currently developing a national energy policy green paper that recognizes RE combined with EE and utilization of CNG in the transportation sector, as important strategies for the promotion of sustainable.
- The Ministry of Energy and Energy Affairs is currently spearheading a number of initiatives in this regard.

FINANCE ACT NO. 13 OF 2010

SOLAR
25% Tax Credit on Solar Water Heaters (SWH)
0% VAT on SWH& Solar PV Systems
Wear & Tear Allowance on 150% of cost of acquisition of SWH; SWH Plant , Machinery and Equipment & Solar PV Systems
Conditional Duty Exemptions for SWH Manufacturers

WIND
0% VAT on Wind Turbines
Wear & Tear Allowance on 150% of cost of acquisition of Wind Turbines and supporting equipment

Energy Efficiency
150% Tax Allowance for the design and installation of energy saving systems by an Energy Service Company (ESCO)
ESCO can write off value of assets in two years: - a)75% Depreciation on plant, machinery and equipment acquisition; b)25% Wear& Tear allowance in following year.

LEGISLATIVE AGENDA

- Review of the Trinidad and Tobago Electricity Commission (T&TEC) and Regulated Industries Commission (RIC) Acts

Key Issues:

- Open access
- Grid interconnection
- Feed-in tariff
- Net metering
- Net billing

Collaboration with UNEP to develop a framework for policy and legislation to govern feed-in tariffs

PILOT PROJECT: HOME EFFICIENCY SELF SUFFICIENCY (HESS) PROGRAMME

Landmark : First Grid- tied RE Project in T&T

Wind turbine at Islamic Children's Home Gasparillo, South Trinidad

- Hybrid PV and Wind 2.5Kw
- PowerGen spearheaded initiative
- T&TEC technical support & monitoring

Why should a hydrocarbon fuel producer invest in RE?

- Prolongs the life of the hydrocarbon reserves
- Reduces risk and enhances profits through diversification
- Ensures long term growth and energy security while reinforcing its position as a global/regional energy leader
- Gains international recognition
- Secures a sustainable future
- Preserves the environment and fragile eco system.

Why should a hydrocarbon fuel producer invest in RE?

Economics of Solar Energy

- The cost of power generation from RE is less expensive than fossil fuels if the hidden costs of environmental and public health costs are considered.
- A reduction in GHG emissions reduces environmental pollution and saves expenditure on health care.

ACHIEVING SUSTAINABLE DEVELOPMENT

In order to achieve sustainable development and ensure that all three pillars are recognised as fundamental to the process, the following steps must be taken:

-Institutional strengthening
-Revision of legislative and regulatory framework
- Increased public education, genuine consultation and participation
-Attitudinal changes
-Diversification of the economy
-Reforms in the social sphere.

TRANSITION TO SUSTAINABILITY

- The transition requires a greater synergy among the three (3) pillars of sustainable development.

- Greater emphasis must now be placed on managing natural resource base and protecting the environment so that development in this area would be on par with the other two (2) pillars.

- This requires formation of new laws and legislation, and also the strengthening of existing ones with special focus on more stringent enforcement and initiatives to promote a green economy.

RECOMMENDATIONS FOR SUSTAINABLE CITIES

- Promote urban transportation system reform that encourages the integration of efficient public transit systems and non-motorized modes (pedestrian and bike paths) through national policy, financial incentive development, technical analysis and support for local implementation;
- Establish pioneering transit-oriented design and compact development pilots, and draw upon these demonstrations to inform national policy;
- Build strong capacity for sustainable urban planning and development through training programs for key government and technical personnel; and
- Support development of eco-cities, including policy and implementation.

WAY FORWARD TO SUSTAINABLE CITIES

- Advance economic policy activities wrt. RE
- Formulate legislative frameworks and establish government structures
- Reduce subsidy on fossil fuels and increase subsidy on RE
- Increase cooperation with international organisations, foreign companies and donor countries
- Political Will and Conviction for Development of Renewable Energy
- Focus on Sustainable Cities

THANK YOU