Stocktaking of Existing Initiatives:
The Guyana Energy Sector

GEA
GUYANA ENERGY AGENCY

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Presentation Outline

- Policy and Strategy Framework
- Country Background
- Vision and Mandate
- Renewable Energy
- Energy Efficiency

National Energy Policy

- Developed in 1994
  - One of the first to be formalized in the region
  - Foundation that has helped catalyse the sustainable energy roadmap for the country

- Key objectives:
  - to provide stable, reliable and economic supply of energy;
  - to reduce dependency on imported fuels;
  - to promote where possible the increased utilization of domestic resources;
  - to ensure energy is used in an environmentally sound and sustainable manner.

National Development Strategy (2001-2010)

- Emphasizes that the Energy sector can play a strategic role in the development of Guyana's economy through improving the quantity, quality and reliability of the electricity supply.
- Specific objectives include
  - reducing our dependency on imported petroleum products;
  - increasing the utilisation of new and renewable domestic energy resources;
  - ensuring that energy is used in an environmentally sound and sustainable manner; and
  - encouraging, through public awareness programmes and incentives, energy conservation practices.

Hinterland Electrification Strategy (2007)

- GoG, as part of its socio-economic development and poverty alleviation objective, embarked on the Unserved Areas Electrification Programme (UAEP)
- Objective:
  - extend electricity to unserved areas where extension of existing distribution networks is deemed to be economically feasible.

Guyana Power Sector Policy and Implementation Strategy (2010)

- Developed primarily for the Power Sector to ensure its viability, this Policy inextricably links renewable energy and energy efficiency as a means of reducing the country's dependence on imported fossil fuels.

Low Carbon Development Strategy (LCDS) (2010)

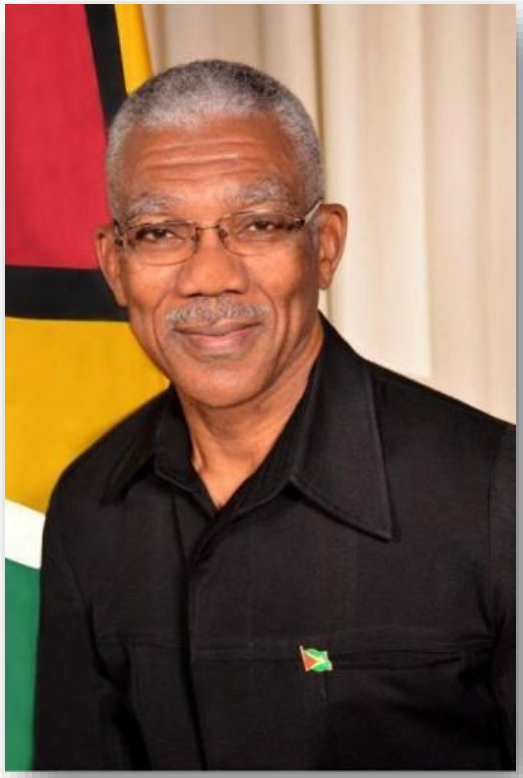
- Seeks to protect and maintain Guyana's forests to reduce global carbon emissions and at the same time attract resources for the country to grow and develop
- Several focus areas including:
  - Investing in strategic low carbon economic infrastructure, including a hydro-electric plant at Amaila Falls

Regional Context

"One of the priorities of CARICOM Heads of Government is for the Region to embark on a more **sustainable pattern of energy supply**, and end-use for the **future**, through greater utilization of renewable and **sustainable energy** sources, **reduced dependence on fossil fuels** and greater **efficiency and conservation** in the use of energy, within the context of energy security and the desire for a **low carbon** approach to development." (CARICOM Energy Policy).

"The Government of Guyana must lead the way in transitioning towards greater **renewable energy** use.

Every **government building**, every **exhibition centre**, every **hospital**, every **school** must over the **next five years**, convert to utilising alternative sources of energy."



Brigadier David Arthur Granger, MSM, MSS
President of the Cooperative Republic of Guyana

Update of the Guyana Energy Policy

- Development of a cohesive, appropriate and broad-based national energy policy to move Guyana from an economy that is inefficient in its energy use and wholly dependent on imported, market sensitive fossil fuels, to an energy efficient, low emission economy, based largely on economically efficient, indigenous energy resources. The process will involve consultation with the relevant stakeholders.
- Currently ongoing. Expected to be completed by December 2016.

Guyana's Power Generation Systems Expansion Study

- This study examined Guyana's current power generation and transmission systems and future electricity demand up to 2035, current and future oil prices, renewable energy technologies and regional developments and initiatives for power generation such as natural gas, Arco Norte Interconnection Project, and recommends the options and action plan for the optimal development and expansion of the country's power generation systems for the next 20 years.
- Identified a combination of 150 to 180MW hydropower, 13 to 26 MW Wind, 6MW Solar, 15MW bagasse power and eventual conversion from HFO and LFO to Natural gas.

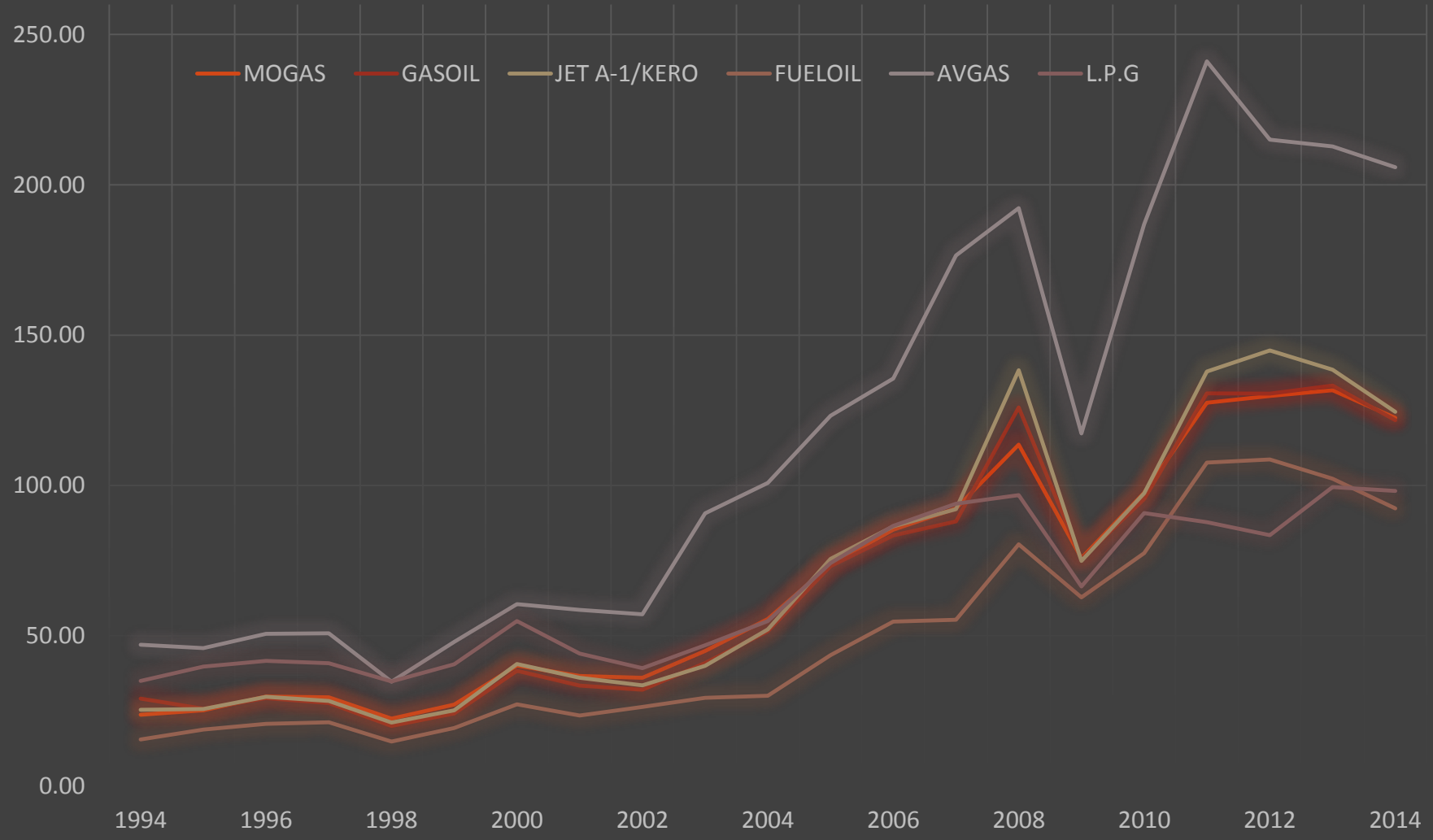
Our Energy Dependence

- Current energy supply: diesel (gasoil), bagasse, fuel oil, gasoline, rice husk, kerosene, LPG, fuelwood, charcoal, avgas, solar photovoltaics, biogas and biodiesel.
- World energy consumption in 2013 = 66,436 million boe
- Guyana's energy consumption in 2013 = 4.5 million boe

(0.007% of world energy consumption)

2014	
Population	**747,884 (2012 census)**
GDP	**US$2.7 billion**
GDP/Capita	**US$3,148/capita**
Main Energy sources	**Imported petroleum products**
Petroleum Imports	**US$562 Million**
Petroleum Imports/GDP	**21%**
Avg. Petroleum imports	**13,531 bpd**
Final Energy Consumption	**4,628 kboe**
Energy Intensity	**1.72 kboe/US$Million**

Unit CIF Value of Petroleum Imports



Overview of Existing Sustainable Energy Policies

- Energy efficiency and renewable energy: 2 main elements of sustainable energy.
- At present, highly dependent on petroleum fuel imports but the vast natural resource base provides the country with significant options for the development of renewable energy sources.
- The country's energy policy is therefore remains focused on developing and utilizing its own energy sources, improving efficiencies and energy conservation.

Vision:

- Ensure that reliable energy is provided to all in Guyana within an economically, environmentally and socially sustainable framework; with increasing consideration of renewable energy sources.

Mandate:

- Advice and recommendations to the Minister regarding any measures necessary to secure the efficient management of energy and the source of energy in the public interest;
- Develop and encourage the development and utilization of sources of energy other than sources presently in use.

Alternative Energy in Guyana

- Hydropower
- Biomass and Bagasse-based cogeneration
- Rice Husk
- Biodiesel
- Ethanol
- Biogas
- Wind
- Solar Thermal
- Solar Photovoltaic
- Effective and Efficient use of energy

THE GEA WISHES TO INFORM THE GENERAL PUBLIC THAT THE FOLLOWING ITEMS ARE NOW

ZERO RATED

(Schedule I Paragraph 2A(r) as amended of The Value Added Tax Act 2005)

AND

FULLY EXEMPT FROM IMPORT DUTIES:

(Part III B(ii), Item 49 (a) of the First Schedule as amended of The Customs Act cap 82:01)

Machinery and equipment for obtaining, generating, and utilizing energy from renewable energy sources, including-

-Solar panels
-Solar Lamps
-Deep-Cycle Batteries
-Solar Generators
-Solar Water heaters
-Solar Cookers
-DC Solar Refrigerators
-DC Solar Freezers
-DC Solar Air Conditioners
-Wind Turbines
-Water Turbines
-Power Inverters

-Compact Fluorescent Lamps (CFL)
-Light Emitting Diode Lamps (LED)

Guyana Energy Agency

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Hydropower

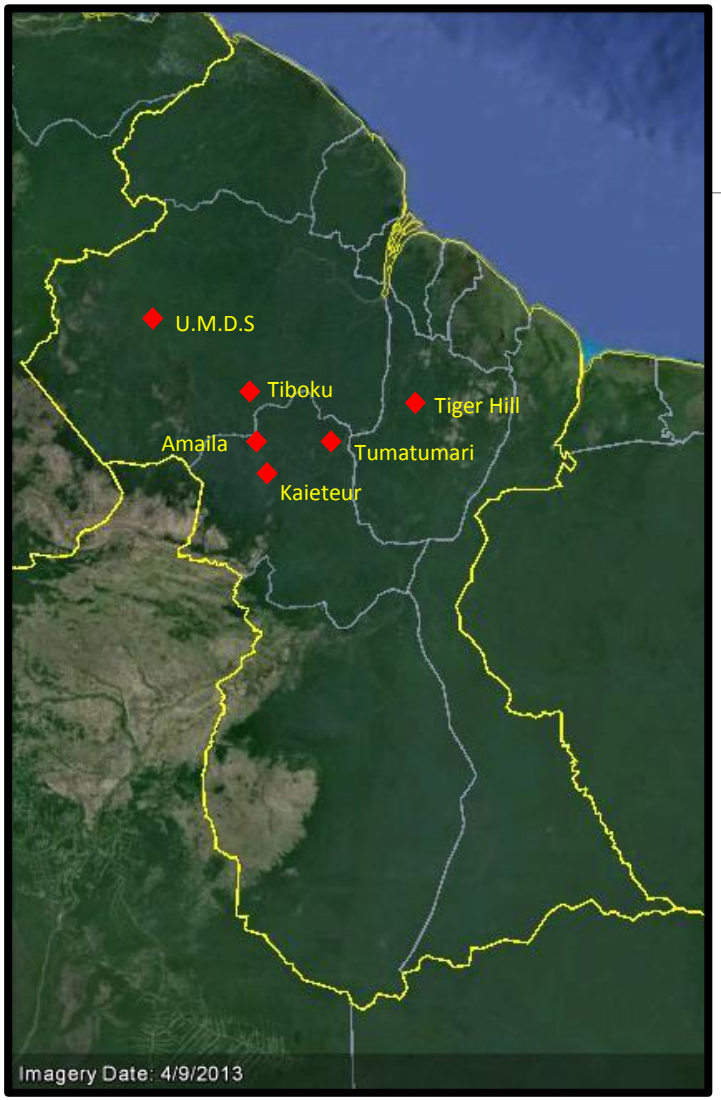
- Hydropower, also known as Hydraulic Power or Water Power, is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes.
- 67 potential sites identified in the mid 1970's
- Total hydropower potential in the country is approximately 7,200 to 7,600 MW

Upper Mazaruni Hydro–Electric Project, 1974: ENERGOPROJEKT: 3,100MW potential.

Amaila, Turtruba and Kaieteur were studied up to pre-feasibility level.

In April 1976, Montreal Engineering Company Ltd. (Monenco), identified the following fifteen sites as most promising for development:

- Upper Mazaruni Diversion Scheme, Turtruba, Tiboku, Apaikwa, Peaima, Aruwai, Chitigokeng, Sand landing, Chi Chi (Mazaruni River Basin)
- Amaila, Tumatumari, Kaieteur (Potaro River Basin)
- Oko- Blue, Kamaria (Cuyuni River Basin)
- Arisaru (Essequibo River Basin)



Guyana Power Study, 1982: SWECO: detailed cost estimates for the following sites:

Region	Site Name
7	Tiboku
7	Upper Mazaruni
8	Amaila
8	Kaieteur
8	Tumatumari
10	Tiger Hill

Hydropower in Guyana

- 1st hydropower station: ***Tumatumari***, Potaro River, Region 8: 1.5MW, constructed in 1957 by British Goldfields Ltd., operated until 1959 when mining operations ceased: 1969: re-commissioned to serve the Guyana National Service Camps and has been defunct for about 4 decades. Currently under consideration for rehabilitation and a PPA with a private developer.
- Moco Moco 0.5 MW hydropower project, Region 9, commissioned November 22, 1999. Landslide July 5, 2003. Government has since been actively discussing options for its restoration. Geotechnical assessment soon to be undertaken.

Hydropower Sites which have attracted interest over the years

- **Tumatumari:** 34MW potential, Potaro River, Region 8. Guyana's 1st hydropower station development (2 x 0.75 MW)
- **Eclipse Falls:** 4MW potential, Barima River, Region 1
- **Upper Mazaruni:** up to 3000MW potential, Merune River, Region 7
- **Turtruba:** up to 800MW potential, Mazaruni River, Region 7
- **Arisaru:** 120 MW potential, Essequibo River, Region 7

Hydropower Sites which have attracted interest over the years

- **Devil's Hole:** 35MW to 62 MW, Cuyuni River, Region 7
- **Chiung River:** 0.3MW, Region 8
- **Moco-Moco:** 0.5 MW hydroelectric plant was commissioned in 1999 but in 2003 the area experienced heavy rainfall and landslides that put the plant out of operation, rehabilitation proposal under negotiation, Region 9
- **Wamakaru:** Up to 3.5 MW, Region 9

Hydropower Development Plans

- 150 to 180 MW Hydro-Electric Project
- 320kW micro hydro project at Kato, Region 8
- 20kW project at Hosororo, Region 1
- 5kW Concept at Kaieteur Falls, Region 8
- 50kW to 200kW Chenapau Concept, Region 8
- 0.5 to 1kW pumped storage Concept Masakenari Village, Region 9
- 100 to 300 kW at Kumu, Region 9
- Studies to be done at Eclipse Falls Region 1, Paruima Region 7 and Ikuribisi Region 7
- Tiger Hill Falls, Region 10 with 15MW potential to be updated.
- Kurupung River Hydroelectric Project, Region 7, Kumarau Falls, 60MW
- Cooperation with the Brazil on a feasibility study for Upper and Middle Mazaruni hydropower development (3,000 +1,500 MW).
- Northern Arc Interconnection Project MOU: feasibility of a electric interconnection of Guyana, Suriname, French Guiana and the northern cities of *Boa Vista* (State of *Roraima*) and *Macapá* (State of *Amapa*) (the Northern Arc Countries) with support from IDB.

Hydropower

- GEA's Regulatory oversight and monitoring of hydropower in Guyana will be achieved by conducting site visits, inspections and measuring the amount of energy supplied.
- GEA will seek to develop run-of-the-river type hydropower stations under 100kW to meet the energy needs of neighbouring communities. Pico-hydro (up to 5kW) options will be reviewed and piloted.

Biomass

- Guyana has approximately 18 million hectares of forest which accounts for about 83% of its land area.
- Guyana's forest products exports range from raw and sawn timber, to plywood, moulding and furniture products all of which produce varying types of wood waste.
- In the past, wood waste was regarded as a troublesome by-product of the sawmilling operation, resulting in disposal as landfill or by burning, with both having negative environmental consequences.
- Utilization of wood waste as a source of energy can address the problems associated with its disposal while providing a source of energy in the form of heat or electricity to offset costs associated with grid-supplied electricity.
- GEA has assessed energy potential from woodwaste in Guyana.

Bagasse

- The sugar factories have traditionally burnt the bagasse generated from sugar cane in the boilers which supplied the electricity and steam for factory operations.
- Total energy value of all bagasse produced in 2014 was 0.954 million boe, but only 9% was converted to electricity for sale to the grid and factory operations.
- Skeldon sugar factory has a 30MW cogeneration facility and requires about 8MW to meet its own power demand.
- Potential for higher electricity output based on higher pressure boilers: Need for studies

Rice Husk

- Rice production attained an all-time high of 635,238 tonnes in 2014.
- By-products such as bran, broken rice and rice husk.
- Rice husk, the outer most layer of the paddy grain, is a form of biomass and accounts for about 20% of the paddy's weight.
- Unlike the other by-products, rice husk is mostly seen as a waste disposal problem for many mills and is usually burnt as a form of waste disposal resulting in environmental concerns.
- GEA has conducted a study on the energy potential from rice husk in Guyana.

Ramlakhan and Sons, Essequibo Coast , Region 2

Model	CPW 480 T
Rated capacity	960000 k Cal/hr
Gasifier type	Down draft
Rated gas flow	960Nm³/hr
Average gas calorific value	1000 kcal/Nm³
Fuel type	Rice husk
Maximum rice husk consumption	480 kg/hr
Permissible moisture content	20% maximum
Ash storage and removal	Continue wet ash discharge
Start up and operation	Through electrical blower and Ignition
Typical thermal conversion efficiency	>75%
Typical gas composition (By volume)	CO 19+3%, H2 18+2%, CO2 10+3%, CH4 up to3%, N2 50%
Water cooling	Natural Draft, 20 Nm³/hr
Power requirement for Gasifier (connected load)	25 kW
Blowers type	Centrifugal type
Grate shaking mechanism	Rotating grate with 2 HP motor

Bio-fuels

The Ministry of Agriculture, with funds from the Special ***Japanese Fund of the Inter-American Development Bank***, had procured consulting services to:

- Improve the capacity of GoG to identify and evaluate viable investment opportunities in the bioenergy production chain,
- Develop a financial vehicle or instrument to promote investment opportunities and develop a strategy to harness Guyana's potential for bioenergy production,
- Increase capacity building and the transfer of technology to build a critical mass of bioenergy technicians, operators, and demonstration programmes, and Institutional strengthening to support the Agro-energy policy of Guyana,
- Support small scale bioenergy demonstration programmes and dissemination of results.

Biofuels

- A number of potential developers have expressed interest in producing biofuels (bio-ethanol and biodiesel) for export
- Potential feedstock: sugar cane, coconut oil, palm oil, sweet potatoes and other feedstock
- A commercial pilot plant was established in Region producing biodiesel from palm oil.
- Small scale production of biodiesel from coconut oil and recycled vegetable oil is also being done by IAST.
- **Guyana will not be converting any traditional food producing land to biofuel production.**
- **Agro-Energy Policy drafted.**

Anhydrous Ethanol

- Guyana's first ever bioethanol demonstration plant at Albion Estate, Region 6, was commissioned in August 2013.
- 1000 litres per day of ethanol from molasses.
- Used by the Guyana Sugar Corporation's (GuySuCo) laboratory and industrial practices and to fuel a small number of vehicles owned by the sugar company and the Ministry of Agriculture using a blend of gasoline and ethanol (10%) to create an E-10 formulation.

Ethanol Production (2014)	
Type	Litres
Hydrous Ethanol (95% v/v)	4,355
Anhydrous Ethanol (99.7% v/v)	2,339


DISTILLATION
DEHYDRATION
ANHYDROUS
ETHANOL
= 99%
DISTILLATION
COLUMN
DNGO
MEMBRANE
whitefox
HYDROUS
ETHANOL
= 95%

Biogas

- The use of methane in Guyana has been largely underdeveloped.
- There are a number of potential sites including poultry and cattle-rearing farms which need to be further explored.
- Potential exists for the use of landfill-based methane gas as a source of energy
- About 28 biodigesters have been installed across the country
- Bio-Methanization plant installed at DDL: Estimated 40,941 boe

Biogas

- In an effort to promote the use of bio-digesters in farming communities, GEA prepared a "***Guide for the Design and Construction of Low-cost Bio-digesters***" which can be used by small scale farmers to convert animal waste to energy in the form of biogas for cooking, lighting and electricity generation. Available for download at www.gea.gov.gy
- GEA will also actively encourage the construction and operation of bio-digesters where suitable and provide technical support to previously installed digesters.

Biogas

Bio-digesters will be further demonstrated and encouraged to provide biogas for cooking and heating water.

Agencies have been working with small farmers to encourage the use of small bio-digesters to reduce waste and produce biogas.

Wind Power

Wind power can be used for the following:

- Generating electricity.
- Performing agricultural tasks (such as grinding corn, crushing sugarcane etc.).
- Pumping water for domestic use.

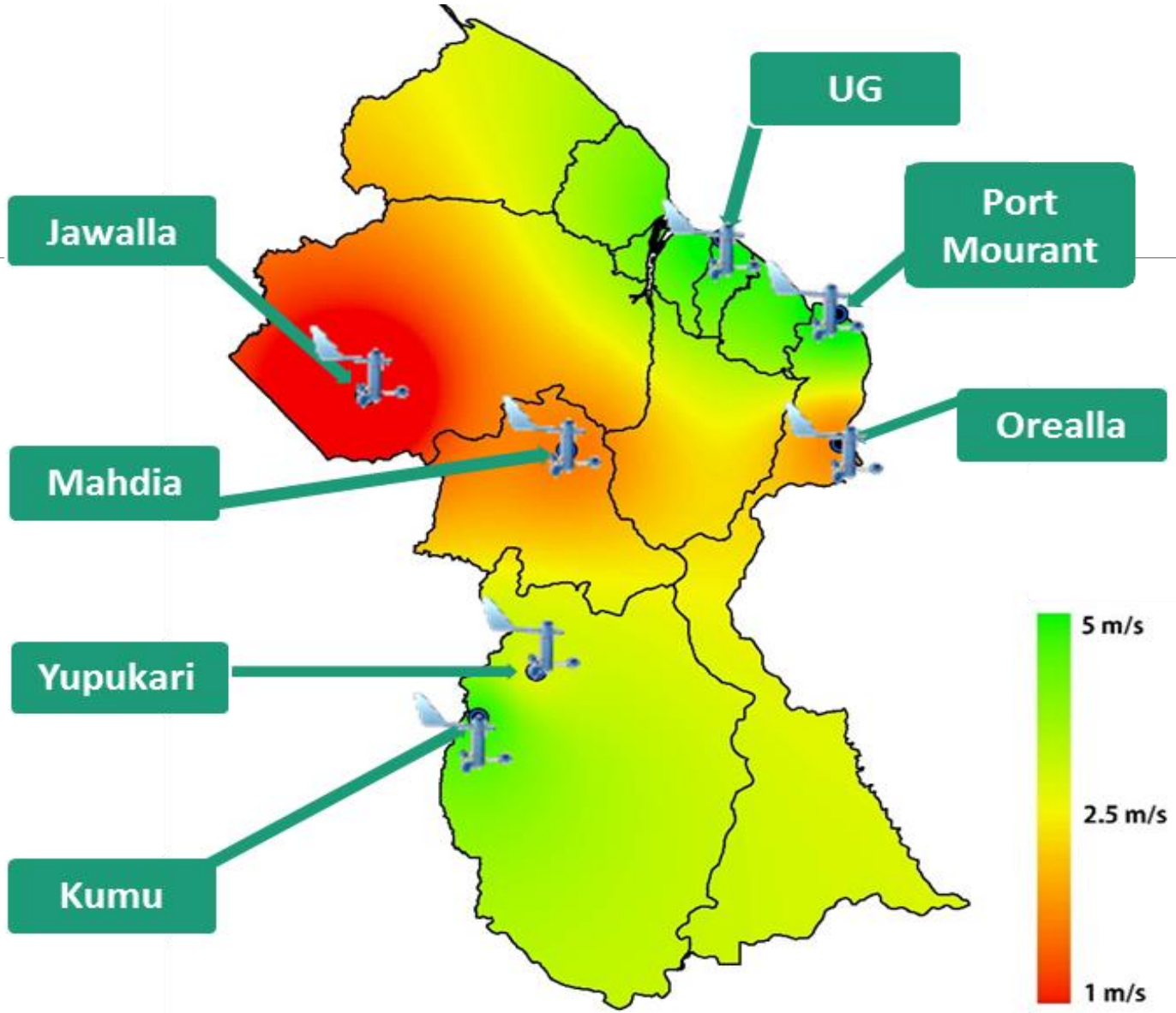
The data collected on East Coast suggests average wind speeds of about 7 m/s at 40m height.

Wind power

- A wind farm to supply electricity to the local grid was proposed by a private company for Hope Beach on the East Coast. The MOU with GoG had expired and was dormant for a few years. The developer is currently seeking to have the project reconfigured.
- Under the UAEP, wind speeds were monitored in the following areas: Orealla, Region 6, Jawalla, Region 7, Campbelletown, Region 8, Yupukari, Region 9. Wind speeds were not very attractive.
  - The measuring towers and equipment were handed over to GEA.
  - GEA is reviewing and maintaining the remaining 3 wind measuring installations for continuous data collection and possible relocation.

Wind Power

GEA procured a wind measuring unit to measure wind speeds at its head office and other convenient locations to gain further experience, understanding of wind speed analysis and energy potential.


UG
Port Mourant
Jawalla
Orealla
Mahdia
Yupukari
Kumu
5 m/s
2.5 m/s
1 m/s

Wind Power

Engineers have created a database to capture the various wind energy installations in the country: 40kW installed capacity identified thus far.

Solar Power

- The Sun is the primary source of energy for our planet.
- PV systems: hinterland regions, health centres, schools, communities and homes for lighting, small appliance loads, water pumping and productive cottage industries
- Solar panels: modular: Cost range: G$1300 to G$2500 per watt installed.

Solar Power

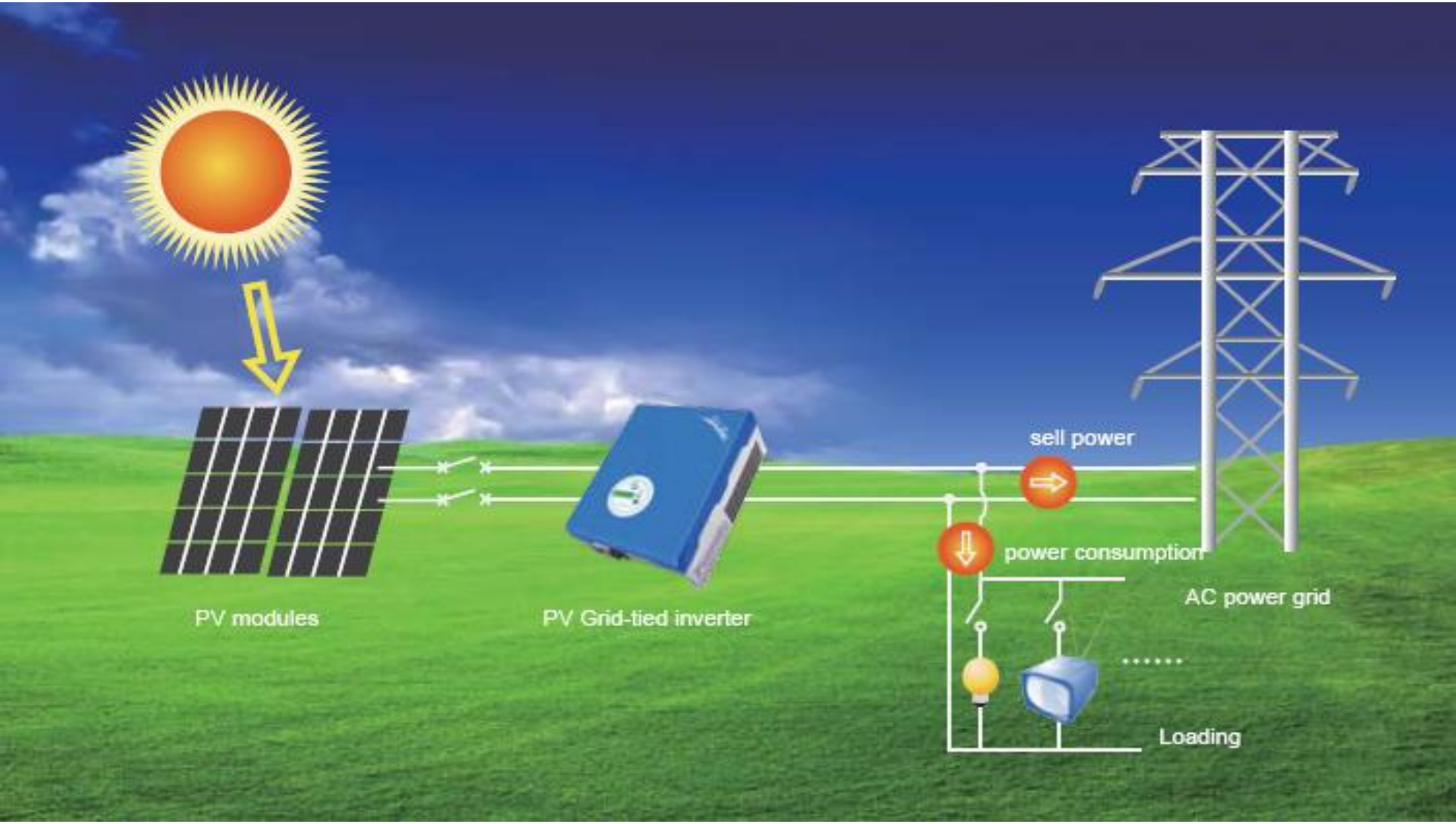
- Actively installing solar photovoltaic systems in remote hinterland communities and schools that do not have access to grid power.
- Under the ***Unserved Areas Electrification Programme (UAEP), Hinterland Component:***
  - 1,750 solar systems were installed in homes (65,125 watts), schools and other community buildings across 21 hinterland villages.

Solar Power

- GoG's ***Low Carbon Development Strategy*** to provide at least basic access to electricity to every hinterland household using solar photovoltaic systems to about 15,000 households without grid access.
- Under a USAID funded project, 12 solar photovoltaic systems were installed at 9 remote health centres in Hinterland Communities in 2013.
- **More than 1 MW of solar photovoltaic systems installed across Guyana with an estimated 2.01 GWh energy generation per year.**

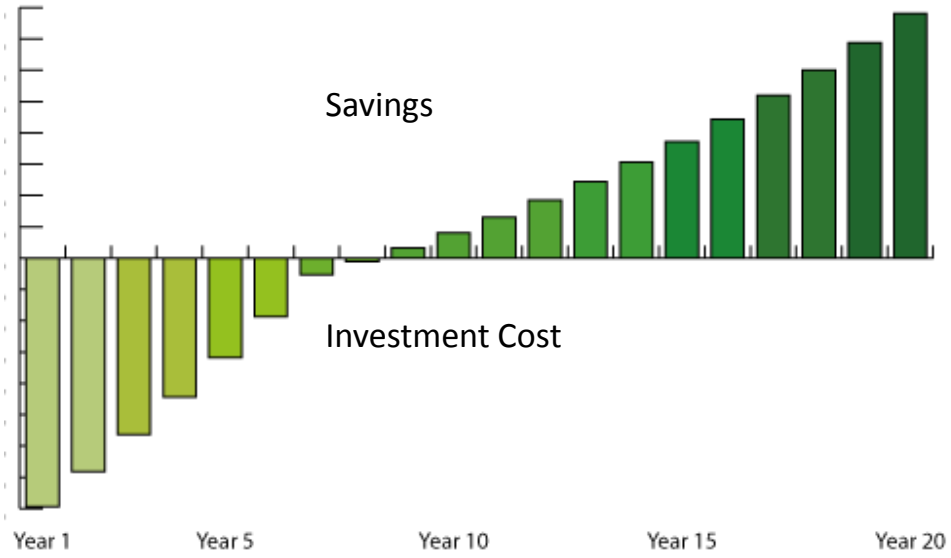
Among a wide range of renewable energy sources, photovoltaic (PV) systems are mature and easily deployed.

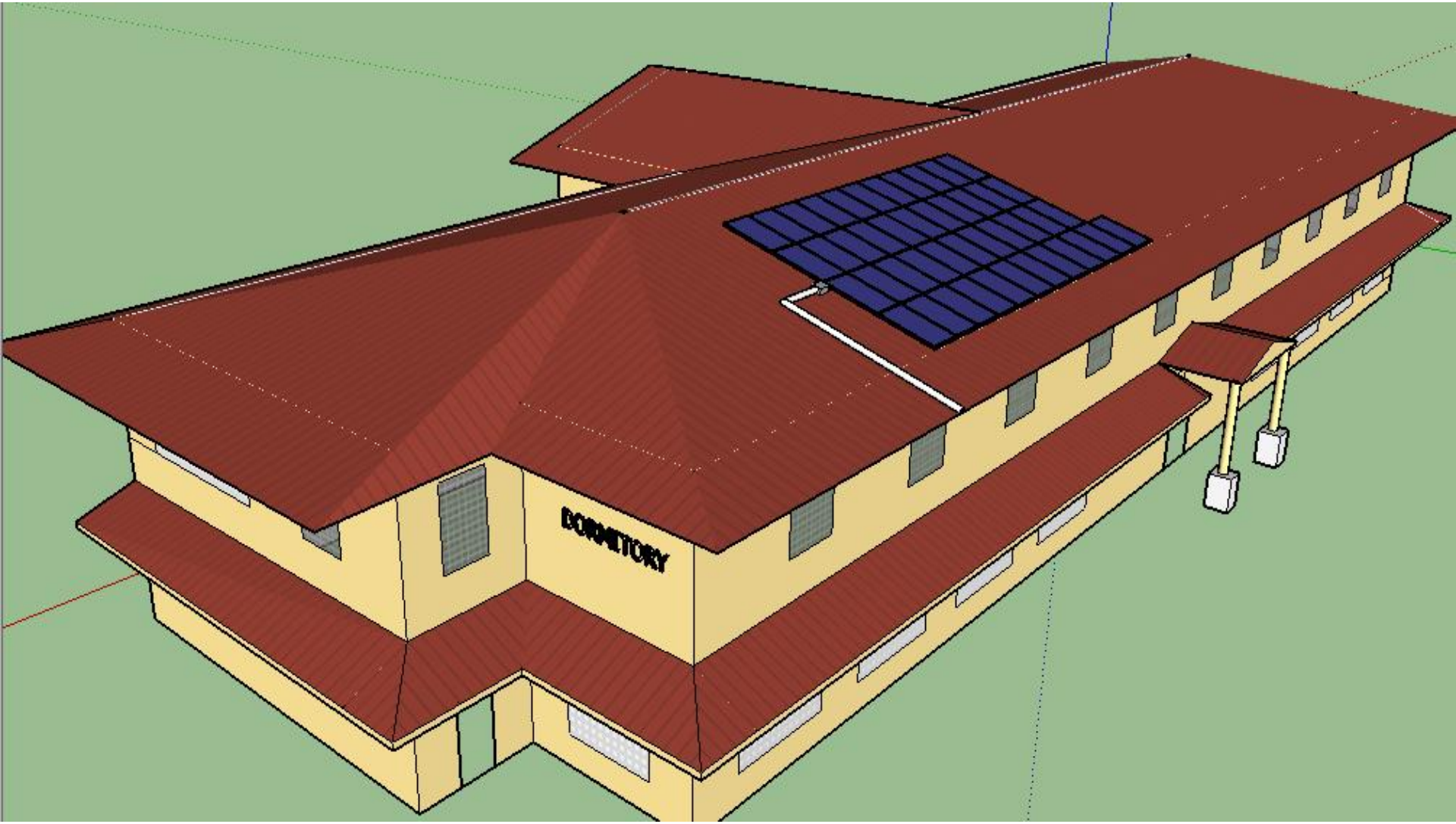
The daily average solar insolation incident over Guyana varies from about **4.1 to 5.5 kWh/m^2/day** with a clearness index of approximately 50 % depending on the location and the time of year. These levels are among the highest globally and therefore Guyana can benefit greatly from solar energy as a means of energy production.


sell power
power consumption
AC power grid
PV modules
PV Grid-tied inverter
Loading

If we were to install a 10 kWp Solar Grid-Tied System at each of the 20 Government Buildings

- Annual Energy Production **262,800** kWh
- Annual Cost Savings **G$17,082,000**
- G$120,000,000 Capital Investment
- **7** years simple payback
- **20 + years System Life**
- Reduction of **183,960** kg CO_2 equivalent




DORMITORY

Year	System Size	Organization	System Cost	Cost/Watt
2012	8,460 Watts	Guyana Energy Agency	G$6,900,000	G$815/Watt
2013	15,840 Watts	National Parks Commission	G$11,716,843	G$740/Watt
2016	10,000 Watts	Guyana Energy Agency	G$4,970,000	G$497/Watt

PV System Size (kW)	Required Space (m^2)	System Installed Cost G$	Annual Energy Generation (kWh)	Annual Cost Savings G$	Avoided CO_2 Emissions (kg)
5	32.9	$3,165,000	5,789	$340,837	3,470
10	65.8	$6,330,000	11,579	$681,674	6,940
15	98.7	$9,495,000	17,368	$1,022,512	10,410
20	131.6	$12,660,000	23,158	$1,363,349	13,880
25	164.5	$15,825,000	28,947	$1,704,187	17,350
30	197.4	$18,990,000	34,736	$2,045,024	20,820

Green Bartica Initiative

Solar PV system to connect to GPL's grid in Bartica to supply power to the community. This intervention will reduce the 100% reliance on diesel fuel thereby improving energy security in the community and eventually reduce generation cost.

35-115 kW Solar-diesel hybrid system for the Kato Secondary School

35-115 kW solar-diesel hybrid system to supply power to the Kato Secondary School as a temporary measure until the hydropower plant is developed.

MPI is currently reviewing the design of the project which is expected to be completed by September 2016.

Solar Water Heaters

By changing your electric water heater to solar water heater, you can drastically reduce your electricity consumption.

Positive impact on the environment.

Safe, efficient, reliable and non-polluting.

Solar Water Heaters

- Solar water heating is also beginning to be used for domestic water heating
- Importation and installation of solar water heaters will be encouraged for both residential and commercial use. The tourism and hospitality sector will be engaged with the objective of promoting the installation of solar water heaters.
- A 50-gallon electric water heater will cost you about 1 million dollars over its 10-year life, BUT, an equally-sized solar water heater will only have a one-time cost of about $330,000 and will serve your hot water needs for more than 20 years.

Solar Cooking Stoves

- GEA assisted OPM in the promotion and distribution of 507 solar cooking stoves to five (5) communities, namely Shulinab (Region 9), Rupertee (Region 9), Powaikoru (Region 1), Kangaruma (Region 7) and Tuseneng (Region 8), educational and health facilities to:
  - Promote and demonstrate the use of Solar Cookers
  - Observe the suitability of the environment for the use of solar cookers
  - Demonstrate the benefits of solar cookers.
  - Observe adaptability to and interest of persons in the use of the solar cookers.
  - Explore distribution of solar cookers to other facilities such as schools and clinics.

Solar Cooking Stoves

Effective and Efficient Use of Energy

A reduction in demand for energy:

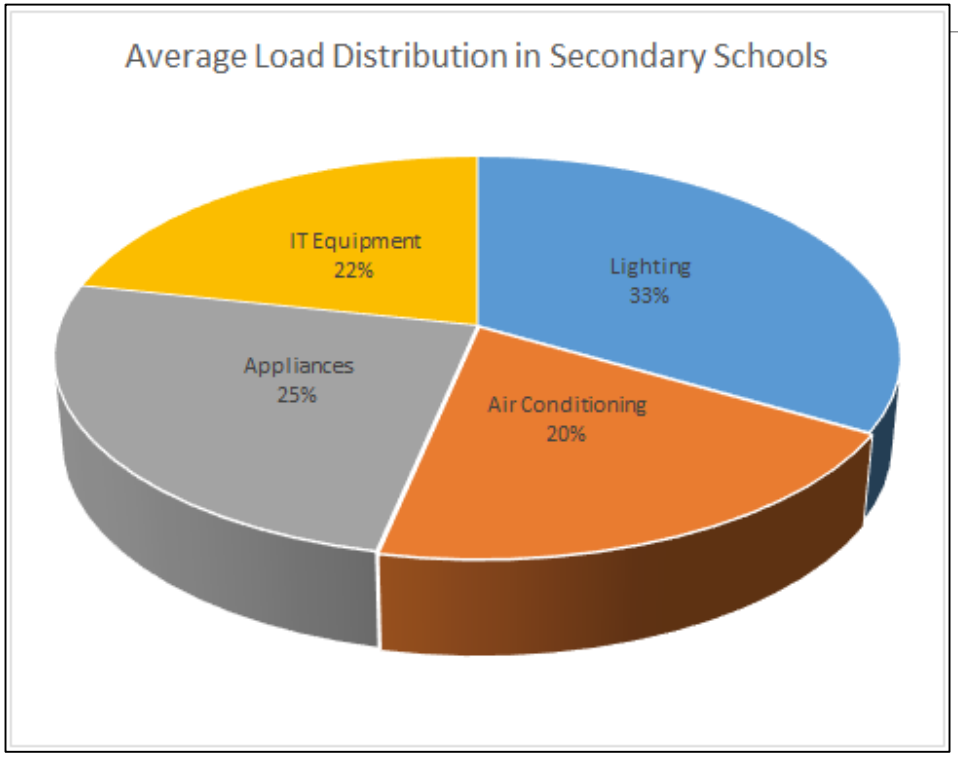
- would reduce the amount of money spent on fuel and electricity;
- can make more financial resources available for other areas of development;
- would delay the need for additional capital-intensive generation capacity and their associated costs;
- would reduce the amount of carbon dioxide and other emissions into the atmosphere.

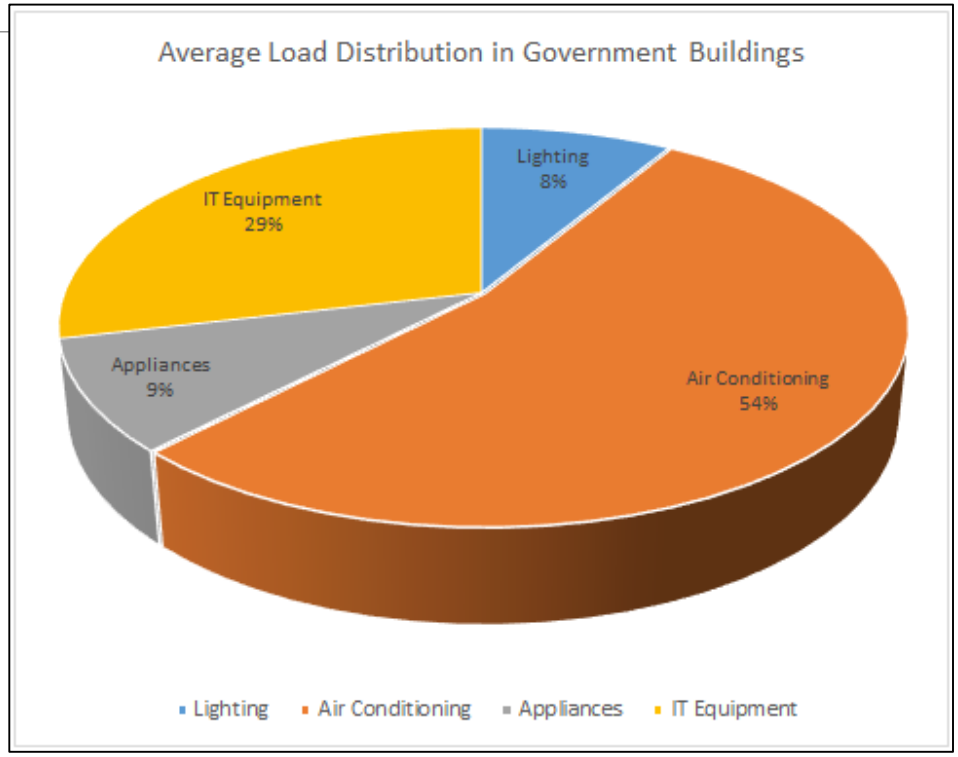
Incandescent Bulb Replacement Programme

- Between 2006 and 2007, 446,796 energy saving bulbs were distributed to 110,000 households across Guyana through the kind courtesies of the Cuban Government.

Energy Assessments Conducted

- GEA commenced Energy Assessments of 20 Government buildings in 2012, expanded this to private sector and schools in 2013, and continued assessments in 2014, 2015 and 2016.
- GEA has completed Energy Assessments of 80 buildings in the last five years along with the change-out of inefficient lighting at 20 public buildings and 15 schools.

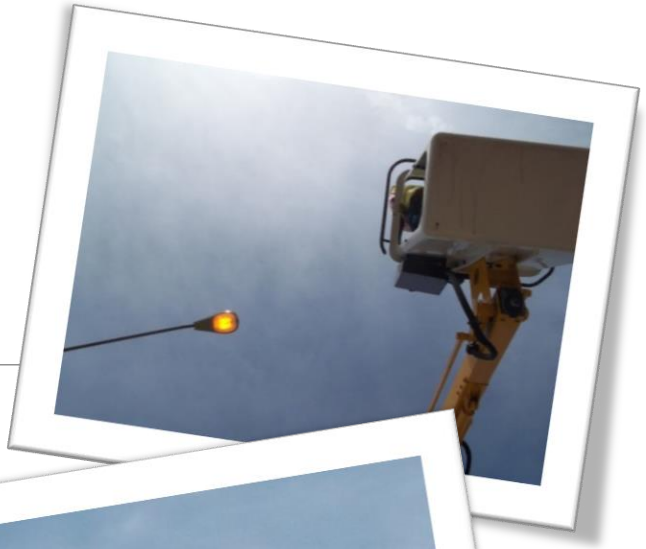

Average Load Distribution in Secondary Schools
IT Equipment
22%
Lighting
33%
Appliances
25%
Air Conditioning
20%


Average Load Distribution in Government Buildings
Lighting
8%
IT Equipment
29%
Appliances
9%
Air Conditioning
54%
Lighting
Air Conditioning
Appliances
IT Equipment

Energy Saving Opportunities

	Quantity	Annual Energy Savings (kWh)	Annual Cost Savings (G$)	CO_2 Emissions Avoided Annually (kg)	Simple Payback Period (yrs)
Replace 4 ft. Fluorescent Lights with 15W LED Tubular Lights	284	13,543	888,041	8,126	2
Replace Mercury Vapour Lamps with 50W LEDs	8	3,024	198,284	1,814	1
Installation Of Occupancy Sensors	20	12,902	846,010	7,741	0.2
Replacement Of Defective Photocells For MV Lamps	5	2,646	173,498	1,588	0.1
Total		**32,115**	**2,105,833**	**19,269**	**1.2**

Street Lamps



- Replacement of 5000+ defective photocells to avoid street lamps remaining continuously lit (24 hours per day).
- Pilot/demonstration of 153 Energy Efficient street lamps.
- Pilot/demonstration of 13 solar-powered LED Street lights.

Energy Efficient Wood Stoves

- Designed to achieve greater efficiency, reduce the demand for wood and reduce soot.
- GEA assisted OPM in the promotion of the energy efficient wood stoves in the following communities: Shulinab (Region 9), Rupertee (Region 9), Powaikoru (Region 1), Kangaruma (Region 7) and Tuseneng (Region 8).
- Indigenous materials (clay, clay bricks and banana sucker) were used to construct the energy efficient wood stoves.
- Residents were invited to witness the construction method and the advantages of the efficient wood cooking stove compared to the traditional open-flame (three-stone) design that was widely used in the communities.


ON
OFF
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SAVE
GEA

4ft FLUORESCENT LAMPS

- At the commercial level, new high-efficiency T8 fluorescent lamp and electronic ballast systems can reduce total system wattage by over 45% relative to the use of older, less efficient T12 fluorescent lighting systems driven by magnetic ballasts.

  Energy-efficient lighting upgrade projects can pay themselves back within 2-3 years and can deliver 30-50% returns on investment.

Cost of electronic ballast (G$)	3,800
Cost of T8 tube (G$)	800
Cost of installation (G$)	500
Total Cost (G$)	**5,100**
4 ft inductive ballast with lamp after 10 hours of operation (kWh)	0.483
4 ft electronic ballast with lamp after 10 hours of operation (kWh)	0.341
Energy saved per day (kWh/day)	0.142
Assuming annual operation (days/yr)	260
Energy Saved per year (kWh/yr)	36.920
Government Industrial Step 1 tariff ($/kWh)	65.81
Energy Savings per year ($/yr)	**2,430**
Avoided carbon dioxide emission per lamp per year (IPCC default value of 0.8kgCO2/kWh for a diesel plant) (kgCO2)	29.54
Estimated value of 1 ton avoided carbon dioxide ($US) =	5
Estimated value of 1 ton avoided carbon dioxide ($G) =	1,030
Estimated value of 1 kg avoided carbon dioxide ($G) =	1.03
Estimated value of avoided carbon dioxide emission per lamp per year (G$) =	**30**
Total Benefits (Energy saving + Value of avoided carbon dioxide) (G$) =	**2,460**
Simple Pay Back (yrs) =	2.07

- High frequency electronic ballasts or solid-state ballasts provide significant energy savings over magnetic ballasts.
- The electronic ballasts are quieter, lighter and virtually eliminate lamp flicker. One electronic ballast can power up to four lamps simultaneously (applicable for the double-lamps housing).
- When changing from magnetic to inductive ballasts, the T12 fluorescent tubes (1.5 inches) must be replaced with the narrower T8 (1 inch) tube for optimal performance and lightoutput.

By changing your old 4FT inductive ballast and T12 tube to a new electronic ballast and T8 tube , you can save up to G$2400 per lamp per year.

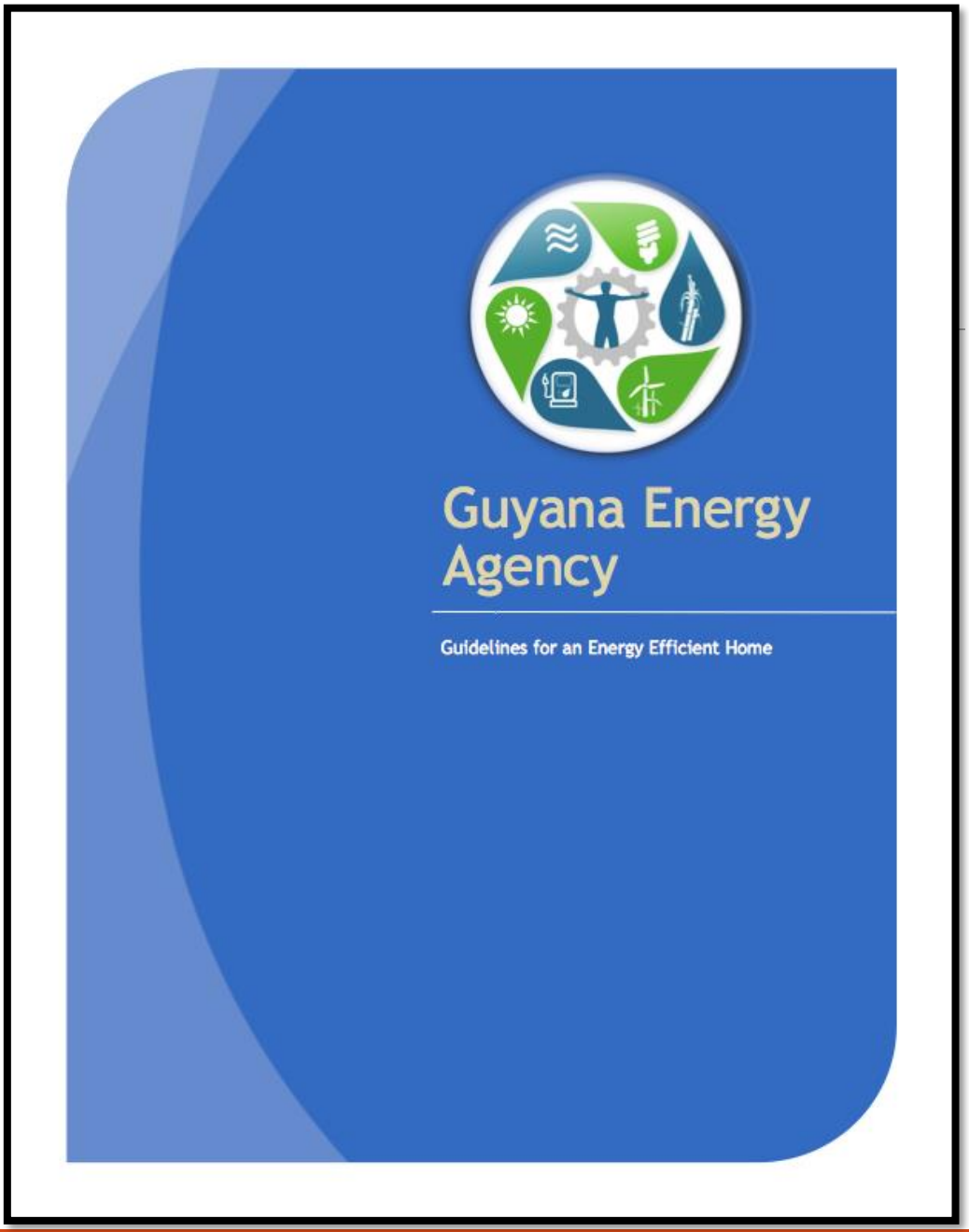
Guyana Energy Agency
www.gea.gov.gy

Guyana Energy Agency

KNOW YOUR LIGHTING

A seemingly inconspicuous and often overlooked element within a building's infrastructure, lighting actually accounts for as much as 30-40% of a typical commercial building's energy costs and an opportunity for significant cost savings in today's competitive market.

Lighting technology has evolved tremendously over the past two decades and has resulted in the availability of a host of exciting, high performing and highly-efficient new lighting products.



- Designed in-house and Launched in 2012
- 2000 Books have been funded and are currently being printed for free distribution to the public.
- Free distribution at the banks to persons applying for mortgage to construct or rehabilitate their homes
- Available for download at www.gea.gov.gy

Energy Month

- An annual feature in fulfilling part of the mandate of the GEA by disseminating information essential to improving public awareness on sustainable energy, conservation and overall efficiency.
- Activities conducted during the week included school competitions, quizzes, media placements with energy saving tips, poster board activity, seminars and an energy forum.

CARICOM


ENERGY
LET'S SAVE IT!

Energy Efficient Buildings

- Building Code
- Occupancy Sensor
- Cool Roof
- Natural Lighting, Sunpipes
- Window Shading
- Energy Efficient Lighting
- Refrigerant Replacement
- Solar Water Heating

Labelling Standards

- Minimum Energy Performance (MEP) standards for building ratings, appliance standards and labelling in close collaboration with private sector.
- Energy efficiency standards and labelling schemes for **household and commercial appliances** and some types of equipment, such as motors, would be explored through an **initial voluntary scheme** that simultaneously provides guidance towards consumer awareness on energy use and **benchmarks** toward efficient appliance and equipment purchase.

Prioritized Appliance Change-out Programme

- Replacement of old, inefficient appliances can yield significant energy conservation benefits.
- According to a 2013 study conducted under the Eastern Caribbean Energy Labeling Project (ECELP), potential savings in electricity consumption through replacement of old refrigerators in St. Lucian households can vary between 49% and 61%, depending on the type and age of the refrigerator.
- GEA will prepare a similar analysis for domestic refrigerators in Guyana to compute the energy savings, reduction in demand, environmental and social benefits of a programme to encourage the replacement of inefficient refrigerators.

Energy-Conscious Procurement Policy

- Procurement decisions often focussed on assets rather than energy services and based primarily on the least cost
- Modelling and encouraging the adoption of procurement policies that include life-cycle energy costs.
- Companies would be encouraged to ensure that decisions regarding the procurement of energy-using equipment are taken with full knowledge of the equipment's expected life-cycle and energy costs.

ISO 50,001

- Supports organizations in all sectors to use energy more efficiently, through the development of an energy management system to make it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.
- Provides a framework of requirements for organizations to develop a policy for more efficient use of energy, fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management.
- GEA will actively encourage the adoption and implementation of the ISO Energy Management Standard.

Transport Sector

- Accounts for 35% of total petroleum imports and therefore requires considerable focus.
- Older Vehicles are more inefficient.
- GEA will conduct an assessment towards the establishment of a vehicle tariff structure that suitably reflects renewable and efficient vehicle technologies.

Data Collection/Surveys

- Greater understanding of consumer choices and habits in equipment purchasing and operation will ensure more focused interventions to reduce energy consumption.
- GEA will design, pilot and conduct surveys to collect end-use information on the following:
  - Transport sector consumption
  - Residential energy consumption
  - Commercial energy consumption
  - Industrial energy consumption

5-Year Strategic plan

- This document, prepared by the Guyana Energy Agency and informed by the LCDS, articulates a 5 year projection for the energy sector in Guyana.
- With collaboration from various stakeholder groups and private sector, GEA's vision is to protect energy security through the provision of reliable energy that is economically, environmentally and socially sustainable for all in Guyana.

Sustainable Energy Programme for Guyana

- Improve institutional capacities of GPL and MPI
- Implement sustainable business models for operations and maintenance of renewable energy projects
- Increase quality energy access in Guyana
- Reduce the long-term operational costs of on-grid and off-grid electricity service
- Contribute to sector sustainability and reduction of green house gas emissions

➢ RE potential assessment developed

➢ Pre-feasibility study of RE projects for rural electrification developed

Sustainable Energy Programme for Guyana

- National RE strategy developed and approved
- Legal and technical revision of electricity regulatory framework developed.
- Public Awareness campaign developed
- 4 Wind Measuring Stations installed, 300 kW on-grid wind power installed
- 2.33 MW rural hydro installed
- 180kW on-grid PV installed
- 1.077 MW rural PV installed

National Energy Efficiency Programme

- ✓Achieve sustainable energy savings
- ✓Prioritise investment needs in the energy sector
- ✓Improve the country's finances and reduce carbon dioxide emissions
- ✓Improving the institutional framework to implement national energy efficiency plans
- ✓Training of professionals in energy efficiency
- ✓Implementation of targeted actions for the industrial sector, public and commercial buildings and efficient lighting in low income areas

Mainstreaming Low-emission Energy Technologies to build Guyana´s Green Economy

- Draft Project Document: UNDP and OCC
- To promote low-emission energy technologies across prioritized sectors, thereby increasing competitiveness and climate-resilience of the national economy.

Needs

- Technical support to design HFO-Diesel-RE Hybrid systems
- Technical support to update Hydropower studies
- Access to grant funding and low cost financing
- Building of technical capacity to design RE projects, prepare pre-feasibility and feasibility studies.

Thank you for listening!