

Appendix 1

WIND ENERGY QUESTIONNAIRE

The purpose of this questionnaire is to understand wind energy in Jamaica, the growth, legal framework, the processes, the barriers, solutions and its future, with the goal of trying to influence policy with respect to domestic/commercial wind energy in Jamaica. Your input is highly valued and the time you take to answer these questions would be well appreciated. The Ministry of Science, Technology, Energy and Mining (MSTEM) mandated this work.

The questionnaire is nineteen (19), pages long and is divided into sections based on the various stakeholders. Different questionnaires were sent to each organization with the questions that pertained to them. The questions were designed for:

1. Government, Parish Councils and Private Organizations
2. Financial Institutions
3. Distributors of Wind Energy Systems
4. Consumers

1. QUESTIONS FOR VARIOUS ORGANIZATIONS

This section is 12 pages long and is divided into two parts. **PART 1** consists of some general questions related to wind/renewable energy in Jamaica, and **PART 2** consists of questions related to your organization.

PART 1: General Questions

1. Does your organization promote wind energy on a domestic scale?

Yes

No

If your answer is **YES**, in what way?

2. Does your organization promote wind energy on a commercial scale?

Yes

No

If your answer is **YES**, in what way?

3. Are GOJ policy papers on Energy & Renewable Energy being implemented effectively?

Yes

No

4. What could be improved and how?

5. Is Legislation and/or regulation required?

Yes

No

What are your suggestions?

6. Is your organization satisfied with the governmental agencies mandate to promote renewable energy in Jamaica?

Yes

No

6b) What recommendations would you make to answer **QUESTION 6**?

PART 2: QUESTIONS FOR VARIOUS ORGANIZATIONS:

RENEWABLE ENERGY AND ENERGY EFFICIENCY DEPT. (REED), [FORMERLY THE
CENTER OF EXCELLENCE FOR RENEWABLE ENERGY (CERE)]

1. Why was CERE created when PCJ and Wigton Windfarm Ltd. were already in place?

2. Why was CERE changed to REED?

3. Does your organization currently conduct research and development for renewable energy equipment?

Yes

No

4. What is the role of your organization to promote renewable energy on a domestic and commercial scale?

5. In promoting the use of renewable energy, what policies and/processes limit/hinder the implementation of small-scale renewable devices?

6. In promoting renewable energy, what social, factors limit/hinder the implementation of small-scale renewable devices?

7. In promoting renewable energy, what economical factors limit/hinder the implementation of small scale renewable devices?

8. In promoting renewable energy, what environmental factors limit/hinder the implementation of small scale renewable devices?

WIGTON WINDFARM LTD.

1. Was Wigton ever mandated to promote wind energy usage on a domestic/community scale?

2. What is your relationship with the Renewable Energy and Energy Efficiency Dept. (REED)?

3. Is there a target for Wind generated power for electricity and other purposes, e.g. irrigation, water pumping, etc.?

4. Are there plans to use wind energy to replace/reduce electricity consumption by traffic lights/street lights?

Yes No

5. Is there information on the general awareness of wind energy and its advantages/ disadvantages over solar PV or other renewable sources?

Yes No

6. Could you describe the growth of wind energy use by domestic/commercial entities?

7. Currently there is an off-the-grid solar townhouse complex being built. What would be required legally for an off-the-grid wind complex?

8. What are the challenges residential consumers could face in implementing small wind energy systems?

9. What are the challenges commercial consumers could face in implementing small wind energy systems?

10. What are the solutions to **Questions 8 and 9** in a legislative way?

11. What are the solutions to **Questions 8 and 9** in a financial/environmental/educational way?

GOVERNMENT ELECTRICAL INSPECTORATE (GEI)

1. Have there been any applications to the GEI for wind energy systems?

Yes

No

1b) How many?

2. Are there any plans to create standards for the installation of wind energy systems?

Yes

No

2b) Please elaborate.

3. Are there any guidelines for installing a wind energy system (rooftop vs. tower)?

4. Do you also regulate people who use renewable to go off-the-grid?

Yes

No

4b) If your answer is **YES**, what is required?

5. How long does it take for renewable energy systems to be approved by the GEI?

6. Is there a cost associated with getting a renewable energy system certified by the GEI?

7. What are some of the problems you have as the GEI in dealing with renewable?

OFFICE OF UTILITIES REGULATIONS (OUR)

1. Do you play a role when residential consumers use renewable energy to go off-the-grid?

Yes

No

1b) Please elaborate.

2. Do you play a role when consumers use renewable systems that are grid-tied, but not a part of net-billing?

Yes

No

2b) Please elaborate.

3. How long does it take the OUR to acknowledge the receipt of a net billing application?

4. How long does it take the OUR to process a net billing application?

5. Are all these timelines regulated or legislated?

6. What are some of the mistakes/omissions consumers make when the OUR receives the net billing application?

7. What does the OUR think could be done to make the net billing application process simpler?

8. What role does the OUR play in the promotion of renewable energy in Jamaica?

JAMAICA PUBLIC SERVICE CO. (JPS)

This section is divided into two parts. **PART 1** consists of some questions related to the JPS and connections to renewable devices and **PART 2** consists of questions related to net billing and **PART 3** relates to the renewable energy market in Jamaica.

PART 1: JPS and Renewable Connections

1. Do you need JPS's approval to go off the grid?
 Yes No

If your answer is **YES**:

- 1b) What are the steps and documents you need to go through to do this?

- 1c) Does this apply to:

Community buildings	Yes <input type="checkbox"/>	No <input type="checkbox"/>
NHT Housing schemes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Townhouse complexes	Yes <input type="checkbox"/>	No <input type="checkbox"/>

- 1d) Please elaborate.

2. Do you need JPS approval to go on-the-grid, but not using net-metering?

Yes No

If your answer is **YES**:

2b) What are the steps and documents you need to go through to do this?

3. From your experience, are consumers well informed about going off the grid or on the grid in relation to JPS and its rules?

3b) Please elaborate.

4. From your experience what are some of the mistakes/omissions consumers make when going on the grid?

5. For small-distributed wind facilities, what are the concerns with respect to JPS connections?

5b) Can they be resolved by clear regulatory rules?

6. Are there any legal requirements of JPS in relation to the processing of on-grid, renewable energy connections, (eg. timelines, penalties)?

Yes

No

6b) Please elaborate.

Net Billing

1. Currently, how many customers have been approved for net billing?
2. How many commercial entities have applied for net billing?
3. Are there any plans to introduce net metering in Jamaica?

4. Why was net-billing chosen over net metering?

5. Are there any steps in the net billing process, not controlled by the JPS, that need to be simplified or modified?

Renewable Energy in Jamaica

1. Does JPS have any plans to introduce wind energy solutions/renewable energy in Jamaica on a domestic scale?

Yes

No

1b) Please elaborate

2. Are there plans to use wind energy to replace/reduce electricity consumption by traffic lights/street lights?

Yes

No

2b) Please elaborate.

3. Has the legal framework/government been a hindrance to the renewable energy market, as a company that uses renewables?

Yes

No

3b) If so, what solutions would you recommend?

4. Has the OUR been a hindrance to the renewable energy market, as a company that uses renewable?

Yes

No

5. From the OUR Consultations on 'Wheeling' do you consider that JPS' views are being taken into account in drafting the regulation?

Yes

No

If the answer to **QUESTION 6** is a **YES**:

- a) What are these?
 - b) Are they specific only to utility scale wind turbine systems?
6. On the aspect of pricing with respect to the sale of renewable energy, would you recommend if JPS and the IPPs negotiated on price ranges?
7. What do you think needs to be done in the legal framework to better generate and distribute electricity generated from a combination of renewables and fossil fuels?

JAMAICA ENERGY SOLUTIONS (JES) [FORMERLY THE RURAL ELECTRIFICATION PROGRAMME (REP)]

1. Is solar energy the only renewable energy you will be using to provide electricity to the remaining 2% of the population that do not have electricity?
2. Was wind energy ever considered in your rural electrification project?

Yes

No

If your answer to **QUESTION 2** is **YES**:

- a) In what capacity

If your answer to **QUESTION 2** is **NO**:

a) Why was it not considered?

b) Will it be included in your mandate to, “design and implementation of energy solutions for major housing initiatives by state agencies?”

Yes

No

AGRO PARKS

1. Was renewable energy included in the designs or plans when setting up an Agro Park?

Yes

No

If your answer to **QUESTION 1** is **YES**:

a) What types of renewable energy?

b) Why were these types chosen for the Agro Parks?

If your answer to **QUESTION 1** is **NO**:

a) Why was it not included?

b) Will it be included in the future plans/developments for the Agro Parks?

PARISH COUNCILS

1. Are there any Parish Council requirements for the installation of a wind turbine in your Parish?

Yes

No

1b) Please elaborate

NATIONAL SPATIAL DATABASE MANAGEMENT DIVISION

1. Is there a national database on Government and privately owned land suitable for renewable energy use?

Yes

No

1b) Given the limited land available for all the demands for socio-economic development, is such an approach considered a priority?

Yes

No

2. Given the priority for large Infrastructure projects requiring large tracts of land, on the coast and in the interior, what ranking is renewable energy given?

Not Important

Low

Medium

High

3. What type of projects are given priority over renewable energy (top 5)?

FINANCIAL INSTITUTIONS

1. Does your Energy Loan apply to all types of renewable energy?

2. What is the interest rate?

3. Does this loan apply to both commercial and residential customers?

4. Do you need to be a member of the PCB to access this loan?

5. What documents do you need to apply for a Energy Loan for wind energy?

6. Does your loan cover energy audits?
Yes No

7. Does your loan cover shipping costs?
Yes No Based on the information you provide

2. QUESTIONS FOR DISTRIBUTORS OF WIND ENERGY SYSTEMS

These questions are divided into two parts. **PART 1** consists of some general questions about your organization and wind energy in Jamaica, and **PART 2** consists of questions related to the legal framework in place.

PART 1: General

1. What type of wind turbines do you sell?

Horizontal

Vertical

Both

2. What model or brand of wind turbine do you sell?

3. What is the range of the capacity of wind turbines do you sell (eg. 400W to 10kW)?

4. Did you use scientific data to determine the area for putting up this combined renewable system?

Yes

No

4b) Elaborate (also include the time taken to do this if possible)?

5. What additional equipment and/ services needed for the installation of a wind turbine other than a turbine, a tower and inverters?

6. What is the average price range for a wind turbine and any additional equipment and services needed?

7. Do you have any arrangements with any financial institution for the importation, purchasing or sale of the renewable energy equipment?

Yes

No

7b) Please elaborate.

8. In dealing with your customers, do you get the sense that they are well informed about renewable energy solutions?

Yes

No

8b) Please elaborate.

9. Can you describe the wind energy market in Jamaica over the years, including the benefits and barriers?

10. From your experience, what are the barriers that prevent consumers from purchasing and using renewable energy solutions?

11. What are the barriers that prevent you as a distributor from maximising on the sale of wind energy solutions, (eg. legal, Bureau of Standards, Customs, JPS, ect.).

11b) Please elaborate.

PART 2: Legal Framework

1. Do you know of any 'red tape' in trying to import and put up a wind turbine?
2. Are there any legal documents or approvals you have to go through to import wind turbines?

Yes

No

If your answer to number 2 is a **YES**:

- a) How easy was it to get and fill out these legal documents?
 - b) How easy was it to get information on the legal framework, documents and or approvals you needed?
 - c) Was it easy to get these approvals and could you give me a time-frame of how long it took?
3. Do you think the Government is doing enough to push the use of renewable energy on a domestic scale?

Yes

No

3b) Please elaborate and give recommendations if any.

4. Do you have any recommendations to improve the **legal framework** for Domestic Renewable Energy use in Jamaica?

3. QUESTIONS FOR CONSUMERS

These questions are divided into two parts and were created after consulting Gayle's study (2013). **PART 1** consists of some general questions about your system, **PART 2** asks about wind energy in Jamaica, and **PART 3** consists of questions related to the legal framework in place.

PART 1: General

1. What type of wind turbines do you have or plan to purchase?

Horizontal

Vertical

Both

2. What type of system are you using?

Wind Energy Alone

A Hybrid System (eg. wind + solar)

3. What model or brand of wind turbine are you using or plan to use?

4. What is the range of the capacity of wind turbines do you have or are planning to have (eg. 400W to 100kW)?

5. Did you use scientific data to determine the area for putting up this combined renewable system?

Yes

No

5b) Please elaborate (also include the time taken to do this).

6. What additional equipment and/ services needed for the installation of a wind turbine other than a turbine, a tower and inverters?

7. What is the average price range for a wind turbine and any additional equipment and services needed?

8. Do you have any arrangements with any financial institution for the importation, purchasing or sale of the renewable energy equipment?

Yes

No

8b) Please elaborate.

9. In dealing with your neighbours or community members, do you get the sense that they are well informed about renewable energy solutions?

Yes

No

9b) Please elaborate

10. Do the residents of your area, have any problems or concerns with the turbines?

Yes

No

If your answer is **YES**, please list them.

11. What are the benefits of wind energy that you have received or hope to receive?

12. What are the negatives of having or purchasing a wind turbine?

13. Do you know the locations of places where wind turbines or the solar/wind system have been used?

PART 2: Renewable Energy Market

1. Could you describe the wind energy market in Jamaica over the years?
2. From your experience, what are the barriers that prevent consumers from purchasing and using renewable energy solutions?

2b) What solutions would you recommend to get rid of these barriers?

PART 2: Legal Framework

1. Are there any legal documents or approvals you have to go through to import wind turbines?

Yes

No

If your answer to **NUMBER 1** is a **YES**:

- a) How easy was it to get and fill out these legal documents?

- b) How easy was it to get information on the legal framework, documents and or approvals you needed?

- c) Was it easy to get these approvals? Could you give me a time frame of how long it took?

2. Do you know of any 'red tape' in trying to import and put up a wind turbine?

3. Do you think the Government is doing enough to push the use of renewable energy on a domestic scale?

Yes

No

3b) Elaborate and give recommendations if any.

4. Do you have any recommendations to improve the **legal framework** for Domestic Renewable Energy use in Jamaica?

X-----X

Appendix 2

Report on the Investigation to Determine the Local Capacity for Production of Small-scale Wind Systems

A section of the scope of the work required for the *Wind Power for Domestic/Community Feasibility Study and Regulatory Review* required the consultant to determine the local capacity for production of small scale wind systems. Factors considered in this assessment were -

- (i) Experience
- (ii) Facility
- (iii) Manpower
- (iv) Capacity for training
- (v) Financial capacity

The only known institution with experience to produce wind turbines is the Caribbean Maritime Institute. The Caribbean Maritime Institute and the University of Technology were known to have large machine workshops to facilitate some level of metal fabrication. The Caribbean Maritime Institute, the University of Technology and the University of the West Indies were known to have the capacity for training in engineering and electronics and to produce manpower capable to carry out the higher level tasks of producing wind turbines. There are institutions capable of metal working and fibre glass fabrication which would have some capability of producing some components of a wind turbine, but without a working model or plan, it was deemed not to serve any practical purpose to visit these institutions at this time. Many institutions are capable of producing manpower to carry out the lower level tasks of producing wind turbines and it was deemed not necessary to investigate these. Similarly, it is obvious that there are many financial institutions and businesses capable of raising funds for viable projects and it was deemed not necessary to investigate these, especially since it is not known if production of wind turbines in Jamaica is a viable or desirable option. Thus initially only the 3 institutions named above were investigated. If a viable option for producing wind turbines were found,

one involving a system design based on research, testing and economic analysis, then other institutions, which would be involved in the production, e.g., the Jamaica Manufacturers Association, Jamaica Tool & Engineering Institute, Jamaica-German Automotive Institute and the Scrap Dealers Association, could also have been investigated.

Caribbean Maritime Institute

The consultant and team member met with Messrs. Donovan Smith and Kevin Senior, staff at the Caribbean Maritime Institute (CMI) on July 24, 2013. The meeting was arranged through the Executive Director, Dr. Fitz Pinnock, who was present at the meeting for a short time. A later meeting was held with Mr. Herman Shim on July 31, 2013.

CMI, located in Palisadoes Park, set up a Renewable Energy Centre in 2012 with grants from the GEF Small Grants Programme (SGP) implemented by UNDP, and the Environmental Foundation of Jamaica (EFJ). Activities of the Unit included setting up a stand alone PV system to power the unit, a reverse osmosis desalination unit and producing demonstration apparatus for promoting the use of renewable energy. The system was temporarily out of service but has now been restored by Mr. Shim and staff.

CMI staff is enthusiastic about the use of renewable energy and actively engaged in promoting renewable energy and energy conservation. The administration sees much promise in engaging in energy projects involving the participation of the local community. Recently CMI signed an agreement with Jamaica Public Service Company to retrofit existing streetlights with light-emitting diode (LED) units. The manufacturing and assembly of the lights are to be done locally by engineers and technicians at the CMI and will involve the local community.

The main activity in the area of wind power is the construction and operation of Savonius type vertical axis turbines. The design of the turbine has moved progressively from the use of half drums, to quarter drums, to PVC pipes as blades. The blades are mounted vertically between 2 large circular disks, fabricated from the

top and/or bottom of oil drums, to form the rotor (See Figure 9 below). The shaft of the rotor is housed in a commercially available bearing. A pulley belt around the circumference of the circular base of the rotor is connected around the rotor of an automobile alternator, which produced rectified DC current. This speeds up the alternator with a speed ratio of approximately 30:1. The DC output of the alternator is then used to charge batteries, which are connected to an inverter to produce AC electricity. The system is capable of providing about 150 Watt of power. At the time of the meeting the rotor was not spinning fast enough to generate the desired power.



Figure 9 Savonius type vertical axis wind turbine at CMI with (a) PVC pipes as blades and (b) quarter drums as blades.

Reports on the projects have been submitted to the donor agencies. However no evaluation on financial feasibility has been done, such as an estimate of simple payback period and the cost of producing energy per kWh for comparison with other turbines. Seven of these turbines have been deployed, three at CMI, one at the Port Royal Basic School and 3 at the Pedro Cays, but one of these was structurally damaged. No performance evaluation has been done to determine power output versus wind speed, or to determine the lifetime of the turbine.

Mr. Shim is of the opinion that more research needs to be done before the turbine can be produced on a large scale. Nevertheless, it is possible for individuals and

communities to copy the present design and provide useful energy for small scale use. A prototype of the turbine was exhibited at the last Denbigh Show and it is reported that some turbines were constructed based on the design.

According to Mr. Shim, improvements are needed in the efficiencies of the blades, drive mechanism and generator. Because vertical turbines are cheaper to produce than horizontal axis, he feels that CMI should continue research on the Savonius type turbine. Presently he is experimenting on the use of a generator using more efficient rare earth magnets, which can generate up to 800 Watts at 1000 rpms, the cost of which is only about US\$200.

UTECH

The consultant met with Dr. Noel Brown, Head of the School of Engineering (SoE) and Mr. Everett Bonnick, Lecturer, in the School of Engineering on July 17th, 2013. Dr. Brown informed the meeting that about 5 years ago, Mr. Alrick Johnson, then a lecturer in the SoE at UTECH, researched the production of wind turbine blades using fibre glass. Mr. Johnson has since left the Faculty but the capability to fabricate fibre glass blades still exists within the SoE. The SoE also has the capacity to assemble other wind turbine components, such as generators.

Production of turbines however is not seen as desired activity for the School. That should be done by a company properly constituted to do so, while UTECH can offer support to the company in research and testing. The School sees that it can make a more worthwhile contribution in research on (i) improving the technology of wind turbines, and (ii) storage and dispatch of firm energy. This research is being looked into but funding is an issue, and future funding initiatives by MSTEM should take this into consideration.

UWI

The consultant met with Dr. Paul Aiken, Deputy Dean of Engineering, Faculty of Science and Technology, UWI, Mona on August 2, 2013. Electronics has been taught at UWI for over 40 years. The Electronics degree programme was reorganized in 2009 and converted in an Electronics Engineering programme. The graduating students are capable of designing inverters and controllers. The first year of the Mechanical Engineering programme will be introduced in 2014, but higher level students will be required to complete their degree programme at UWI St. Augustine in Trinidad, because the cost of setting up the necessary laboratory facilities is prohibitive at this time. There are no present plans to conduct research on, or to produce wind turbines.

Conclusions

The only institution that has produced a working model of a wind turbine is CMI. The model is a vertical axis machine based on the Savonius rotor. However it is not yet at a stage where it could be mass produced and sold on a commercial basis. Further research is needed. However it is possible that the model can be copied, as indeed it has been, using local and imported materials. The local components would be the PVC blades and discarded oil drums to be used at the top and bottom of the rotors. It is also possible to find used automobile alternators. Batteries could also be produced locally from salvaged lead plates. The imported components would be the bearings, inverters and pulley belt. The model could be built and operated by an individual or community for small scale use where the wind is strong (The necessary wind speed has not yet been tested). The present model uses a car alternator which can give about 150Watt in strong winds, but replacing it with an alternator from a truck may increase the output to up to 300 Watts.

The main disadvantage of the Savonius type rotor is the low power produced and high winds required. No study has been done on the economic advantage of producing the low powered machines at CMI. Studies have shown that the power coefficient of Savonius type turbines is approximately a quarter of that of a two-blade or three-blade horizontal axis turbine, as shown in Figure 10 on the next page.

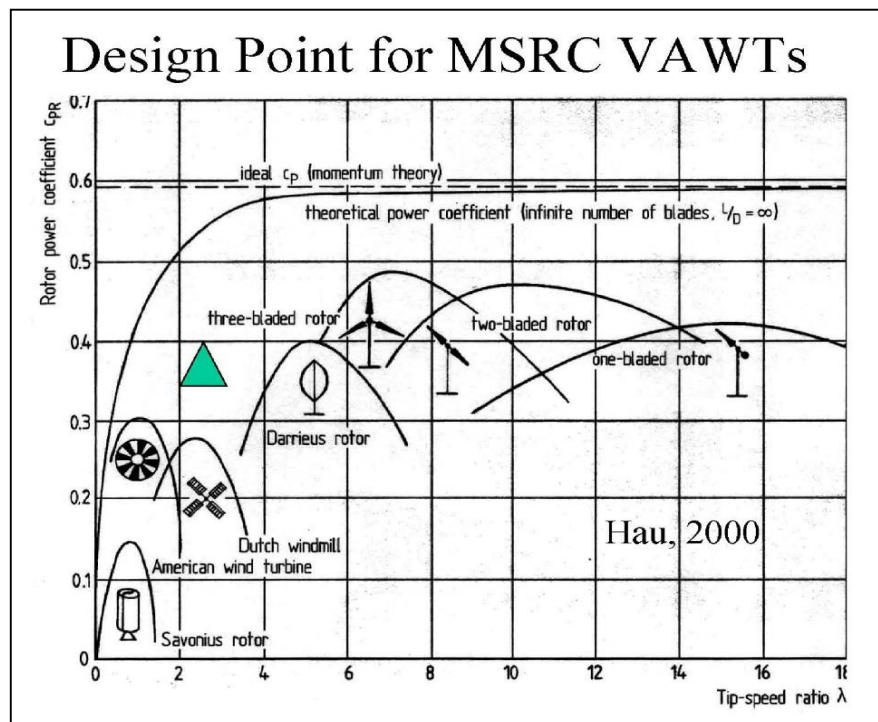


Figure 10 Power coefficient of wind turbines vs tip speed ratio (Reprinted from Wind turbines theory – The Betz Equation and the optimal rotor tip speed ratio in *Intech*. Retrieved from <http://www.intechopen.com/books/fundamental-and-advanced-topics-in-wind-power/wind-turbines-theory-the-betz-equation-and-optimal-rotor-tip-speed-ratio>)

It is possible to produce standard 2 and 3 blade horizontal axis wind turbines if funds are available to set up a production workshop, but this of course would require much more research. UTECH, UWI and CMI have enough experience to do this research and provide training in blade fabrication, building generators and inverters and metal fabrication. But before any commercial entity can be established, a socio-

economic evaluation would have to be done to compare the cost and benefits of setting up such an entity with the cost of importing turbines from overseas suppliers who are already well established.

Recommendations

It is unlikely that conditions for production of 2 and 3 blade horizontal axis turbines will be favourable in Jamaica in the near term because of the research and development needed and the cost of setting up workshops capable of molding blades and generator parts. A vertical axis turbine is easier and less costly to build. It can be built from parts made for other purposes, such as PVC pipes and oil drums. It is so constructed so that a standard commercial alternator can be used as the generator without modification. So far the power output has been low. However if CMI can succeed in developing a working 800 watt machine, that machine will be able to produce useful power for a home or community. Therefore, knowing the limitation of the vertical axis machine and knowing that CMI is capable of carrying out the necessary experiments, it is recommended that the work of CMI be encouraged and funded with an appropriate cap placed on the fund and duration to avoid going on a 'wild goose chase.' The cap could be, say, 10 times the cost of a horizontal axis machine of similar capacity.

**Appendix 3 Information on Sectors Reviewed for Regulatory Framework
Report and Suppliers of Turbines in Jamaica**

Those interviewed/contacted for the regulatory Framework report were:

Suppliers of Wind Energy Systems = 10/17

Potential Users of these Systems (as well as Davina Gayle's information -
<http://www.solarbuzzjamaica.com/2013/06/energy-news-towards-the-domestic-adoption-of-wind-and-solar-energy-technologies/>) = 5/11

Commercial Users of Wind Energy = 1

Residential Users of Wind Energy System = 3

Government Agencies and other bodies from which responses were garnered = 6/7

Parish Council Bodies that were interviewed = 7

No. of Financial Institutions consulted about renewable energy systems = 5

Other Non-Governmental Agencies (JPS and JSEA) = 2

Suppliers of turbines are:

Company	Address	Phone #
Carisol	32 Cassia Park Road, Kingston 10	925-2783/ 924-3306
Alternative Power Sources	4 Stratham Avenue, Kingston 10	907-3534
Gormann Corporation	3 North Avenue, Kingston 5	929-1740/ 960-6052
Alternative Energy Plus	507 Greater Portmore	998-2907/ 878-4500
Alternex Energy Systems	60 Sunset Avenue, Kingston 8	978-7298/ 825-8084
Solwind Energy	15A-17 Red Hills Road	908-4768
Omstar Jamaica	Brumalia Town Centre, 2 Perth Rd, Mandeville	417-7753/ 622-0593
*Fosrich Company Limited	77-79 Molynees Road, Kingston 10	937-5099
Green Lantan Energy	Lititz District Junction, St. Elizabeth	467-6643
*Sun Source Technologies	Main Street, Ocho Rios	383-5453
Conserve It Ltd.	1C Grants Crescent Kingston 10	754-0220
Earthglobe Energy Corp Ltd.	1A Randolph Avenue, Kingston 5	906-8934
Solar Options and Electro Works Ltd.	6 Murray Ave., Morant Bay, St. Thomas	982-2910
*Solar Buzz	6 Haining Road, Kingston 5	968-7797
Green Sun Energy Plus	4 Caledonia Rd, Mandeville, Manchester	622-4834
G.A. Ricketts Engineering Services	Leas Flats	808-0832
JamTech Energy Solutions	Lot 56 West Trade Way, Portmore	704-3020, 384-3223

NB. Some of these companies do not stock turbines but sell them based on personal orders

Appendix 4 Lists of Renewable Energy Items Exempted from GCT.

List of Solar Components for General Consumption Tax Exemption (GCT) and Inclusion in Third Schedule of GCT Act

Description

PV CONNECTORS

MC Connector (Male) - e.g. MC3, MC4 and Tyco

MC Connector (Female) - e.g. MC3, MC4 and Tyco

MC Crimp Tool - e.g. MC3, MC4 and Tyco

PV BALANCE OF SYSTEM COMPONENTS

PV Wire (600V UL 90 Degree Celcius Rated RHW-2, RHH, USE or USE-2 FR-XLP VW-1 Insulation Copper Conductor)

PV Array to Conduit Entry Transition Boxes (Eg. SolaDeck)

PV DC Disconnects

PV Disconnect and Contactor Enclosures

Power Supply Assemblies and Gateway Boxes

PV Combiner Boxes

PV Re-Combiner Boxes & Fuse Boxes

DC Rated Circuit Breakers (Panel or DIN Rail)

DC Rated Circuit Breaker Enclosures

Fuses for PV Installations

Shunt Bus Bars

Breaker Bus Bars

Terminal Bus Bars

E-Panel (Power Panels) for All Types of Renewable Energy Inverters

Generator Auto Start Modules for All Types of Renewable Energy Inverters

Battery Monitoring Kits for All Types of Renewable Energy Inverters

Remote Controls for All Types of Renewable Energy Inverters

Auto Transformers for All Types of Renewable Energy Inverters

Battery Terminals for Renewable Energy Batteries

Hydro Caps for Renewable Energy Batteries

PV RAILING/RACKING

Aluminium Railing/Racking for PV Installations

Mid-Clamps for Aluminium Railing/Racking for PV Installations

End-Clamps for Aluminium Railing/Racking for PV Installations

Bonding Cables for Aluminium Railing/Racking for PV Installations

WEEBs for Aluminium Railing/Racking for PV Installations

Cable Clips for Wires on Aluminium Railing/Racking for PV Installations

OTHERS

Surge Protection Devices AC & DC (Lightning Arrestors) for Renewable Energy Systems

PV Site Analysis Equipment and Software

Solar Pathfinder

Solar Analyzers and Accompanying Software (Eg. Solmetric Sun Eye)

PV String Checkers

Solar Maximizers

Inverter Gateways/Routers for All Types of Renewable Energy Inverters

Monitoring and Communications Controllers and Devices (Wired or Wireless) for All Types of Renewable Energy Inverters

ARP Anti Reverse Power Devices / AVOIDS EXPORT

Submitted by Ministry of Science, Technology, Energy and Mining, July 2013
(<http://www.neich.gov.jm/sites/default/files/documents/Renewable%20Energy/Solar%20Component%20List%20for%20GCT%20Exemption.MSTEM.pdf>)

ENERGY EFFICIENT ITEMS – EXEMPTED FROM GENERAL CONSUMPTION TAX (GCT) EFFECTIVE JUNE 1, 2012

A new part 1C has been added to the Third Schedule part 1 of the GCT Act for energy saving devices:

1. The following lighting equipment –
 - (a) compact fluorescent lamps and ballast;
 - (b) fluorescent fixtures and tubes;
 - (c) circular fluorescent lamps
 - (d) fluorescent ballasts;
 - (e) high intensity discharge fixtures and bulbs;
 - (f) fibre glass panels for sky lighting.
2. Automated, electronic or computerized lighting control system including occupancy sensors and photo-cells for such systems.
3. Solar panels and tubes for solar water heating systems.
4. Solar cells designed to produce electricity from the sun.
5. Apparatus or machinery designed to produce motive power heat, light or electricity through the utilization of renewable sources of energy, for example, sun, wind and water.
6. Solar driers
7. Solar electric fans
8. Solar electric refrigerators
9. Solar water pumping system and accessories
10. Solar street and walkway lamps
11. Parking area and security solar lighting systems
12. Brackets and mount for solar lights
13. Bulbs for solar powered systems
14. Lighting control units

ENERGY EFFICIENT ITEMS – EXEMPTED FROM GENERAL CONSUMPTION TAX

(GCT) EFFECTIVE JUNE 1, 2012

15. Occupancy sensors
16. Seven day and twenty-four hour timers
17. The following water saving equipment-
 - (a) water saving shower heads
 - (b) flow restrictors for water faucets
18. Power factor correction capacitors
19. Ice thermal storage air conditioning systems
20. Air conditioning chillers with rotary screw compressors
21. Polyurethane foam insulation for roofs
22. Reflective films for glass windows
23. Photovoltaic panels
24. Charge controllers
25. Safety disconnects
26. Load breakers
27. Negative bonding blocks

- 28. Transfer switch
- 29. Inverters
- 30. Photovoltaic batteries

(<http://www.mstem.gov.jm/sites/default/files/documents/GCT%20Exemption%20June%201%202012.pdf>)

LIST OF RENEWABLE ENERGY AND ENERGY EFFICIENT ITEMS APPROVED FOR THE SUSPENSION OF THE COMMON EXTERNAL TARIFF EFFECTIVE JANUARY 1, 2013

Tariff Code	Description of Item (s)	Rate of Duty
8539.31	Compact Fluorescent Lamps	0%
8415.82	Air Conditioning Chillers with Rotary Screw Compressors	0%
8418.29.10 (Electric)	Vapour Absorption Refrigeration Systems	0%
8418.29.20 (Solar Non-Electric)	Vapour Absorption Refrigeration Systems	0%
8415.82	Thermal Storage Air Conditioning Systems	0%
8415.10	Ice Thermal Storage Air Conditioning Systems	0%
8415.20	Air Conditioning Chillers with Rotary Screw Compressor	0%
8414.51	Solar Electric Fans	0%
8418.21.20	Solar Electric Refrigerators	0%
3925.90.90 (Plastic)	Solar Water Heating mounting accessories	0%
8506.80, 8507.80	Photovoltaic Cycle Batteries	0%
8539.39	Bulbs for Solar Powered System	0%
8418.29.10 (Electric)	Absorption Refrigeration Equipment and Materials utilizing solar energy	0%
8418.29.20 (Solar Non-Electric)	Absorption Refrigeration Equipment and Materials utilizing solar energy	0%

(<http://neich.gov.jm/sites/default/files/documents/EEC/Approved%20COTED%20List%20January%201%202013.pdf>)