

# Little St. James Island

## *Solar Photovoltaic & Energy Storage Proposal*

**February 1, 2013**

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Jeanne Brennan  
LSJ, LLC  
6100 Red Hook Qtr B3  
St. Thomas, VI 00802

-----Submitted via email -----

REF: Little St. James Island  
**RENEWABLE ENERGY PRODUCTION PROPOSAL**

Dear Ms. Brennan:

Toshiba International Corporation (“Toshiba”) is proud to provide this preliminary proposal to evaluate and develop a renewable energy production system for island of Little St. James. Per our discussions we have provided you with four different options. Two of which will allow you to permanently isolate yourself from the WAPA grid, one being a total “green” solution the other utilizing your existing backup generation to provide the balance of power. We have also provided two solar only options that will allow you to save energy costs from those facilities when the solar resource is available, however, the balance of power will be provided from WAPA at their then current costs.

Regrettably, the 100% “green power” solution requires significant additional capital cost to address energy storage requirements, however, over the longer term could result in being the most economical solution.

Toshiba is a market leader in the development, installation and operations of fossil, nuclear and renewable energy power plants worldwide. We have developed and installed power plants as small as a few hundred kilowatts up to and exceeding 1,500 MWs. Our innovative power and electronic products along with our conservative design approach has yielded consistent customer satisfaction.

It will be important for you as the customer of this project to choose a provider that has not only the experience and capabilities to ensure your system functions as designed but also has the financial wherewithal to stand behind each project we install. TIC has already installed the largest commercial PV system in the Virgin Islands for a big box retailer and is currently in the process of implementing a utility scale solar PV project for WAPA on the island of St. Croix.

We look forward to discussing this preliminary proposal with you in anticipation of refining our estimates to provide you with the most economical and long lasting renewable project for your customers and staff.

Regards,

*Mark Lonkevych*

Business Unit Manager

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**Toshiba International Corporation ("Toshiba") proprietary information for use by TIC designated recipient.**

This Proposal is confidential and proprietary to Toshiba and is submitted to you for your evaluation purposes only. The information contained herein may only be disclosed to your employees or representatives who have a "need to know" in order to properly evaluate Toshiba's response for you and who have been informed of these confidentiality restrictions.

## Executive Summary

Toshiba International Corporation (“Toshiba”) has prepared the following high level overview of several different renewable energy production options for Little Saint James Island in the USVI.

The options are as follows:

1. Solar under WAPA’s Net Metering Program – Install a 100 kW<sub>AC</sub> solar photovoltaic system, remain connected to WAPA’s grid and purchase all additional power at WAPA’s published rates.
2. Solar to meet the average maximum daily kilowatt demand (kW) with exporting power to the grid – Install a 200 kW<sub>AC</sub> solar photovoltaic system, remain connected to WAPA’s grid and purchase all additional power at WAPA’s published rates. Note that this option may not be feasible without the approval of WAPA due to the fact that this option exceeds WAPA’s Net Metering Program and has potential to export power to the grid.
3. Solar to meet the maximum daily kilowatt hours (kWhs) required to power the island continuously for 24 hours – Install a 500 kW<sub>AC</sub> solar Photovoltaic System along with 200 kW<sub>AC</sub>, (1,998 kWh<sub>AC</sub>) of battery storage and disconnect from WAPA’s grid. Use the existing diesel generators only in emergency or backup situations whenever the solar or battery systems are not delivering the required power to meet island’s energy needs. This provides the island with a 100% green power solution.
4. Solar to meet the average maximum daily kilowatt demand (kW) and run the existing diesel generators as supplemental power – Install a 200 kW<sub>AC</sub> solar photovoltaic system and disconnect from WAPA’s grid. The existing diesel generators will be required to run whenever the solar system is not delivering the required power needs of the island. The island will however be subject to future and volatile fluctuations in the market supply and price of diesel fuel.

The contemplated solar generation systems being evaluated will ideally be located in the southern end of the island away from any existing structures. Final location and layout of the array will be determined upon option selection and during the detailed project development and engineering phase of this project. The proposed maximum area required for the largest solar system (700 kW<sub>DC</sub>) is approximately 2-3 acres.



## Preliminary Project Economics

Toshiba has developed this preliminary project’s economic analysis using budgetary information and very basic pricing models. None of the preliminary economics include any dollars for long term component replacement, insurance or cost of capital.

In evaluating these options it is important to not only look at first costs (simple payback) but also to understand the long term costs to operate and maintain these systems and supply fuel over a period of 20 to 30 years. In all options below there are additional capital costs for either interconnection to the WAPA grid for a partial solar solution, or computerized control systems for a 100% off-grid solution that must be contemplated over the cost of the basic solar system itself. Our analysis shows that all of these new systems should bring down the average cost of a kilowatt hour to between 30 and 40 cents. Presently, option 3 which includes the largest solar system with battery storage technology is slightly above 40 cents per kilowatt hour but we believe that this number will decrease if we go to a mix of different battery technologies.

Table 1: Capital Costs and Savings

Options	Description	VIWAPA Connection	Estimated Project Installation Cost	Solar DC Wattage	\$/KW DC installed	Est. Annual Savings	Simple Payback	Annual Fossil Cost	Annual O&M Cost	Total Annual Costs
1	100 kW <sub>AC</sub> Net Metered PV System	Yes	\$ 700,000	140	\$ 5.000	\$ 84,117	8.32	\$ 256,233	\$ 5,000	\$ 261,233
2	200 kW <sub>AC</sub> PV System with Generation Controls to Ensure No Export to VIWAPA	Yes	\$ 1,200,000	280	\$ 4.286	\$ 192,312	6.24	\$ 167,116	\$ 10,000	\$ 177,116
3	500 kW <sub>AC</sub> PV System with 200 kW Energy Storage System Rated for 2,000 kWh	No	\$ 7,000,000	700		\$ 330,350	21.19	\$ -	\$ 15,000	\$ 15,000
4	200 kW <sub>AC</sub> PV System Utilizing Existing Generators When Solar Irradiance Not Sufficient to Meet Load	No	\$ 1,200,000	280		\$ 155,628	7.71	\$ 139,722	\$ 60,000	\$ 199,722

Table 2: Capital Costs and Average Costs per kWh

Options	Description	VIWAPA Connection	Estimated Project Installation Cost	Solar DC Wattage	Total Annual Costs	New Island Avg. Cost per kWh without Amortized System Costs	20 year System cost per kWh without O&M and Amortization	Est. System cost per kWh
1	100 kW <sub>AC</sub> Net Metered PV System	Yes	\$ 700,000	140	\$ 261,233	\$ 0.31	\$ 0.042	\$ 0.36
2	200 kW <sub>AC</sub> PV System with Generation Controls to Ensure No Export to VIWAPA	Yes	\$ 1,200,000	280	\$ 177,116	\$ 0.21	\$ 0.072	\$ 0.29
3	500 kW <sub>AC</sub> PV System with 200 kW Energy Storage System Rated for 2,000 kWh	No	\$ 7,000,000	700	\$ 15,000	\$ 0.02	\$ 0.422	\$ 0.44
4	200 kW <sub>AC</sub> PV System Utilizing Existing Generators When Solar Irradiance Not Sufficient to Meet Load	No	\$ 1,200,000	280	\$ 199,722	\$ 0.24	\$ 0.072	\$ 0.31

## Next Steps

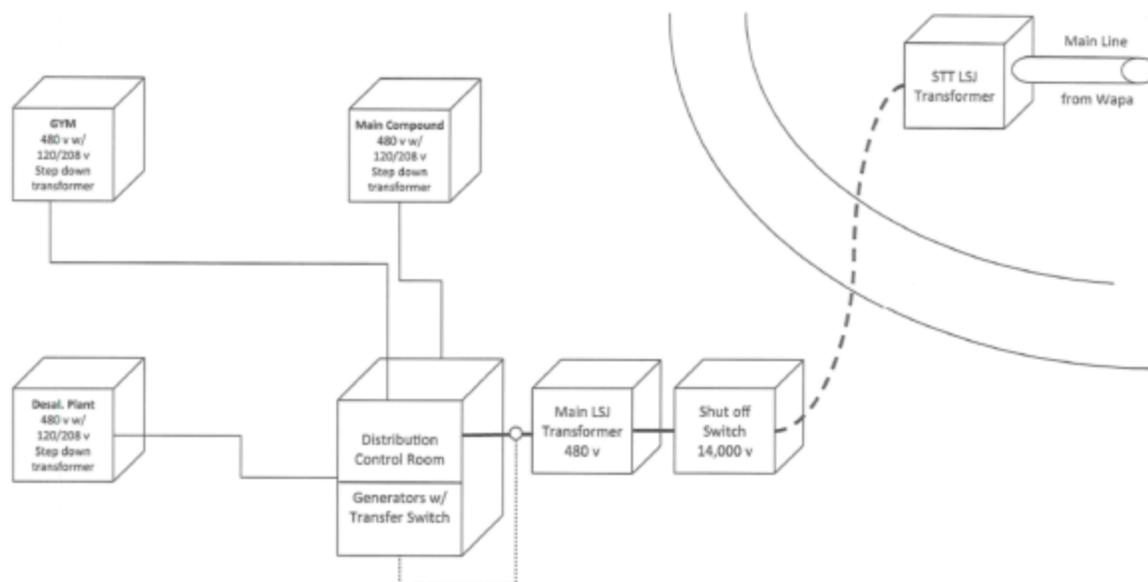
The next step would be to select one or two options to evaluate. This evaluation and detailed design phase is estimated to cost \$120,000 and can be started immediately. It will include site visits to examine the existing equipment and determine the actual and projected island electricity demand and consumption. Once these systems are evaluated and this data is collected it will be used to size the systems. The design will include all of the equipment and controls needed to construct a fully automated renewable energy power plant. At the conclusion of the detailed evaluation and design phase, the results will be presented to LSJ along with the updated costs to install, operate and maintain the systems. Should you select Toshiba to implement either one of the options listed above the design fee above will be waived as it has been incorporated into the capital costs for each option.

## Preliminary System Overview

Based upon the option selected by LSJ, Toshiba will evaluate and design a ground mounted solar photovoltaic generating plant and if applicable a battery energy storage system utilizing fixed tilt mono- or poly- crystalline solar modules and lithium ion or other similar battery storage technology.

## Facility Description

The PV system will be located on the south end of the island away from any existing structures and will comprise no more than 2-3 acres of land. The location of the energy storage battery cells and their associated charge controllers has yet to be determined, but will most likely be located near the existing distribution control room building.



**Ground Mounted Photovoltaic System based on 700 kW<sub>DC</sub>**

The PV system has conceptually been designed to be comprised of a ground mounted fixed tilt photovoltaic solar system utilizing poly-crystalline solar technology or equal with the following specifications:

PV Module:	REC 250PE-BLK-US
Manufacturer:	REC Group
Number of PV Modules:	
In Series	14
In Parallel	200
Interconnection:	480 V island distribution voltage
Nameplate Capacity:	700 kW <sub>p</sub> / 500 kW <sub>ac</sub>
Inverters:	(5) – 100kW-480V PV Powered or equivalent
Fixed Tilt:	16 degree
Azimuth:	0 degrees South



**Battery Energy Storage System**

The Battery system has conceptually been designed to be comprised of Toshiba SCiB quick charging and long life battery cabinets with the following specifications:

Battery Cabinet:	SCiB
Manufacturer:	Toshiba
Rated Size:	54 kWh
Number of Cabinets:	37
Interconnection:	480 V island distribution voltage
Nameplate Capacity:	200 kW <sub>ac</sub> , 1,998 kWh <sub>ac</sub>
Battery Inverter:	(2) – 100kW-480V Toshiba

**Long Cycle life**

Usable for more than 6,000 charge-discharge cycles

**High output**

Input/Output power density equivalent to a capacitor

**Safety**

The possibility of rupturing or ignition is low, even under extreme conditions



**Rapidly Rechargeable**

Rechargeable in approx. 5 minutes

**Cryogenic Operation**

Usable in extremely cold environments (-22 ° F/-30°C)

**High Effective Capacity**

High amount of actual usable energy over a wide range of SOC



### Inverters – and Interconnection System

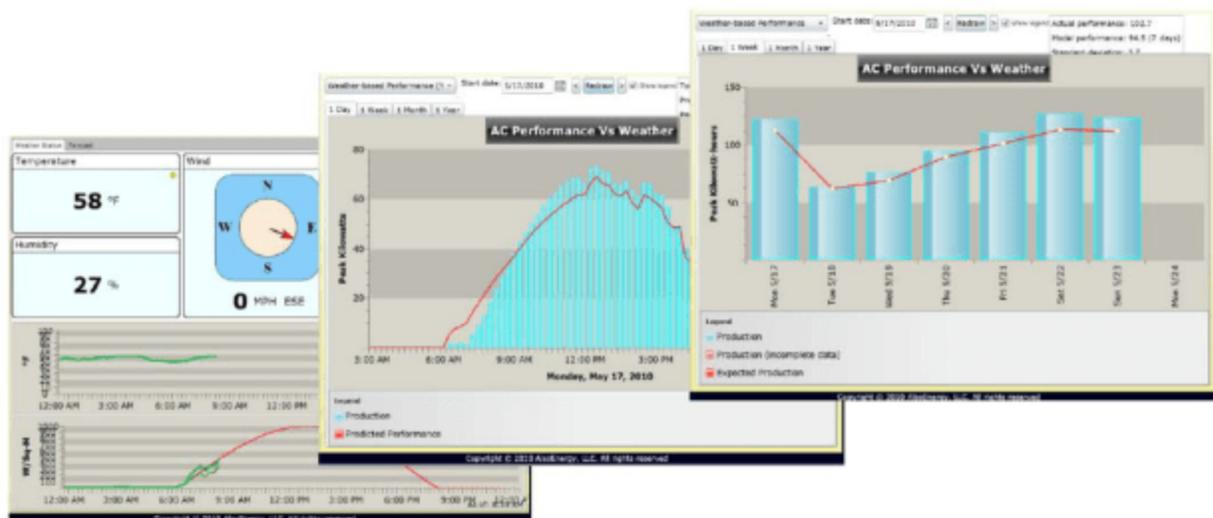
The AC output of the inverters will be connected in parallel with the main island electrical distribution system. Each inverter contains within it an AC and DC disconnecting means.



### Data Acquisition System

Toshiba will provide a Data Acquisition System (DAS) for the photovoltaic and battery energy storage systems. The DAS will monitor the performance of the system and the performance data will be integrated into an internet-based, display that enables the client to see the following:

- Current system outputs (the solar arrays, batteries and the AC inverters)
- Weather information, temperature, solar radiation
- Current and historical system performance (by day, week, month or year)
- Energy output quantified in kilowatt-hours, as well as equivalent numbers of homes powered by the sun
- Emissions eliminated or displaced by the system quantified in tons of CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub> or in equivalent numbers of cars eliminated from the road.



## Preliminary Proposal Assumptions and Clarifications

- Interconnection to the distribution system can be completed without major surprises (such as excessive costs or unreasonable delays). Interconnection can be completed within 1,500 feet of the edge of the array fields.
- There are no existing environmental conditions at the site which will prevent the project from being permitted by local, state, or federal authorities in a reasonable time frame. No wetlands, endangered species, etc. exist within the solar array boundary. Approvals from the DPNR can be obtained in a timely manner.
- Site storm water management requirements can be completed without major surprises (such as excessive costs or unreasonable delays) during construction.
- There are no significant underground obstructions. LSJ, LLC will locate any underground obstructions that may be in the path of proposed underground electrical cables.
- Design wind speeds are less than or equal to 145 mph.
- Land is suitable to support ground mounted structures. Only minor grading is required and no backfill, import or export of soils is needed.
- Standard steel posts ("H piles") able to be driven directly into the soil at an average rate of no less than 40 per hour per pile-driving machine. Required depth below grade to be not greater than 6 feet. Excludes delays caused by unforeseen subsurface conditions, such as rock, that may require drilling or other excess labor or a water table higher than the pile design depth which would require concrete foundations.
- A single contiguous PV power plant
- Minimal if any removal of trees and/or grubbing is required
- We have not included sales tax on the construction of the system.
- Lightning protection other than inverters has been excluded.
- Any costs for site recording, test excavation of archaeological sites, or formal evaluation of archaeological sites or historic resources are not included.
- Biological or environmental surveys will not be required for the site and if any such environmental documentation is required it shall be completed by LSJ, LLC.
- If desired, Toshiba will be responsible for [REDACTED] for a predetermined period at an additional cost.
- All output of the solar project shall be used by LSJ, LLC. Toshiba is not responsible for low loads (present or future).
- It has been assumed that there are no land remediation issues at the proposed site.
- Proposed design and system costs will remain valid through March 2013, but pricing will remain indicative and subject to change based on market conditions, actual site conditions and final system configuration
- Insurance - Risk or Loss (Hurricane) has not been included in our cost estimate.

## Project Evaluation and Design Activities

Toshiba will begin the initial engineering and design of the photovoltaic and battery energy storage systems based upon the data we collect on site. The project design package will include:

1. The design and drafting of Solar PV & ESS installation plans, including:
  - a. Title page
  - b. Site plan
  - c. PV array plan
  - d. Building elevations (if applicable)
  - e. PV balance-of-system (BOS) equipment details and elevations (racking, concrete pad, elevations, combiner boxes, re-combiners, disconnects, etc.) (if applicable)
  - f. PV array electrical plan (string diagram, conduit runs, etc.)
  - g. PV wire diagram(s)
  - h. PV electrical interconnection plan/details
  - i. PV system specifications
  - j. PV labels & markings
  - k. PV array-to-inverter matching
  - l. PV string sizing calculations
  - m. Wind load calculations for PV mounting system provided by OEM or Structural Engineer (PE)
  - n. Structural analysis & calculations provided by OEM or Structural Engineer (PE)
  - o. PV NEC wire sizing calculations
  - p. PV voltage drop calculations
  - q. PV conduit fill calculations
  - r. PV Electrical Engineering review and seal/stamp
  - s. PV Structural Engineering review and seal/stamp (if applicable for concrete pad(s), enclosures, etc.)
  - t. ESS layout
  - u. ESS electrical plan
  - v. ESS wire diagram(s)
  - w. ESS electrical interconnection plan/details

- x. ESS BOS equipment details and elevations (concrete pad, elevations, combiner boxes, disconnects, fencing, bollards, HVAC, enclosures, etc.) (if applicable)
  - y. ESS system specifications (if applicable)
  - z. ESS labels & marking
  - aa. ESS battery-to-inverter matching (if applicable)
  - bb. ESS string sizing calculations (if applicable)
  - cc. ESS NEC wire sizing calculations
  - dd. ESS voltage drop calculations
  - ee. ESS conduit fill calculations
  - ff. ESS Electrical Engineering review and seal/stamp
  - gg. ESS Structural Engineering review and seal/stamp (if applicable for concrete pad, enclosures, etc.)
  - hh. ESS thermal and auxiliary power distribution details (if applicable)
2. Permitting support, equipment research and trouble-shooting, technical support for installers, plan checkers, permit couriers/runners, field technicians, and engineers.
  3. Deliverables will be electronic PDFs of 8-1/2" x 11", 11" x 17", and/or 22" x 34" sized plan sheets.

Toshiba is currently in the design phase of a PV solar and battery energy storage system demonstration project at our factory in Houston, TX. There may be synergies of developing these projects together.

## Toshiba Overview

As a leading global manufacturer and integrator of power systems, Toshiba is uniquely qualified to meet the power generation needs of today and tomorrow. Toshiba has pioneered many industry advancements with innovative and environmentally friendly products and services, representing more than 100 *gigawatts* of power throughout the world.

Toshiba boasts over 100 years of power systems experience, with over 40 years in the Americas. Toshiba's power systems expertise and experience includes:

- **Steam Turbine Generation** – over 1,700 units delivered worldwide; #1 provider in United States for past six years
- **Hydroelectric Generation** – over 240 hydroelectric turbines and 300 hydraulic generator units delivered
- **Nuclear Generation** – delivered 32 nuclear reactor units and constructed 112 nuclear power plants representing 110,000,000 MW of generation
- **Renewable Generation** – designed and constructed over 50 MW of distributed and utility scale solar power plants
- **Transmission and Distribution Systems**

Our rich history, paired with our focus to be one of the world's foremost eco-companies, has sparked Toshiba's commitment to provide customers with renewable energy and smart grid solutions.

As a global solutions provider of photovoltaic and renewable energy systems, Toshiba offers ground and roof mounted solutions for utility scale and behind-the-meter applications. From design to power plant operation and maintenance, Toshiba delivers comprehensive, customizable solutions for a variety of users including utilities, governments, commercial energy users, land owners, and developers.

**“One of our core commitments is the Toshiba Group Environmental Vision 2050, with an aggressive goal of raising the eco-efficiency of our products and business processes 10 times by 2050 as we endeavor to address one of today's most pressing problems, global warming. We are proactively implementing environmental initiatives throughout our business activities. More specifically, we are helping to mitigate the impact of global warming by promoting state-of-art environmental technologies, such as carbon capture and storage (CCS) systems, solar photovoltaic systems for solar power generation, a new generation of innovative rechargeable batteries for industrial and automotive applications and new eco-friendly LED lighting systems.”**

**Norio Sasaki**  
President and CEO



Toshiba's proven track record of delivering highly reliable power from clean renewable sources, backed by performance guarantees, make Toshiba the ideal solar power solutions provider. The full suite of services includes:

- Power Plant Development
- Full Turnkey Engineering & Construction
- Operations & Maintenance
- Performance & Availability Guarantees
- Battery Storage and MicroGrid Control System

The Toshiba Photovoltaic Team is comprised of over 120 employees located throughout the world. Photovoltaic projects in the Americas are the responsibility of Toshiba. Toshiba is headquartered in Houston, Texas at a 650,000 square foot, state-of-the-art facility for manufacturing hybrid electric vehicle motors, uninterruptible power supplies, adjustable speed drives, inverters, motor control centers, and other power electronics. The manufacturing process is totally integrated, from research and development, design, engineering, production and manufacturing to after-market service and support.

Toshiba's Photovoltaic Systems Team leverages the extensive knowledge and capability of Toshiba's power electronics engineers and field service technicians and the systems expertise of Toshiba's Power and [REDACTED] Divisions to deliver highly efficient and very reliable photovoltaic power systems. Additionally, Toshiba's Photovoltaic Systems Team works closely with our colleagues in Japan to thoroughly qualify technologies deemed reliable and of the highest quality in order to meet Toshiba Corporation's standards. This includes exhaustive quality assurance audits of the manufacturing process involved in the production of photovoltaic modules.

**Toshiba International  
Corporation**

- Incorporated 1967
- Headquartered in Houston, Texas
- Offices in San Francisco, Denver, Philadelphia, Milwaukee, Detroit
- Wholly owned subsidiary of Toshiba Corporation
- Power, [REDACTED], and Industrial businesses throughout the Americas
- 1,100 employees
- ISO9001 & 14001



## Past Experience

### Photovoltaic Experience

Toshiba has designed and constructed over 50 MW of both utility scale and distributed generation photovoltaic systems, and has a development pipeline of over 1,000 MW. Following is a sampling of notable utility-scale projects in operation that demonstrate Toshiba's experience with photovoltaic technology.

### Projects Under Development

#### Citizens Energy Corporation:

Toshiba International Corporation is in the final phase of construction of a portfolio of five photovoltaic projects in Massachusetts representing 9.3 MW<sub>DC</sub> in aggregate. Toshiba's scope includes:

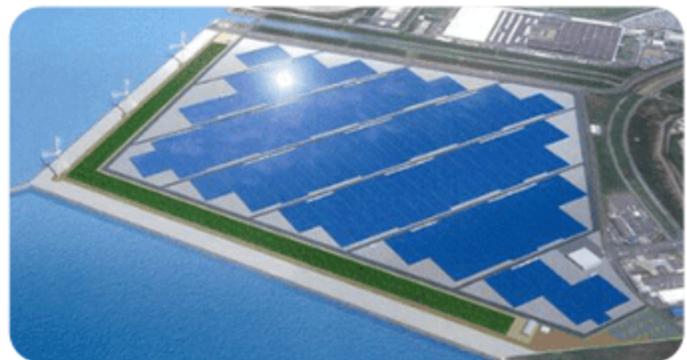
- final detailed design and value engineering
- procurement
- full turnkey construction
- commissioning and startup
- operations and maintenance.

#### Contact Information:

Brian Morrissey  
Citizens Energy Corporation  
88 Black Falcon Avenue  
Boston, MA 02210  
(617) 951-0405

#### Mitsui Chemical Plant:

On November 7, 2012, Toshiba Corporation, in partnership with Mitsui Chemicals, Inc., Mitsui & Co., Ltd., C-Tech Corporation, Toagosei Co., Ltd., Toray Industries, Inc., and Mitsui Engineering & Shipbuilding Co., Ltd., broke ground on Japan's largest solar and wind power generation facility. Located in Tahara City, the power generation facility will consist of a 50 MW of solar power plant and 6MW of wind turbines. The project total investment is around 18 billion yen.



#### Minamisoma City, Fukushima Prefecture:

In June, 2012, Toshiba Corporation and the city of Minamisoma partnered to develop and build mega-solar power plants in an effort to boost reconstruction from the March 2011 earthquake and tsunami, and ensuing nuclear disaster.

The large-scale solar farms, currently in the development phase, will produce a total of 100,000 kilowatts of electricity. Commercial Operation is planned for 2014.

**SB Energy, a subsidiary of SoftBank:**

Toshiba is developing two utility-scale solar projects in partnership with SB Energy, including the 111MW Yasuhira Plant which will likely be the largest solar plant in Japan. The other 22MW plant is located in Arao, Kumamoto Prefecture.

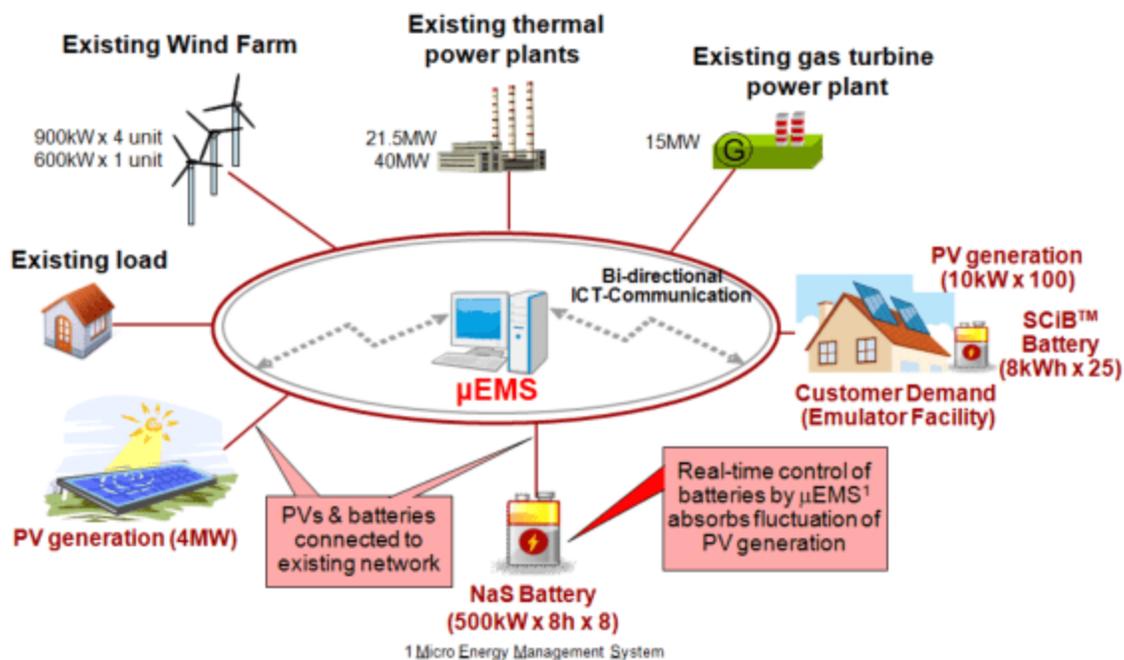
Additional projects under development include a 10MW plant in Kyushu Prefecture and a 10MW plant in Himeji Hyogo Prefecture.

**Completed Projects**

**Solar Project #1: Miyako Island Smart Grid Project**

Toshiba was the prime contractor for the Miyako Island Smart Grid Project, located on Miyako Island, Okinawa prefecture, Japan. The project demonstrates the benefits of implementing a next-generation supervisory control Micro Energy Management System to optimize supply and demand management for networks with a high penetration of renewable energy sources. As prime contractor for the project, Toshiba was responsible for all engineering, procurement of major equipment, and implementation of a 4MW photovoltaic system. The project incorporated Toshiba’s highly-advanced SCiB™ battery technology for electricity storage. It also included Toshiba inverters which have a conversion efficiency of 97.5% and are in the world’s highest class for power conditioners.

**Schematic of Miyako Island Smart Grid**



### Miyako Island 4MW Photovoltaic System



### Solar Project #2: Ukishima Solar Power Plant

Toshiba was the prime contractor for the 7MW Ukishima Solar Power Plant, a project jointly developed by Tokyo Electric Power Company and Kawasaki City. The project is located at the Ukishima First Waste Landfill owned by Kawasaki City, Japan.

### Ukishima 7MW Photovoltaic System



**Solar Project #3: Italy (San Rocco)**

Scope: 3.2 MW – Full EPC Contract

Contract Value: 10,530,000 €

Contract Award: October 2010

Contract NTP: December 2010

Completion Date: December 2010

Scope of Works: Design, engineering, supply and commissioning of PV parks )PV panels, MV switchgears, inverters, SCADA, cabling, steel supports, civil works and ██████ for two years.

Main Suppliers: LG (PV panels), Inverters (Toshiba), SCADA (Prisma Impianti)



**Solar Project #4: Italy (Alessandria)**

Scope: 7.3 MW – Full EPC Contract

Contract Value: 27,000,000 €

Contract Award: September 2009

Contract NTP: November 2009

Completion Date: September 2010

Scope of Works: Design, engineering, supply and commissioning of PV parks )PV panels, MV switchgears, inverters, SCADA, Anti-intrusion system, cabling, steel supports, civil works and maintenance for twenty (20) years.

Main Suppliers: Panels (Upsolar), Inverters (Siemens), SCADA (Siemens)



**Solar Project #5: Italy (Carpi)**

Scope: 2.2 MW – Full EPC Contract

Contract Value: 7,500,000 €

Contract Award: November 2010

Contract NTP: March 2010

Completion Date: March 2010

Scope of Works: Design, engineering, supply and commissioning of PV parks )PV panels, MV switchgears, inverters, SCADA, cabling, steel supports, civil works and ██████ for two years.

Main Suppliers: LG (PV panels), Inverters (Toshiba), SCADA (Cematech)

**Solar Project #6: Italy (Valenza)**

Scope: 5.0 MW – Full EPC Contract

Contract Value: 13,000,000 €

Contract Award: May 2011

Contract NTP: August 2011

Completion Date: August 2011

Scope of Work: Design, engineering, supply, and commissioning of PV parks (PV panels), MV Switchgears, inverters, SCADA, Anti-intrusion system, Cabling, steel supports, civil works) and maintenance for twenty years.

Main Suppliers: Panels (LG), Inverter (Toshiba), SCADA (in Trattativa con Ufficio Acquisiti)

## Toshiba Team's Photovoltaic Experience

The Toshiba Photovoltaic Team's experience includes the following representative projects that have been completed and are in operation:

### Solar Project #1: Industrial Facility

Build, Own and Operate solar power system in accordance with a PPA. The solar PV system consists of both solid crystalline panels and flexible thin-film panels – installed 2,100 Solar World 175 W crystalline panels, and 92,000 square feet of flexible thin-film material. The total system output is 1,000 kW and annual energy produced by this system is approximately 1,100,000 kWh.



The electricity generated was sold to the customer under a 20-year Power Purchase Agreement (PPA). PPAs allow customers to reduce or completely avoid up-front capital costs. Estimated reduction in electricity costs of approximately 30%.

Federal tax credits and the value of Renewable Energy Credits were utilized to provide this renewable solution.

### Solar Project #2: State Government Facility

This solar system involved the installation of both crystalline and thin film panels on the roof of the building and nearby grounds. The 294 kW system includes 1,488 Solar World 175W crystalline solar panels as well as 5,522 sq ft of Uni-Solar thin film PV panels. The total output of the system is approximately 300 kW and the annual output is approximately 399,000 kWh. The system offsets 50% of the facility's total power needs.



The PV system provides 50% of customer's annual electric needs. Power is sold to customer under a 15 year Power Purchase Agreement. Tax credits and Renewable Energy Credits were utilized to provide this renewable solution.

### Solar Project #3: Federal Facility

Completed and brought on-line a 520 kW solar PV system on the roof top of the customer's building. Completed the design, procured major equipment, engaged local subcontractors to build, and continue to own and operate the system.



The thin-film photovoltaic (PV) system covers 95,000 sq. ft. of rooftop, and is expected to generate about 667,000 kWh per year with a peak rating of 468 kW. The system supplies approximately 13% of the building's electricity needs.

Approximately 50% of the project's cost was avoided through the use of rebates and incentives. Power is sold to customer via a 10 year Power Purchase Agreement.

**Solar Project #4: Industrial Facility**

This installation features approximately 50,000 square feet of thin-film solar panels—lightweight, flexible photovoltaic material that can be easily applied directly to existing rooftops. The project is estimated to reduce greenhouse gas (GHG) emissions by 200 metric tons annually and reduce electricity costs by approximately six percent. This system produces approximately 200 kW peak output and 303,000 kWh annual output. The system will offset 15% of the facility’s peak kW power needs. Power is sold to the customer under a 15 year Power Purchase Agreement.



**Solar Project #5: Industrial Facility**

This 5 MW solar installation produces approximately 20% of the customer’s electricity requirements. This is a ground-mounted system on approximately 21 acres and utilizes a single axis tracker to optimize the exposure of solar panels to sunlight. Electricity is sold to the customer under a 20 year Power Purchase Agreement.

**Solar Project #6: Commercial Airport**

This 4.4 MW solar power installation supplies approximately 7,000 megawatt-hours of electricity to the customer, utilizing approximately 19,000 Yingli solar panels. Generating the same amount of electricity that will be produced by the new solar installation using non-renewable sources would result in the release of more than 5,000 metric tons of carbon dioxide. Electricity is sold to the customer under a 20 year Power Purchase Agreement.

**Solar Project #7: Industrial Facility**

The system features 2,490 Uni-Solar 136-watt, thin film solar panels. The 400 kW system is expected to supply approximately 16% of the energy for the customer. Electricity is sold to the customer under a 15 year Power Purchase Agreement.

**Solar Project #8: Commercial Facility**

This 525 kW solar power installation supplies approximately 30% of the customer’s power and spans over 7 building rooftops. The installation required approximately 2,800 crystalline panels. The system generates more than 12 million kWh of electricity over 20 years, and will prevent the release of more than 8,800 metric tons of carbon dioxide into the atmosphere. Electricity is sold to the customer under a 20 year Power Purchase Agreement.