SOLAR TECHNOLOGY

FCL

2018

This information was last revised March 2018

CANADIAN GREEN ENERGY TECHNOLOGY (CGET)

The following technologies, process and systems are under the FCL umbrella and its subcontractors.

All Clean/Green Technologies included herein allow the use of the mechanisms provided by COP21-CMP11 (Paris, 2015) Climate Conference – United Nations Framework Convention on Climate Change with Carbon Banking Operations/Green Bonds Programs.

United Nations Framework Convention on Climate Change

Geo-Thermal Power Applications/Turn Keys are usually carried out simultaneously with Wind and Solar Applications.

→

Geo-Thermal
+
Wind
+
Solar

Typically an ROI for Geo-Thermal can be organized within sixty (60) months and Carbon Credits to also apply.

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- Merchant Bank Financial Backing
- Authorized Subcontractors

FCL

COUNTRY

- Government Approvals
- IPP and PPA

- Concentrated Solar Power (CSP) Technology
- Patented

CGET

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INTRODUCING: THE FUTURE OF SOLAR

- The first Base Load 24/7 Solar to Thermal Power Generation
- The KEY: Unique Solar Storage
- The most efficient. Low cost deployment & minimal impact Solar System
- GE Energy: Highest performance Power Turbine
- Fast Schedule
- Long Term Reliability
- Bankable

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24/7 SOLAR TO THERMAL POWER

BREAKING THE ENERGY WALL

- 60% of power usage is not during daylight hours
- Solar as prime source requires:
  - cost reduction
  - efficiency and
  - energy storage to become viable

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CGET - SOLUTION TO SOLAR

MULTI-DAY BASE-LOAD POWER

integrating

CGET POWER SOLUTIONS

combines

LOW COST SOLAR COLLECTION

&

UNIQUE LONG TERM

ENERGY STORAGE

with

General Electric

GE Energy Efficient Steam Turbine Generation

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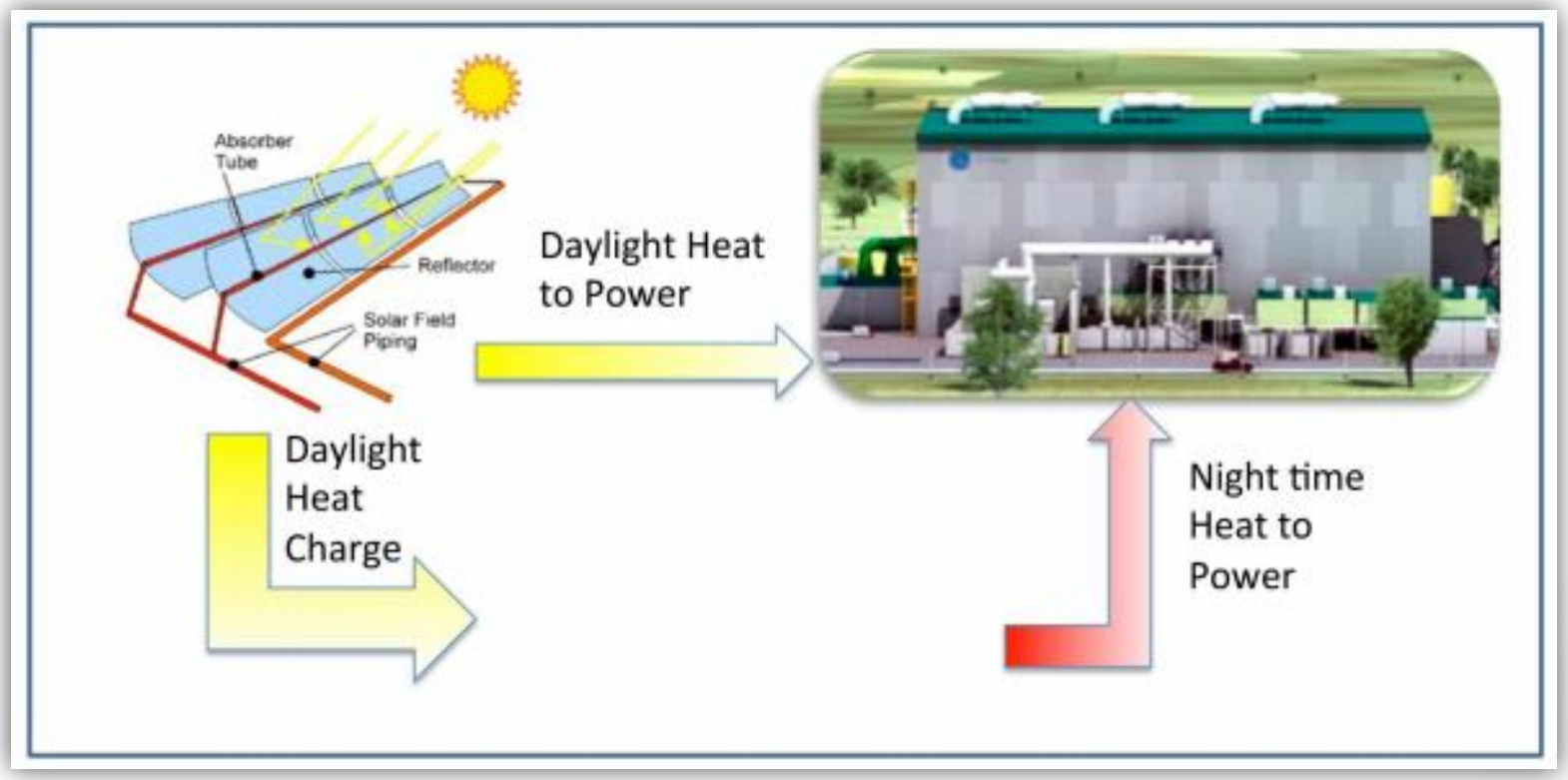
SOLAR TO STEAM TO POWER CYCLE

Solar to Steam . . . drives **DAYTIME POWER** and builds **STEAM BATTERY** for **NIGHT TIME POWER** via **STEAM TURBINE GENERATOR**



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EFFICIENT SOLAR COLLECTOR

Technological Advancements make SOLAR CONCENTRATORS . . . Competitive

PATENTED SOLAR RECEIVER TECHNOLOGY

≡ Produce temperatures over 850° C

≡ Extremely low energy loss

THE WORLD'S MOST EFFICIENT SOLAR TO HEAT ENERGY CONVERSION

≡ Small SOLAR field reduces cost

≡ Minimizes environmental impact

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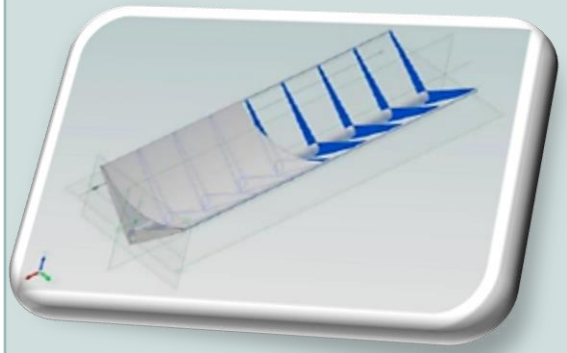
SOLAR ARRAYS

PATENTED TECHNOLOGY uses:

≡ Vacuum draw behind mirror surface and

≡ Pressurized structural support for low cost solar reflector system



≡ Reduces weight of traditional steel and glass mirrors by 80%

≡ Manufacture solar arrays “on-site” to reduce shipping weight & cost

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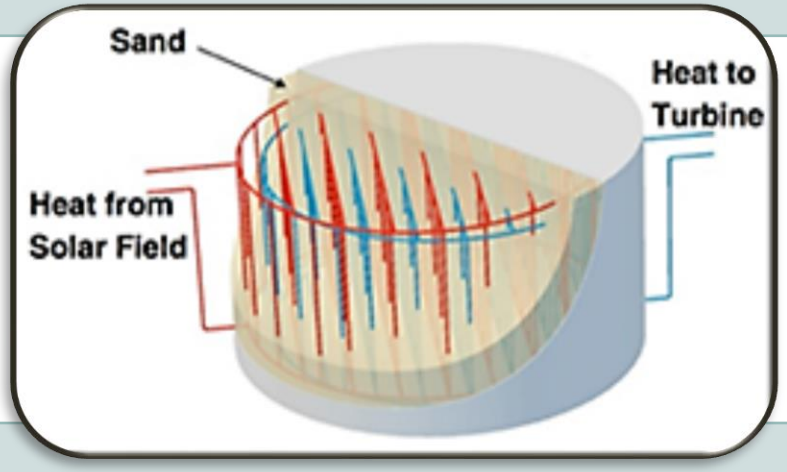
THERMAL STORAGE . . . FIRST SOLAR BATTERY

CONFIGURABLE THERMAL STORAGE

- Patented solid phase storage is ½ the volume of molten salt

  ≡ ½ the cost of molten salt makes multiple day energy storage affordable.



- Internal heat exchanger delivers conditioned 350 psig

  ≡ 850° C energy to GEE STG

  ≡ Unique heat carrier technologies

INTEGRATED GEE FLEX 50 TURBINE

. . . BEST IN CLASS

GE Energy has specifically engineered the Flex-Efficiency 50 Plant to give customers a total plant design that is:

SIMPLE & COST EFFECTIVE

to

INSTALL, CONTROL & MAINTAIN

≡ 100% increase in power density over competitive systems
≡ Steam side at 60% base load efficiency
≡ Generator exceeds 99% efficiency
≡ Reaching 99.6% availability

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INTEGRATED GEE FLEX 50 TURBINE

. . . BEST IN CLASS

2018

ADVANCED POWER WITH A NEW STANDARD OF HIGH EFFICIENCY & OPERATIONAL FLEXIBILTY

≡ Designed to work effectively with Renewable Energy

≡ Pre-planned schedule, less than 24 months order to commissioning

≡ Fast Turn Up – Turn Down

≡ Responsive to steam cycles & grid requirements

≡ Optional Heat Recovery

≡ Stand-by power block (LNG Turbine)

EPA Canada, USA, Eu, London Certified

CANADIAN GREEN ENERGY TECHNOLOGY (CGET)

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CONFIGURATION REQUIREMENT

CGET SOLAR BATTERY

DEFINES:

- **# of days of Energy Storage**
- days to fully recharge
- the size of the Thermal Storage Field
- the Solar Array Field beyond Day Light Power

GEE POWER GENERATION

DEFINES:

- **Power output & Structure**
- 1 or 2 n turbine generators
- grid connection
- steam supply for highest efficiency

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PROJECT FINANCIAL SUMMARY

CGET SYSTEM @ 70% STEAM TURBINE EFFICIENCY

	10 MW	50 MW
Daylight Power Total	26 M	100M
CGET Base Power System: 24/7 with 2 Days Energy Storage and 8 Day Recharge		
Base Power 24/7 Total	60M	250 M
Acres for 24/7	67	333
GEE Power	10 M	50 M
SOLAR Field 24/7	26M	110 M
EPC Total	14 M	45 M

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½ MW, RAMPED 5 MW AND THEN TO 10MW CONCENTRATED SOLAR POWER (CSP) SYSTEMS FOR DAY-NIGHT SOLAR-FUELED POWER GENERATION

By increasing the efficiency of energy collection it will enable cost-effective, long-term energy storage, therefore allowing Utility Class Solar Fueled System.

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PROJECT REVIEW

- Continuous solar-fueled electrical power generation 24 hours a day, 365 days a year from solar power.
- GE supplied turbines are available for 10MW and larger installations. Siemens Turbines for this specific application will be deployed. The Steam Turbine requires a small customer supplied outbuilding and the ground based thermal storage will be located in close proximity to the solar arrays and turbine facility.
- Systems are designed to operate 24-hours continuous with an additional 48-hour continuous storage in the case of multi-day solar outage and a 4-day recharge of the storage when 100% depleted.
- Turnkeys will provide the transport, assembly and commissioning supervision of the project using local labour and construction.

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TOTAL COST SUMMARY

Key Assumptions

Power Plant Size (MW Peak Solar Noon Rating)	**0.50**	**5.00**	**10.00**
Yearly kWh Generated (8000 hours)	3,383,172	33,831,724	67,663,448
Turbine Efficiency	70%	70%	70%
Overnight Storage	yes	yes	yes
Days of Add'l Storage	1	1	1
Energy Loss Rate per 24 Hours	5%	5%	5%
Days to Recharge	4	4	4
Number of Solar Arrays	39	393	785
Thermal Storage Mass (Tonne)	748	7,483	14,967
Land Hectares Required	0.57	6.08	12.57
Total Thermal Storage MWh	23	229	457

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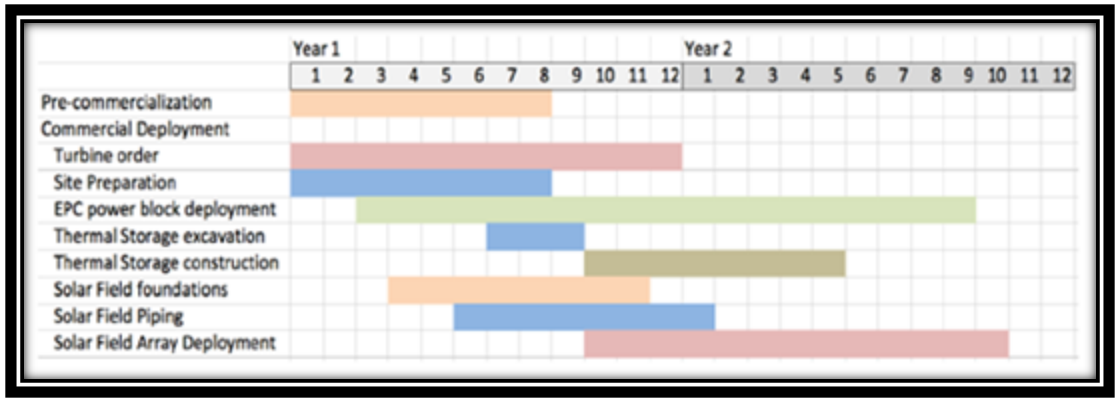
50 MW SYSTEM + COMMERCIAL BUSINESS

FROM START OF ORDER – 20 MONTHS TO COMMISSIONING:

- 50MW within 24 months of final Prototype plant testing
- GEE turbine delivery determines schedule
- Requires local EPC for site preparation and array erection



SOLAR IN PRE-COMMERCIALIZATION PHASE

FUNDING REQUIRED TO COMPLETE FULL SYSTEM TESING IN 6 MONTHS

CGET "Trough based" solar concentrators

- Laboratory bench scale – Testing completed in 2012
- Full scale unit-in-process – to be completed 3 months from funding
- Implementation of ongoing project in North Americas continental, CARICOM, Brazil (in-land & offshore, onsite field upgrade testing in Mexico done in October 2012

CGET Thermal Store – Sand based solid state heat storage

- Laboratory bench scale – Testing completed in 2011
- Full scale unit-in-process – to be completed 5 months from funding

Full scale pilot plant without steam turbine – power block

- Begin testing program month 7
- Complete testing month 8

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INVESTMENT REQUIREMENTS: $16M

- 100 KW Prototype plant for completion within 6-8 months of funding
- 50 MW within 20-24 months of final Prototype plant testing
- November 2012 – offering 10MW in-country Prototype to follow with up to 5,000 MW in-country manufactured with an investment of $16M USD in trust through Counsel of Record – Fasken Martineau at their Head Office in Toronto, Ontario, Canada.

Pre-Commercialization Costs

	Costs $MM	Timing - Months from Funding 1 2 3 4 5 6 7 8 9 10 11 12
100 KW Pilot with Storage, no Power Block		
Mirror Deposition System	6.000	
Proprietary Production System	2.000	
Thermal Store Assembly	0.500	
Full Scale Plant Assembly	0.500	
Controllers System Completion	0.500	
Testing and Rework	1.000	
Plant Construct & Test: Sub-Total	10.500	
Intellectual Property Expenses	0.750	
R&D (Proprietary 2, etc.) (2 Yrs)	2.000	
Mkt Dev & Op Funding	2.000	
Funding and Organization Expenses	0.973	
Total	16.223	

SUMMARY

NEXT GENERATION RENEWABLE ENERGY:

- SOLAR with high efficiency, lowest environmental impact and competitive @ approximately $6 per Watt turnkey solution according to the World Bank and UN pricing.
- With multi-Mega application, a budget of $5 or less per Watt could be considered.
- Solved the solar battery dilemma.
- The only solution with viable 24/7 operating capacity
- Key suppliers: GE Energy, FCL (and its subcontractors)

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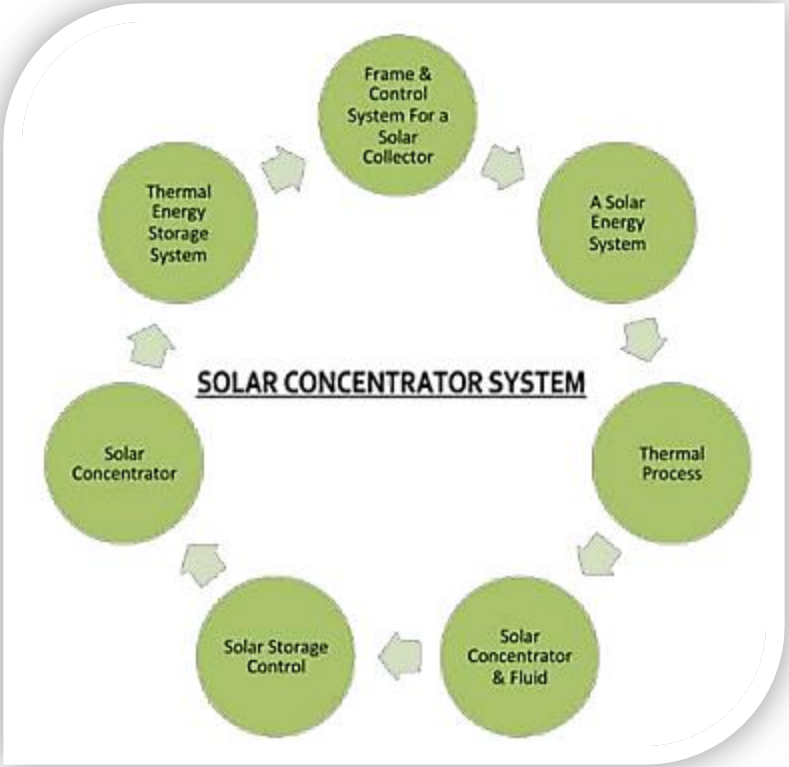
FRAME AND CONTROL SYSTEM FOR A SOLAR COLLECTOR

This invention is in the field of equipment for collecting solar energy and in particular a frame and control system for solar collectors, such as mirror arrays/placements.



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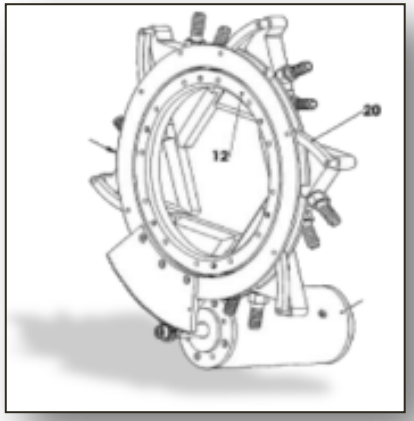
A SOLAR ENERGY SYSTEM

Includes a solar concentrator operative to direct a concentrated solar beam onto a solar receptor. A shutter plate is positioned between the solar concentrator and the solar receptor and is movable frim an open position adjacent to the solar beam, to a closed position wherein at least a portion of the solar beam contacts a front face of the shutter plate and is blocked from contacting the receptor. A cooling circuit is operative to move at least one shutter plate from the open position to the closed position and a shutter control operative to stop movement of the shutter plate at a plurality of locations between the open position and the closed position.



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THERMAL PROCESS

A method of providing controlled heat transfer between two bodies of dissimilar temperature incorporates regulated heat pipe to control the vapour phase heat transfer characteristics of the working fluid.

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SOLAR CONCENTRATOR AND FLUID

An apparatus for collecting heat from a solar concentrator has an isothermal body defining an elongated cavity with a circular opening having a diameter equal to a diameter of a focus of the solar concentrator, the cavity having reflective walls such that solar rays contacting the walls are substantially reflected.

The circular opening is located at the focus of the solar concentrator and perpendicular to a principal axis of the solar concentrator and the axis of the cavity is aligned with the principal axis of the solar concentrator. The heat generated in the isothermal body is absorbed by the hear sink. The length of the cavity is about 5 to 9 times the diameter of the opening of the cavity. Depending on material used, the isothermal body can be enclosed in a reducing atmosphere to maintain reflectivity of the cavity wall.

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PATENT #5

2018

FCL

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SOLAR STORAGE CONTROL

Provided is a method and apparatus for segmenting packets into cells of variable sizes in order to facilitate the parallel transport of data symbols common to a single packet through a composite medium made up of a number of lanes. According to the invention, the method of segmenting packets results in cell sizes that efficiently use the available capacity and minimize the complexity of any additional apparatus required in the receivers used to reassemble the packets from the variable sized cells. Additionally, the invention could be advantageously combined with the Generic Framing Procedure (GFP).

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SOLAR CONCENTRATOR

A solar concentrator has frame members connected together to form a framework and a flexible sheet attached to the framework such that the flexible sheet takes a loose shape and can flex in response to shaping forces exerted thereon. The sheet has a reflective surface located between the frame members. A shaping force system is operative when activated to exert the shaping forces on the sheet, the shaping forces configured to draw the sheet from the loose shape into a desired shape such that solar rays striking the reflective surface are focused on a target. Thin wall tubing filled with pressurized air can provide strong light frame members. When the shaping force system is deactivated, the flexible sheet reverts substantially to the loose shape.

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