New CO₂ Fuels: An Introduction...

11th April 2013
Greenearth Energy – Group Overview

**Greenearth Energy Efficiency**

**Cash Generator**
- Energy Efficient Lighting Solutions
- **Sector Focus:** Industrial - Warehouse - Manufacturing
- Key customer base established
- Cash flow generating
- Proven efficiencies over 60%
- Pay-backs between <1 and 3 years

**NewCO2Fuels**

**CO2 to Fuel**
- Joint Venture with NCF Israel and Erdi Fuels Ltd

**Geothermal**

**Established Government Grant**
- Three Geothermal permits in the Latrobe Valley & Geelong
- $25m State Government ETIS Grant awarded for Geelong
- Geelong Geothermal Power Project
  - to establish a proof of resource and
  - 12MW demonstration plant
  - Partners include:

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New CO2 Fuels

**CO$_2$ to Fuel Conversion Technology**

Relationship initiated in 2011

Greenearth Energy holds 42.5% of the equity in NewCO2 Fuels Ltd.

Under development with Weizmann Institute in Israel.

Only Australian company in the past 30 years to establish a deal with the Institute.

**Greenearth Energy Ltd.**

NCF Staff

**New CO2 Fuels**

Why is Greenearth Energy excited by this?

- **Game changing technology:**
  - Converting CO$_2$ to Fuel using solar energy

- **Proven Science with key efficiencies & stability:**
  - Proven in the laboratory with electrical and gas energy
  - Industrialise via modular plants, not larger scale

- **Proof of concept nearing completion, pilot phase approaching:**
  - Technology Demonstrator to be completed 2013

- **Interest building amongst high CO$_2$ emitters in Australia:**
  1. Establishing a viable new fuel source at <50% of the price
  2. Carbon Price; turning a cost centre into a profit centre.
  3. A social conscious; environmentally aware customers

- **Discussions held with key CO$_2$ emitters:**
  - Talked with 11: representing >30% of Aust CO$_2$-e emissions

- **Technical reviews initiated with key potential partners.**

- Greenearth Energy retains a royalty stream on all future production of fuel and construction of plants / systems.

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A current example - The numbers are compelling

An example of an operating, brown coal power station in Australia

Assume in this example we only capture & process 5% of the CO₂ emitted at the plant

<table>
<thead>
<tr>
<th>Units of Measure</th>
<th>Units</th>
<th>CO₂ Conversion Units</th>
<th>Occupied land area</th>
<th>Amount of CO₂ processed</th>
<th>Amount of H₂O processed</th>
<th>Amount of Oxygen produced</th>
<th>Amount of methanol produced</th>
<th>Revenues per year</th>
<th>Royalties from Sales for GER @1% per module</th>
<th>Daily royalties to Greenearth from Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of units</td>
<td>150,000</td>
<td>7,500</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$4,750</td>
<td>$130,137</td>
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<tr>
<td>Hectares</td>
<td>22,000</td>
<td>1,100</td>
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<td></td>
<td></td>
<td>$47.5</td>
<td>$6,507</td>
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<tr>
<td>Millions of tons p/year</td>
<td>15.7</td>
<td>0.785</td>
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<tr>
<td>Millions of tons p/year</td>
<td>12.8</td>
<td>0.64</td>
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<td>Millions of tons p/year</td>
<td>17</td>
<td>0.85</td>
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<tr>
<td>Millions of tons p/year</td>
<td>11</td>
<td>0.55</td>
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<td>Millions of $USD</td>
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<td>$238</td>
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<tr>
<td>Millions of $USD</td>
<td>$47.5</td>
<td>$2.4</td>
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<tr>
<td>$USD</td>
<td>$130,137</td>
<td>$6,507</td>
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</table>
Long term potential scenarios for Greenearth Energy

<table>
<thead>
<tr>
<th>Penetration scenarios:</th>
<th>0.5% market share</th>
<th>1% market share</th>
<th>5% market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of CO₂ processed</td>
<td>1,250,000 tons/year</td>
<td>2,500,000 tons/year</td>
<td>12,500,000 tons/year</td>
</tr>
<tr>
<td>Amount of methanol produced</td>
<td>321,888 tons/year</td>
<td>643,777 tons/year</td>
<td>3,218,884 tons/year</td>
</tr>
<tr>
<td>Revenues per year</td>
<td>$140m</td>
<td>$280m</td>
<td>$1,400m</td>
</tr>
<tr>
<td>Royalties from Sales per year to GER</td>
<td>$1.4m</td>
<td>$2.8m</td>
<td>$14m</td>
</tr>
<tr>
<td><strong>Daily royalties from Sales to GER</strong></td>
<td><strong>$3,836</strong></td>
<td><strong>$7,671</strong></td>
<td><strong>$38,356</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Penetration scenarios:</th>
<th>0.25% market share</th>
<th>1% market share</th>
<th>5% market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of CO₂ processed</td>
<td>97,500,000 tons/year</td>
<td>390,000,000 tons/year</td>
<td>1,950,000,000 tons/year</td>
</tr>
<tr>
<td>Amount of methanol produced</td>
<td>25 Million tons/year</td>
<td>100 Million tons/year</td>
<td>500 Million tons/year</td>
</tr>
<tr>
<td>Revenues per year</td>
<td>$10,900 M</td>
<td>$43,500 M</td>
<td>$217,600 M</td>
</tr>
<tr>
<td>Royalties from Sales per year to GER</td>
<td>$109 M</td>
<td>$435 M</td>
<td>$2,176 M</td>
</tr>
<tr>
<td><strong>Daily royalties from Sales to GER</strong></td>
<td><strong>$298,630</strong></td>
<td><strong>$1,191,781</strong></td>
<td><strong>$5,961,644</strong></td>
</tr>
</tbody>
</table>
From Challenge to Opportunity
Producing Liquid Fuels
Out of CO₂
By Use of Solar Energy
Who are we and where we are

- Incepted in 2011
- Exclusive licensed CO₂ dissociation technology and IP from the Weizmann Institute of Science
- A Greenerth Energy (Australia) affiliated company, funded by Erdi Group

ErdiGroup

Greenerth Energy Ltd.
What Makes NCF Unique

- Combination of
  - Methanol / Electricity Production
  - CO₂ as feedstock
  - Solar energy driven
  - Very high efficiency (~40%)
  - Cost effective
- Flexible solutions
- Integrated / self sufficient solution
- Growing through duplication – no scale up
- Dissociation process improvement in parallel to system demonstration
- Competitiveness not based on incentives
- Highly qualified and diversified team
Market Overview

Global Energy Sources
- Crude Oil: 32%
- Coal: 27%
- Gas: 21%
- Biofuels/Waste: 10%
- Nuclear: 6%
- Others: 4%

Global Energy Production
- Transport: 25%
- Electricity: 34%
- Other energy: 34%

CO2 Emission Sources
- Transport: 23%
- Electricity: 41%
- Industry: 20%
- Other: 16%

CO2 Emission Problem

Natural Reserves left:
- Oil: 43 years
- Natural gas: 167 years
- Coal: 417 years

Source: www.iea.org (2011)
Our Solution
CO₂ to Liquid Fuel

CO₂ Sources

NCF Core Business

Markets

For personal use only
Technology Developed at the Weizmann Institute of Science

CO$_2$ dissociation into CO and O$_2$

The CO$_2$ dissociation uses a combination of heat and energy.

High temperatures decrease the electricity required to dissociate the CO$_2$.

At ~2300°C the dissociation happens spontaneously.
The Technology

- Concentrate solar energy to heat air reaching >1000°C
- Proprietary high temperature process
- Advanced structural design and selection of materials
- Use the excess heat to generate electricity
- Self contained apparatus
The Product

The receiver/Reactor

The Conversion Unit

The Tracking Conversion Array

Multiple Conversion Units mounted on a solar tracker comprise the tracking CO$_2$ conversion unit

CO$_2$ Dissociation Plant

For personal use only
Plant size is flexible and the above table is an example.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of 500m$^2$ dishes</td>
<td>Units</td>
<td>1,075</td>
</tr>
<tr>
<td>Land use</td>
<td>Km$^2$</td>
<td>1.6</td>
</tr>
<tr>
<td>Annual CO$_2$ consumption</td>
<td>Tons</td>
<td>115,600</td>
</tr>
<tr>
<td>Annual H$_2$O consumption</td>
<td>Tons</td>
<td>94,700</td>
</tr>
<tr>
<td>Annual methanol production</td>
<td>Tons</td>
<td>80,000</td>
</tr>
<tr>
<td>Project methanol product cost</td>
<td>$/litter in equivalent energy content to petrol</td>
<td>0.5</td>
</tr>
<tr>
<td>Number of cars running on the produced fuel</td>
<td>#</td>
<td>50,000</td>
</tr>
<tr>
<td>(average annual consumption)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual O$_2$ production</td>
<td>Tons</td>
<td>126,000</td>
</tr>
</tbody>
</table>
The Proof of Concept Device
The Solar Testing Facility
The Tracking Mirrors’ Field
Tracking Alignment
Testing Fixtures
Focusing Mirror Holding Structure
Mounting the Mirrors
Mirror Structure Assembly
The Control Room
The Team

Mr. David Banitt – 30 years’ experience in product development, marketing and senior management in the High-Tech industry, including multidisciplinary systems, electro-optics and energy products. Holds a B.Sc. in electrical engineering from the Tel-Aviv University, Israel.

Dr. David Scheiner has over 15 years of experience in product development and management in the high-tech industry. He was previously CTO and VP R&D at BrightView Systems and CTO at Nova Measuring Instruments. He holds a B.Sc. and M.Sc. in electrical engineering from the Technion – Israel Institute of Technology and a Ph.D. in physics from the Weizmann Institute of Science.

Mr. Uzi Aharony has more than 25 years of experience in a variety of industries in product development, operation and manufacturing. Holds a B.Sc. in mechanical engineering from the Technion-Israel Institute of Technology and M.Sc. in manufacturing systems engineering gained at Stanford University, California, U.S.A.

Dr. Yury Alioshin – holds a M.Sc. in mechanical engineering and has more than 18 years in research and development in various multidisciplinary systems. Holds a Ph.D. in the field of Solar energy at the Weizmann Institute.

Dr. Gidon Ferdinan Holds B.Sc. in Mechanical engineering and M.Sc. in Aeronautical engineering, from the Technion, Israel, and has 10 years of practical development and engineering experience in the Israeli defense Industry. Holds a Ph.D. in the field of Solar energy at the Weizmann Institute.

Senior Advisor

Professor Jacob Karni – Holds a B.Sc. in civil engineering, M.Sc. and Ph.D. in mechanical engineering, gained at the University of Minnesota. Over 20 years of research and development of concentration, absorption, conversion transmission and storage of concentrated solar energy.
From Challenge To Opportunity
New CO2 Fuels – Summary

- Game changing technology converting CO$_2$ to Fuel via solar energy;
- The science is laboratory proven;
- Technology Demonstrator to be completed 2013;
- GER maintains a royalty stream on all fuel produced & every plant commissioned;
- The numbers are compelling.
Australian & International Press past 12 months

The Australian – May 12, 2012

Jerusalem Post – June 6, 2012

7:30 Report (ABC TV) – May 15, 2012
http://www.abc.net.au/7.30/content/2012/s3503600.htm
Contact Us

Greenearth Energy Ltd.

Registered Office:
Level 14
500 Collins Street
Melbourne Victoria
3000

Websites:
Greenearthenergy.com.au
Greenearthenergyefficiency.com.au

Energy Security in a Carbon Constrained World

Samuel Marks
Managing Director
Samuel.Marks@greenearthenergy.com.au
Tel: +61 3 8625 0500

David Banitt
CEO - NewCO₂Fuels Ltd
dbanitt@newco2fuels.co.il
Tel +972 8 910 6660

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