



EcoGlobalFuels

ecoglobalfuels

EGF Addresses two significant problems





- ❖ The need to manufacture renewable carbon neutral Ethanol/transportation fuels
- ❖ The global environmental need to deal with waste CO₂ greenhouse emissions

THE TEAM

Ross Spiros - Australian, inventor
Owner: Eco Global Energy PTY LTD
Research and Development Company

Roger Green - New Zealander / Australia / USA
Owner: Eco Global Fuels - principal investor.
Exclusive Global license IP
CEO: Eco Global Fuels PTY LTD

Offices in New York City and Sydney Australia



Presentation Overview

- ❖ Overview of technology and its unique features: I.P.
- ❖ Independent Validation report
- ❖ Comparisons Conventional Hydrogen competition
- ❖ Cost efficiency, Low maintenance, Economically Scalable
- ❖ CO2 sequestering and iron fertilization
- ❖ Marketplace, ROI, sequestering, carbon credits
- ❖ Technology applications using 60 -100 MW utilizing PV, off peak electricity and natural gas producing hydrogen, oxygen and solanol
- ❖ Prototype investment and budget
Investment into Eco Global Fuels





EGF production of Ethanol is unique because

It is the only process that converts the sun's energy and also off peak electricity

economically into a liquid transportation fuels



- 
- ❁ Carbon neutral, safe, renewable, sustainable
 - ❁ It is a 24 hour base load energy producer (electricity and fuel)
 - ❁ Uses existing infrastructure
 - ❁ Win-win for all industries (Gov.coal.oil)
 - ❁ Major environmental/public/planetary benefits
 - ❁ Achievable and scalable
 - ❁ The time is right
 - ❁ Produces an exceptional ROI





PRODUCING SOLANOL

The above combines into producing the cheapest Hydrogen, Oxygen and “Solanol”

Without using FOOD,
And is completely carbon neutral, renewable...

and REMOVES CO₂ from the atmosphere and from coal/oil power stations and gas fields

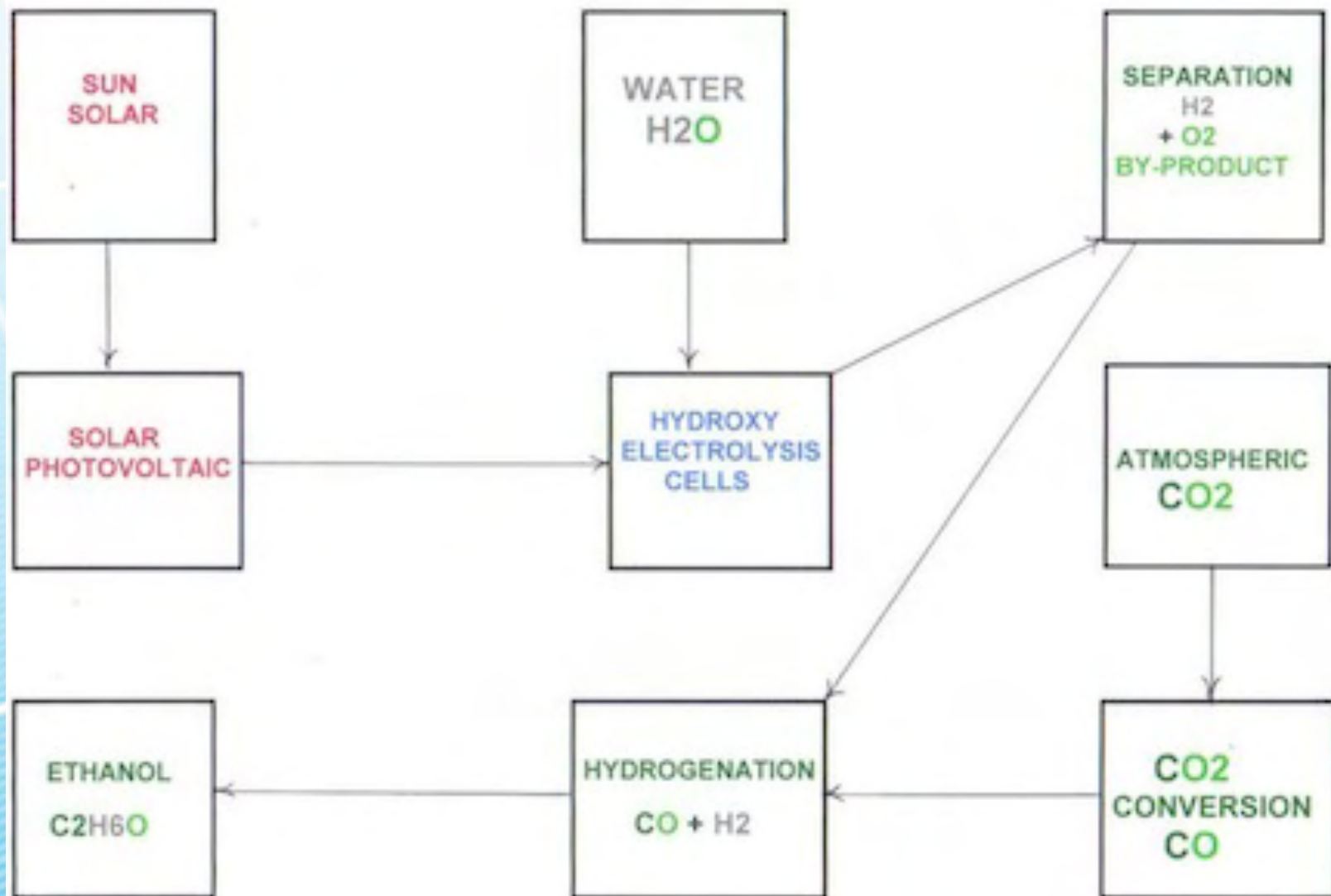


A WIN-WIN FOR ALL



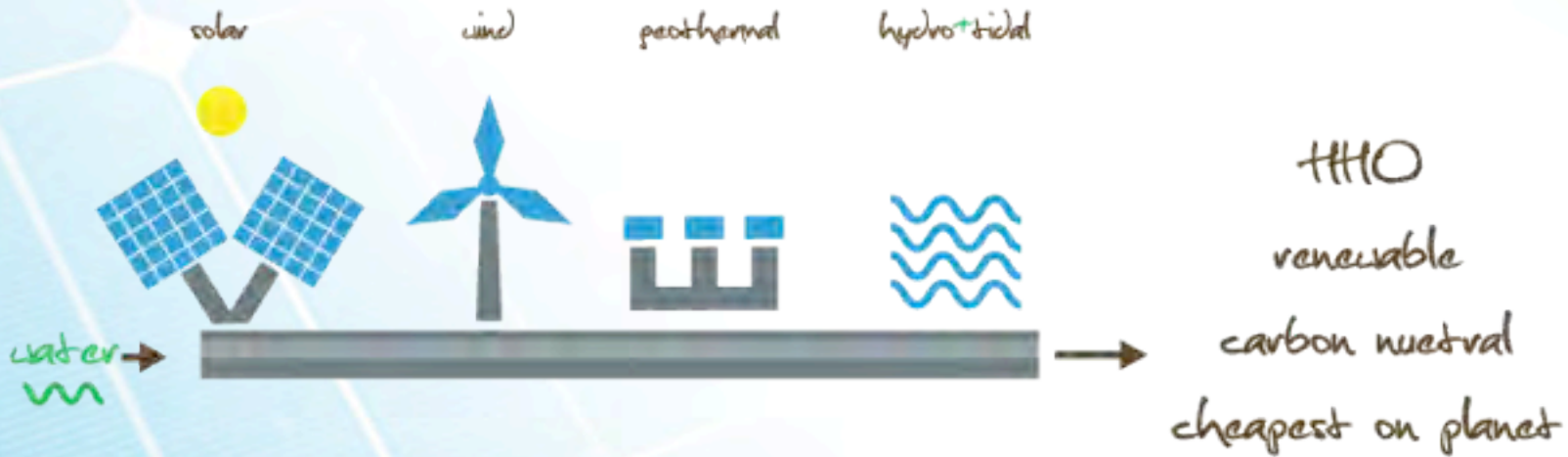
PRODUCING SOLANOL

- We can use a renewable energy source for DC input such as Solar, geothermal, wind, hydro
- And off peak electricity including natural gas turbine generators
- Hydroxy generators producing the cheapest Hydrogen in the world
- External separation producing H₂ and O₂
- Catalysts
- CO₂ normally vented (coal, gas, gas fields)





SOLANOL PRODUCTION ...



Solar panels +
Hydroxy generators +
External separation +
Catalyst/CO2 extraction =
Renewable Ethanol

+ Producing O₂ as by-product
for Industry /coal power stations



water

- Local water supply
- Bore water
- Sea water
- Filtered with reverse osmosis (R.O)
- Pressure is min for R.O
- e.g. 600 psi salt water
- 100-200 psi normal water for R O
- Very cost effective.
- Min costs for filtering, pumping, equipment and maintenance
- 1000 litres of water costs \$2 (Australia)
- 1 litre water makes 1860 litres hydroxy gas
- 18 litres of water needed to produce:
- 1 kg Hydrogen and 8 kg Oxygen

Costs:

- 0.036 cents per hour per 18 litres to produce 1 kg H₂ and 8 kg O₂
- Quotes available for local construction of R.O

Hydroxy Generators

- Patentable I.P
 - Unique Design.
 - Validated flow rate and durability
 - Measured degradation
 - Turns water into Hydroxy gas
 - Locally manufactured
 - Easy construction
 - Cost efficient mild steel
 - Using 6 mm gauge plate increases production and lifespan
 - 200 H.G. needed for prototype
 - \$2000 per H.G. current price
 - Scale up reduces to \$500 per unit
-
- Budget will include electrical and computer system to run
 - Quotes available for local construction
-
- 300 kWh prototype need 200 H.G
 - 10 MW needs 6700 H.G
 - 50 MW needs 33,000
-
- Powered by renewable DC input e.g. photoV
 - Powered by off-peak electricity
 - Powered by natural gas turbine generators

Cryogenics

- Cryogenics Density Separation
- Takes hydroxy gas mix from the Hydroxy Generators and separates into H₂ and O₂
- Density separation operates on principle of
- Oxygen liquifying at - 186 C
- Hydrogen remains as a gas

- Because we liquify O₂ it is ready for transport and selling
- Costs of liquidification is 20 % cheaper than competition because we do not use air- we use pure O₂ (they use -190 C below)

- 3 kg H₂ with 24 kg O₂ liquified has been quoted
- Known Industrial process and safe

- 26 % additional power needed for cryogenics
- However, H₂ is looped back into a heat exchanger to refrigerate (cool) the incoming hydroxy gas

- 20 M prototype development
- Easily scaled up for 10-50-100-5000 MW

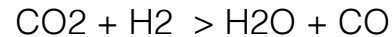
Ethanol Synthesis Catalyst Chamber

Catalyst Chamber

Takes in H₂ and CO and compresses to 1500 psi (10.45 MPA) to produce all of the solanol alcohols such as Ethanol, Methanol, Butanol etc

Carbon Monoxide

CO is produced from CO₂, by using a catalytic reaction
Concentrated CO₂ is pumped into a catalytic chamber with H₂



CO₂ Sources

Major source is from Natural Gas fields
Pure CO₂ is available from cement, lime, iron, steel, ammonia, and bio-fuels production,
Natural CO₂ from Land/Ocean

Coal powered stations

require further filtering- however:

Our pure oxygen can provide the mechanism for a “Pure Oxygen Burn”, which utilizes emissions and creates concentrated CO₂ (which we use for Solanol) which can be further converted into useful products, such as iron fertilization sequestering

Imagine:

A coal or gas plant, utilizing our pure oxygen, forming pure CO₂ that is catalyzed with hydrogen into the production of Solanol, with the totality of the CO₂ emissions sequestered by iron fertilization

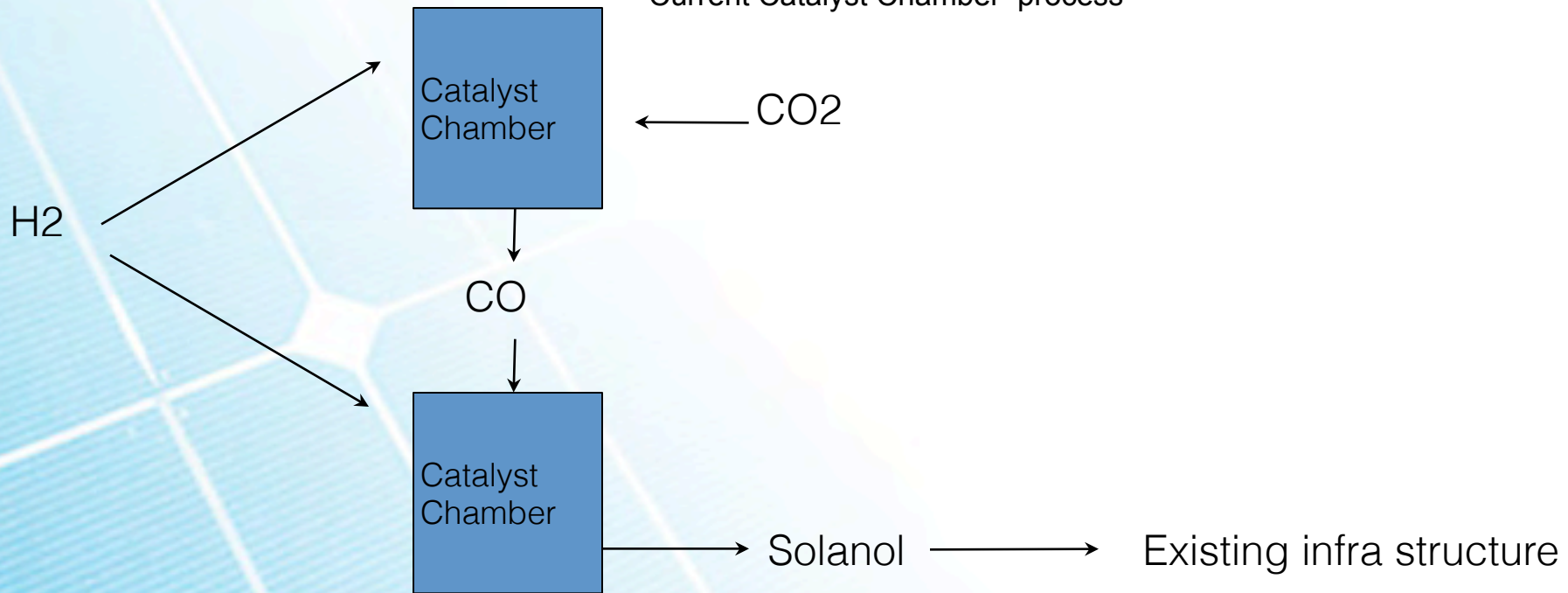
Ethanol Synthesis
Catalyst Chamber

Advanced Catalyst Chamber

H₂ and a direct input of CO₂ into one catalyst chamber to be developed by CSIRO

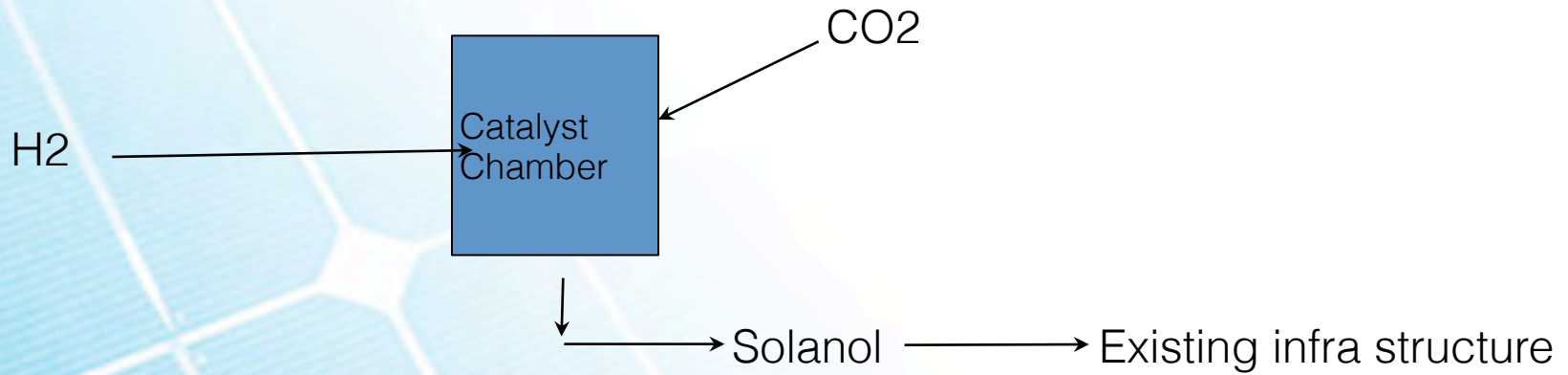


Current Catalyst Chamber process





Advanced Catalyst Chamber process





BIG ANNOUNCEMENT

ECO GLOBAL FUELS

Independent testing/validation

COMPLETED

Official proof of concept

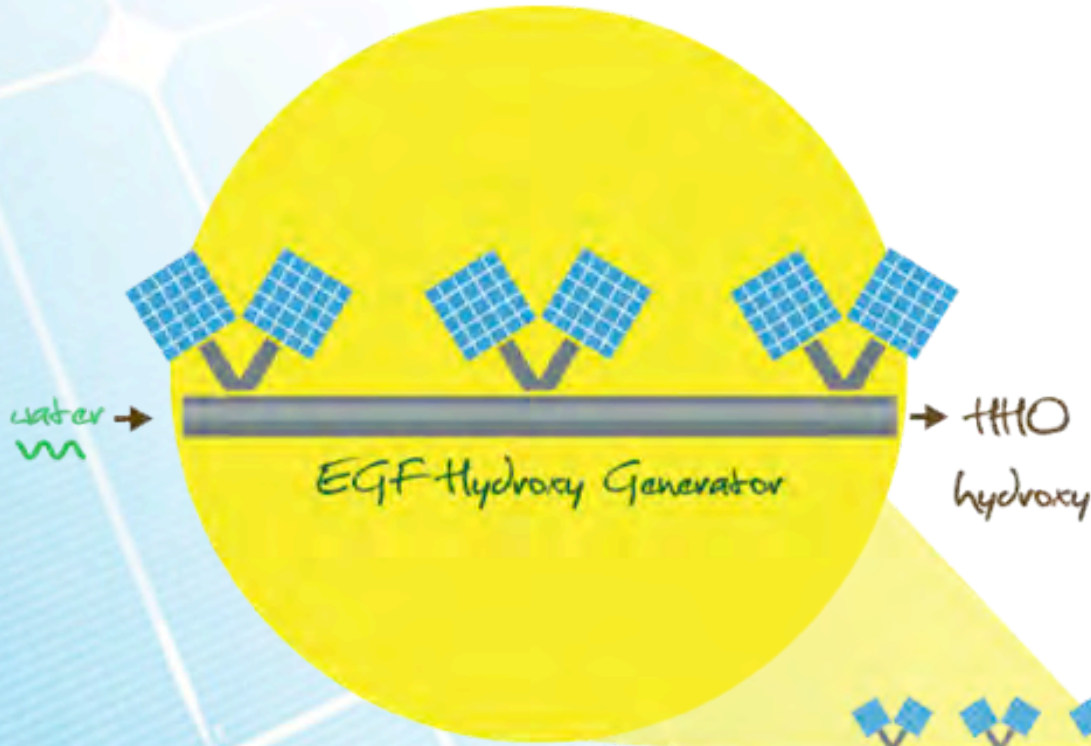
Sign-off Report



EGF HYDROXY GENERATORS



- ☘ The world's first
- ☘ Unique IP
- ☘ Ultra reliable



170 Litres/Kwh
25 Year Life Span
Best in the World!



ECO GLOBAL FUELS



- Unique IP
- Patentable
- Ultra reliable
- Low cost to manufacture
- Cheapest hydrogen in the world!
- Durable, robust, safe
- 10-25 year span!
- Similar life span to solar panels
- External separation (competition unreliable internal sep.)
- No exotic expensive materials (as with competition)
- Low maintenance- no obstruction (as with competition)
- Scaleable, economically achievable (unlike competition)
- FLOW RATE PROVEN independently tested
- 162 Litres/ KW hour hydrogen production

Validation Report

- Over 1 month non stop testing
- Macquarie University Sign-off
- Proven, worlds first
- Ultra reliability design
- Min. maintenance
- Low cost manufacturing
- Economically scaleable
- safe

Validation Report

- Unique Hydroxy Generators IP
- turns cheap mild steel into hydrogen !
- 0.30 cents = 426 gms of mild steel = 34 days
- 10 years durability
- uses no noble metals (e.g expensive nickel)
- no internal diaphragm

unlike conventional electrolysis

- relies on internal separation- high cost maintenance
- high cost construction- not economic

Validation Report

- our unique hydroxy generator, 3 meters long with 150 mm dia tested with:
- 1.6 mm mild steel plates
- 35 amps and 18 volts= 630 watts
- 40 psi (270 kpa) pressure
- temperatures average 30 c (room temp)
- continuous 787 hours

Validation Report

PROVES

Degradation rate

- Degradation rate of unique Hydroxy cells
- Weighed before and after
- = only used **426.6** grams of mild steel
- = cost 0.30 cents of mild steel
- = over 787 hours input DC 495.81 KW
- = which produced
- = **120, 500** litres of hydroxy gas !
- = **Worlds first Cost Efficient Technology**

Validation Report

PROVES

Degradation rate

- 1.6 mm electrode plates last 10 years (signed off)
- Increasing plate gauge and energy input.....
- 6 mm electrode plates at higher amps and volts @ 80 amps @ 20 volts = 1.6 Kw
- increasing efficiency to
- 270-300 litres per kWh (current 243 litres kWh)
- = **Worlds first Cost Efficient Technology**

Validation Report

PROVES

Flow rate confirmation

- Unique Hydroxy Generators input DC @ 0.63 kWh
- produced **243 litres** of hydroxy gas per kWh equates to:
 - **162 litres** of Hydrogen
 - **81 litres** of Oxygen
- reliable, low maintenance, safe
- cost effective

Hydroxy Generators



- average 3 metres x 150 mm dia
- construction mild steel with installation
- cheap electrolyte - replaced 5 years
- current price \$2000 each
- scale up= average \$500 each or less
- prototype needs 200 H.G.'s
- basic water filtering- reverse osmoses-low cost- mains pressure-minimal water usage
- energy input: renewable or cheap waste electricity
- **1 litre** of water produces **1860** litres of hydroxy gas

Hydroxy Generators

LOW MAINTENANCE
very important criteria

- material maintenance costs only
- **water** filtering, pumping per hour = \$0.03
- **H.G** degradation steel costs: 0.001 cents per kWh
- **Hydrogen** (1 kg) plus **Oxygen** (8 kg) requires **65 kWh** (includes cryogenic separation costs)
- Total HG maintenance per year
- 65 kWh to make $65 \times 0.001 = \$0.065 + \0.03
- \$0.095 per 1 kg of Hydrogen and 8 kg of Oxygen

Hydroxy Generators



- Iron from degradation (plate size 1.5 mm)
- produces a pure iron
- 1 H.G. produces 5 kg per year
- 200 H.G prod. 1000 kg (1 tonne)
- 10 MW 31 tonnes per year
- value= \$200 per tonne per year approx.
- Fully recyclable and environmental
- complete sequestering of CO₂
- Iron fertilization growing Algae

Hydroxy Generators Iron Fertilization



- Iron from degradation (plate size 3 mm)
- produces a pure iron
- 1 H.G. produces 12.5 kg per year
- 33,000 H.G required for 60 MW
- 60 MW prod. 840 tonnes of pure iron per year
- value= \$200 per tonne
- Fully recyclable and environmental
- complete sequestering of CO₂
- Iron fertilization growing Algae

Iron Fertilization Sequestering

- Iron is a by- product of our hydroxyl generators (we turn steel into Hydrogen)
- produces the necessary iron oxide to increase algae growth!
- Based on 1.84 Kwh creates 2.08 gms of iron oxide per hour
- **Based on 60 MW off peak electricity input, we produce:**
- 2.08 gms per kwh x 60,000 kilo watt hrs = 125 kilograms
- Algae growth cycles in 48 hrs requires 4.5 tonnes of iron oxide
- $125 \times 48 = 6$ tonnes !

Which gives us the excess ability to utilize and sequester 1.5 tonnes which has the benefit of taking out existing CO2 from atmosphere

Iron fertilization sequestering

- **Based on 60 MW Natural Gas electricity input, we produce:**
- 2.08 gms iron oxide per kwh x 60,000 kilo watt hrs = 125 kilograms iron oxide
- Algae growth cycles in 48 hrs requires 4.5 tonnes of iron oxide
- $125 \times 48 = 6$ tonnes !
- Which gives us the excess ability to utilize and sequester 4.1 tonnes which has the benefit of taking out existing CO₂ from atmosphere

- **Using PV for power input:**
- 60 MW input
- Sequestering 6 tonnes of iron oxide in 48 hrs
- Which gives us the excess ability to utilize and sequester 5 tonnes which has the benefit of taking out existing CO₂ from atmosphere

Technologies and industries which benefit from increasing the growth of algae:

- **Iron oxide** is a by-product of the hydroxy electrolysis process, and with our calculations above, we have proven that sequestering all CO₂ from a 60 MW turbine is achievable (which means we can apply this to any scale, using any power supply for example photovoltaic, gas /coal turbines, off peak electricity etc.).
- Because it is a by product- it is free to be utilized into various methodologies (making them economical)
 - Ocean fertilization for Algae growth and Ocean Gardens
 - Algae based bio fuels
 - Algae based fertilizers
 - Algae products (supplements, cosmetics)
 - Sewage treatment
 - Produces freshwater
 - Food production
 - Pharmaceuticals

COMPARISON

conventional Hydrogen production

- Referred to as 'Steam Reforming' or 'Steam Methane Reforming'
- Natural Gas (CNG- CH₄) is passed through a catalyst reaction with an external heat source - converts steam and lighter hydro carbons such as methane into hydrogen and carbon monoxide referred to as syn gas
- Also produces CO₂ in this process
- More separation is required to get pure hydrogen
- Wholesale cost of liquid hydrogen, made the cheapest way from steam reforming, based on USA figures, shipped to large customers is approx.
- \$6.00 per kg
- along with every kg H₂ - produces 56 kg CO₂ !

COMPARISON

EGF process with Electricity @ \$0.18 per kWh **RETAIL**



- E.G.F. process costs 70 kWh per 1 kg of Hydrogen includes producing by-product 8 kg of oxygen
- Retail price of electricity is \$0.18 per kWh (highest prices electricity used in formula below...)
- Note: Wholesale varies around the world e.g \$0.04 per kWh (next slide)
- Hydrogen: 18 cents X 70 kWh = \$12.60
- Oxygen: 40 cents per kg **retail** = \$3.20 (0.40 x 8kg)
- E.G.F. process Carbon credits = \$350 per kg Hydrogen
- FORMULA: Hydrogen \$12.60 minus Oxygen \$3.20 plus Carbon Credits
- **EGF Retail cost of making Hydrogen = \$9.40 per kg Hydrogen**
- **plus added benefit of \$350 per kg of Hydrogen carbon credits**



COMPARISON

EGF process with Electricity @ \$0.04 per kWh wholesale

- E.G.F. process costs 70 kWh per kg of Hydrogen
- EGF also produced by-product 8 kg oxygen
- Wholesale electricity \$0.04 per kWh
- Hydrogen: $\$0.04 \text{ cents} \times 70 \text{ kWh} = \mathbf{\$2.80}$
- Oxygen: 20 cents per kg (8 kg) wholesale = \$1.60
- E.G.F. process Carbon credits
- FORMULA:
- Hydrogen \$2.80 minus Oxygen \$1.60 plus Carbon Credits
- EGF wholesale cost of making Hydrogen =
- $\mathbf{\$1.20}$ per kg Hydrogen
- Plus added benefits of carbon credits

COMPARISON

- E.G.F. produces no CO₂
- Gains Carbon credits
- Produces O₂ as by-product that can be used also in pure O coal powered Stations and sold for industry
- We use CO₂ in Ethanol production
- basic costs are stable: water and steel
- Produces by product iron that is used in major sequestering

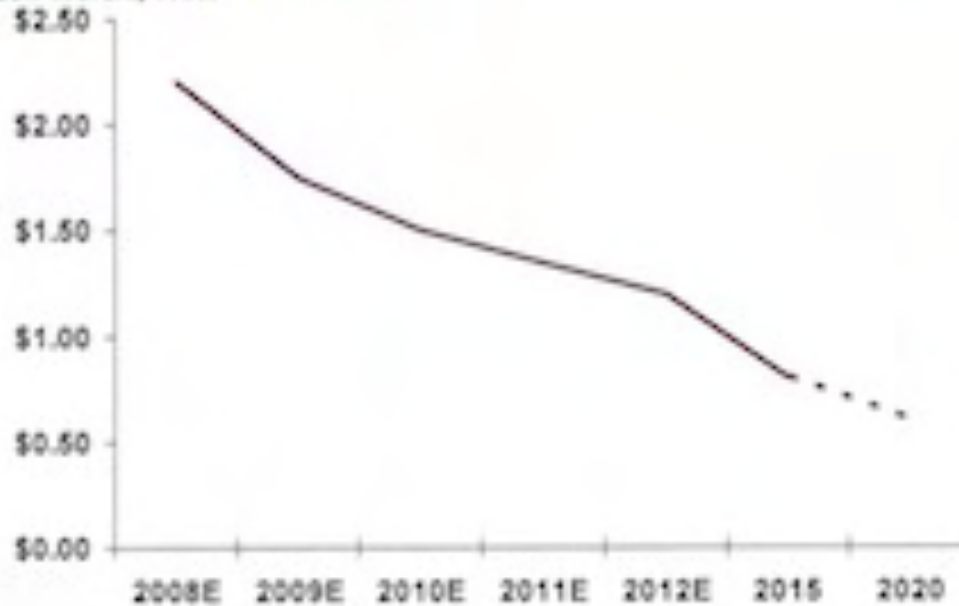
COMPARISON

- Conventional Hydrogen production
- Costs going up
- Major CO2 emissions
- Taxed at beginning \$23 per tonne
- Tax going up +++ over years to come
- reliant on fossil fuels
- fossil fuels costs going up
- refer to charts

Projected costings

Falling Cost of Silicon

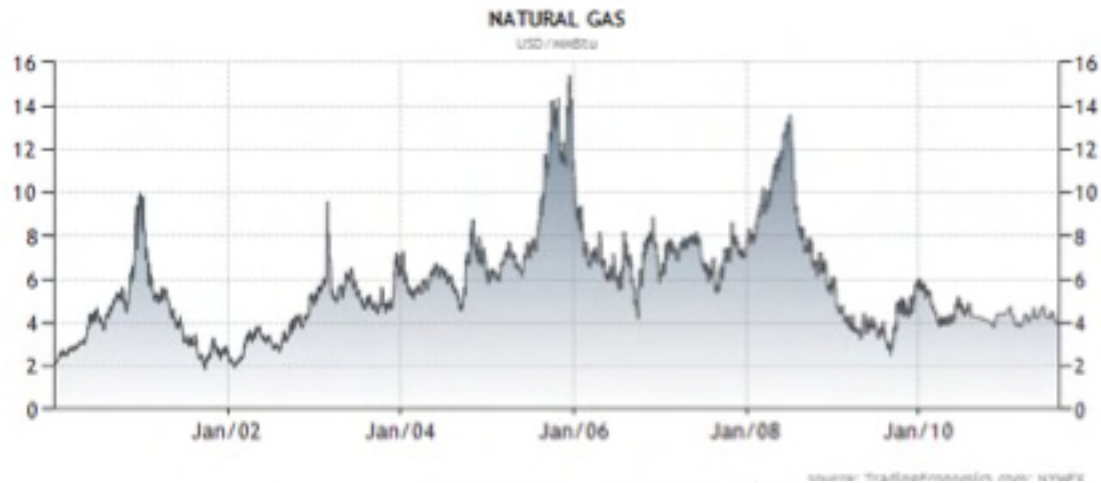
Cost of Silicon Wafers/Watt



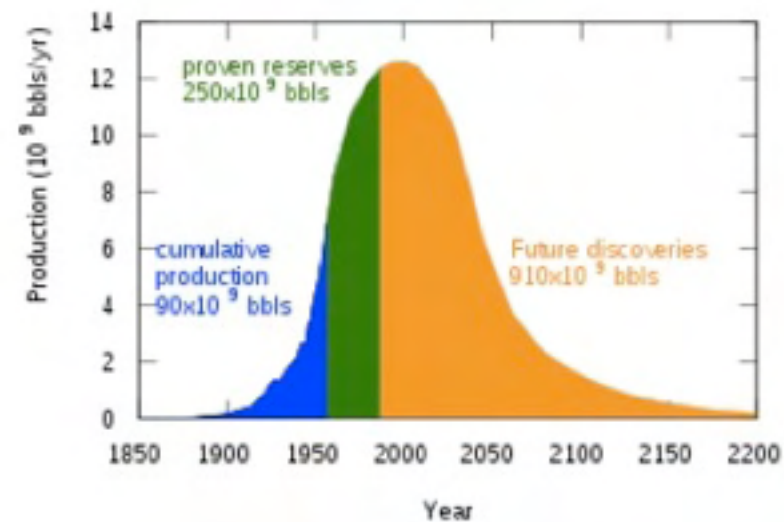
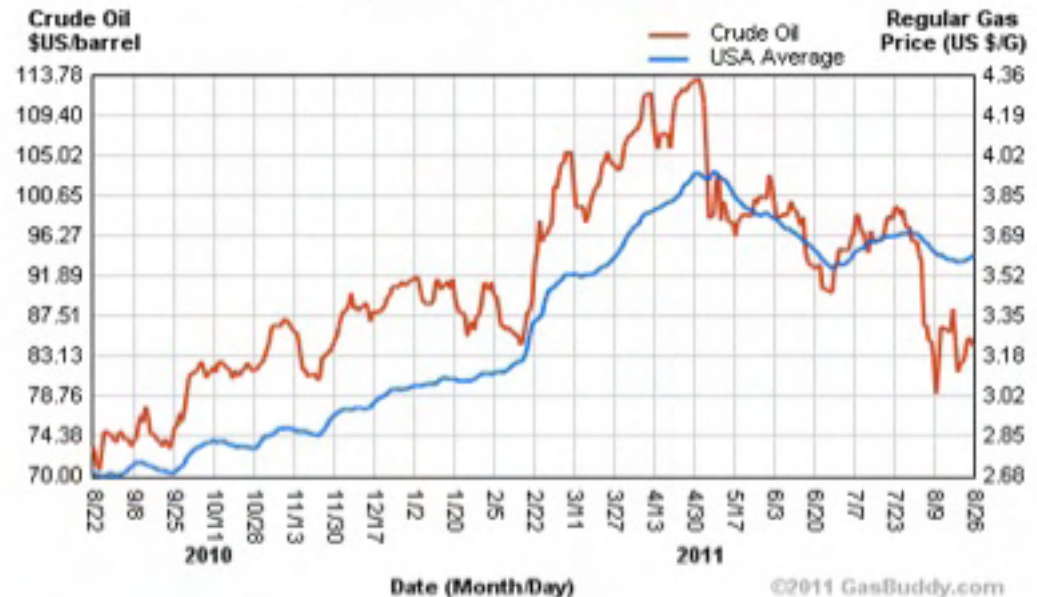
Silicon Costs to Decrease with Growing Polysilicon Supply, More Efficient Use of Silicon and Greater Integration

Assumptions: Falling cost of wafers to 2012 are based on Company's current and expected contract pricing for output of 100MM in 2008 and 50% output growth through 2012; cost of wafers in 2013 and 2020 based on Company estimates

Projected costings



12 Month Average Retail Price Chart



CRYOGENICS

Converts hydroxy into pure hydrogen & oxygen

Catalyst

Converts CO₂ to CO



Converts CO into Ethanol

CO + H₂ + catalyst

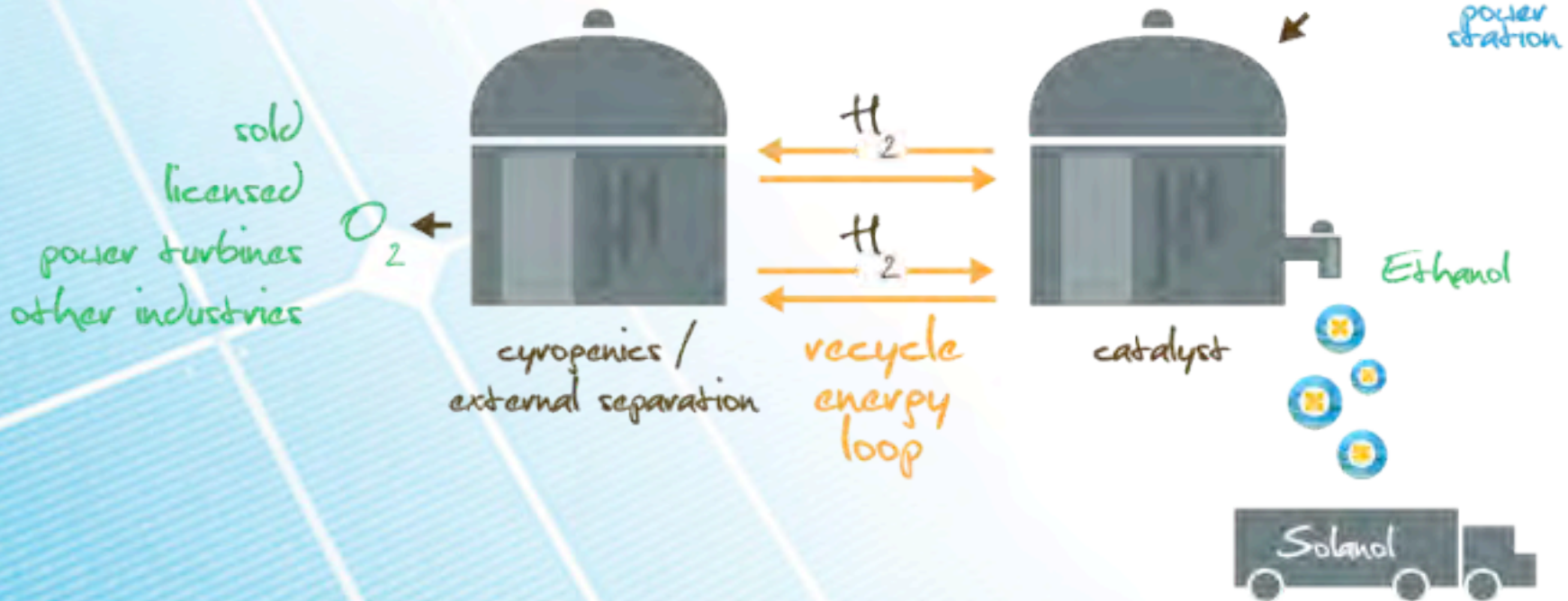
= Methanol, Ethanol, Butanol's etc

= 'Solanol'

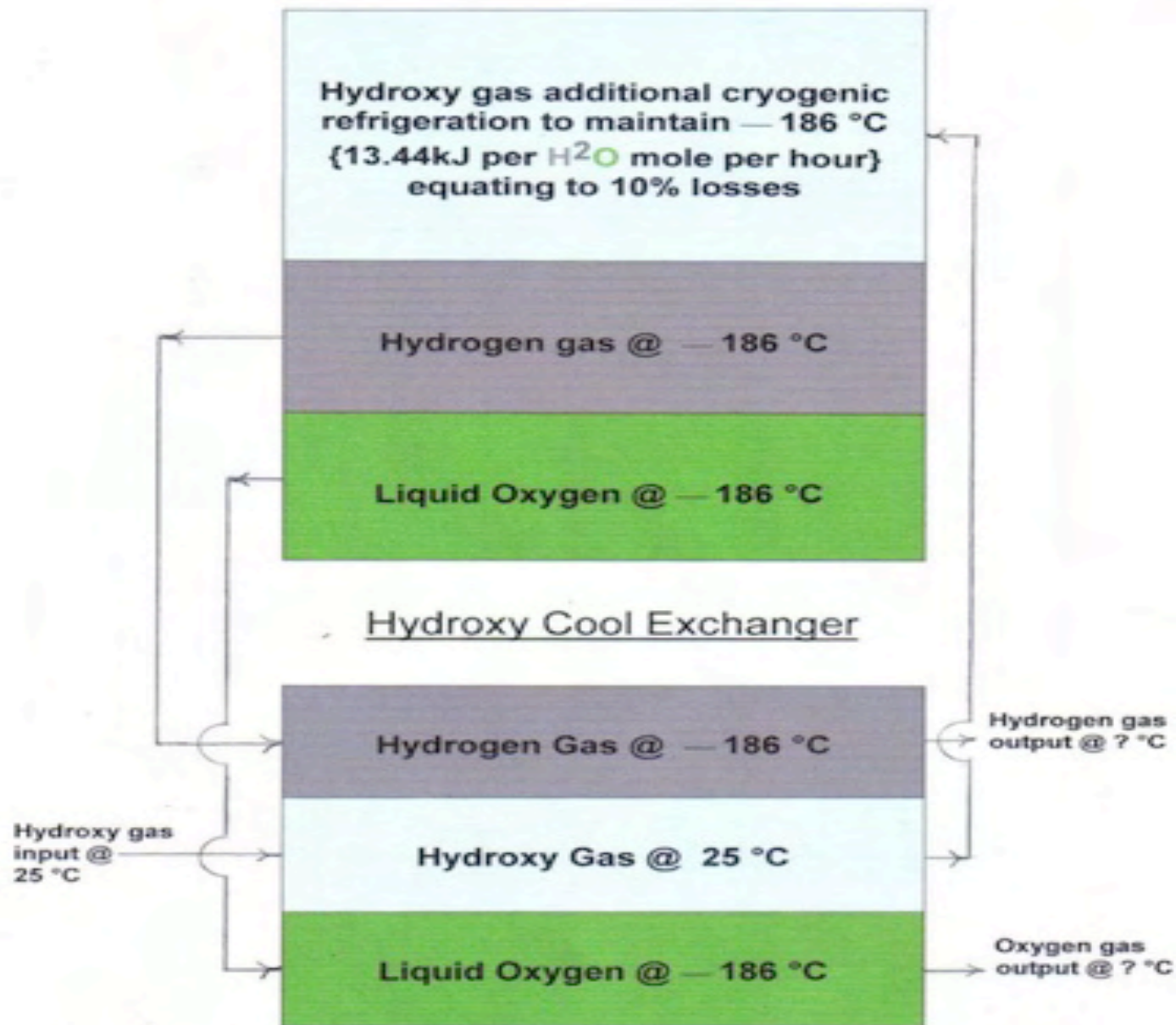


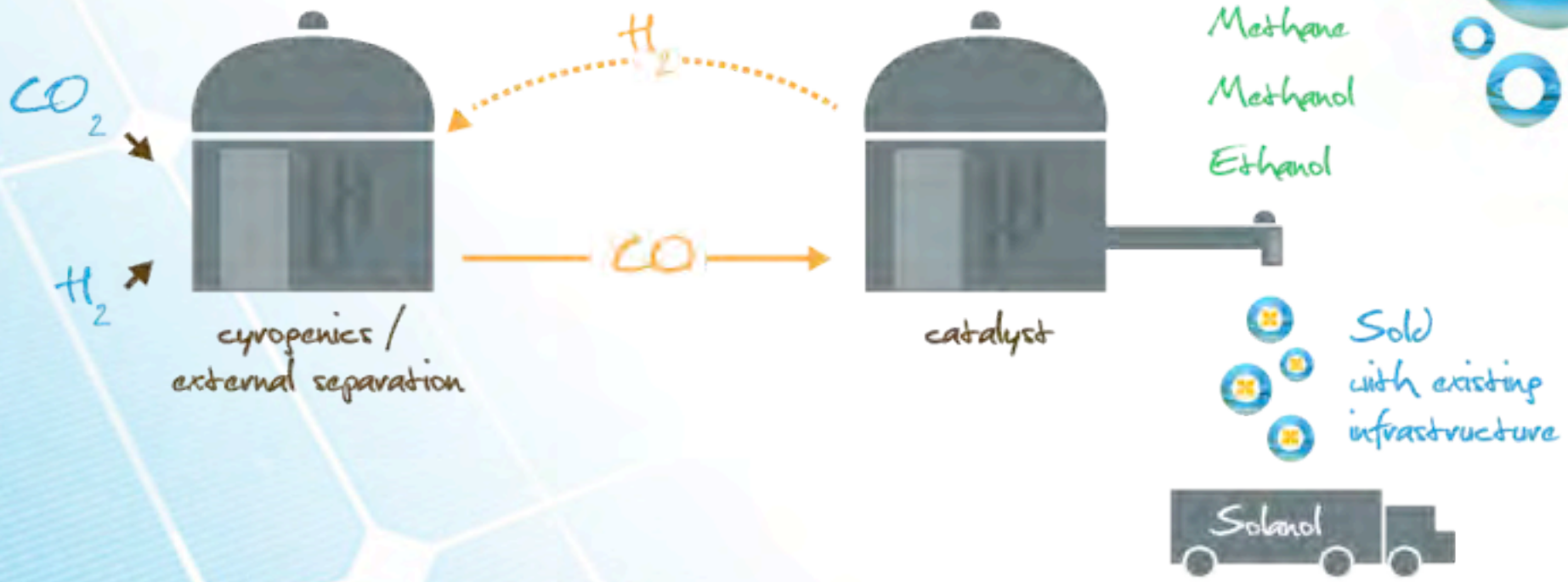
UNIQUE LOOPED ENERGY EFFICIENT

Cryogenic and catalyst System (IP)



Hydroxy Cryogenic Separation Flow Diagram





CO₂ from atmosphere, gas fields, coal power stations:

EGF
greenhouse gas
reducer

ABOUT ETHANOL

Burns cleanly

Exhaust emissions reduced up to 92 %

Increased efficiency of 16% in loaded vehicles

23.44 MJ per litre- Ethanol caloric value/ octane

34.6 MJ per litre- Petrol caloric value/ octane

Used by 90 % of cars and trucks in Brazil

Suited to hybrid car market because carbon neutral

Easily blended with petrol

Uses existing infrastructure unlike other alternative fuels

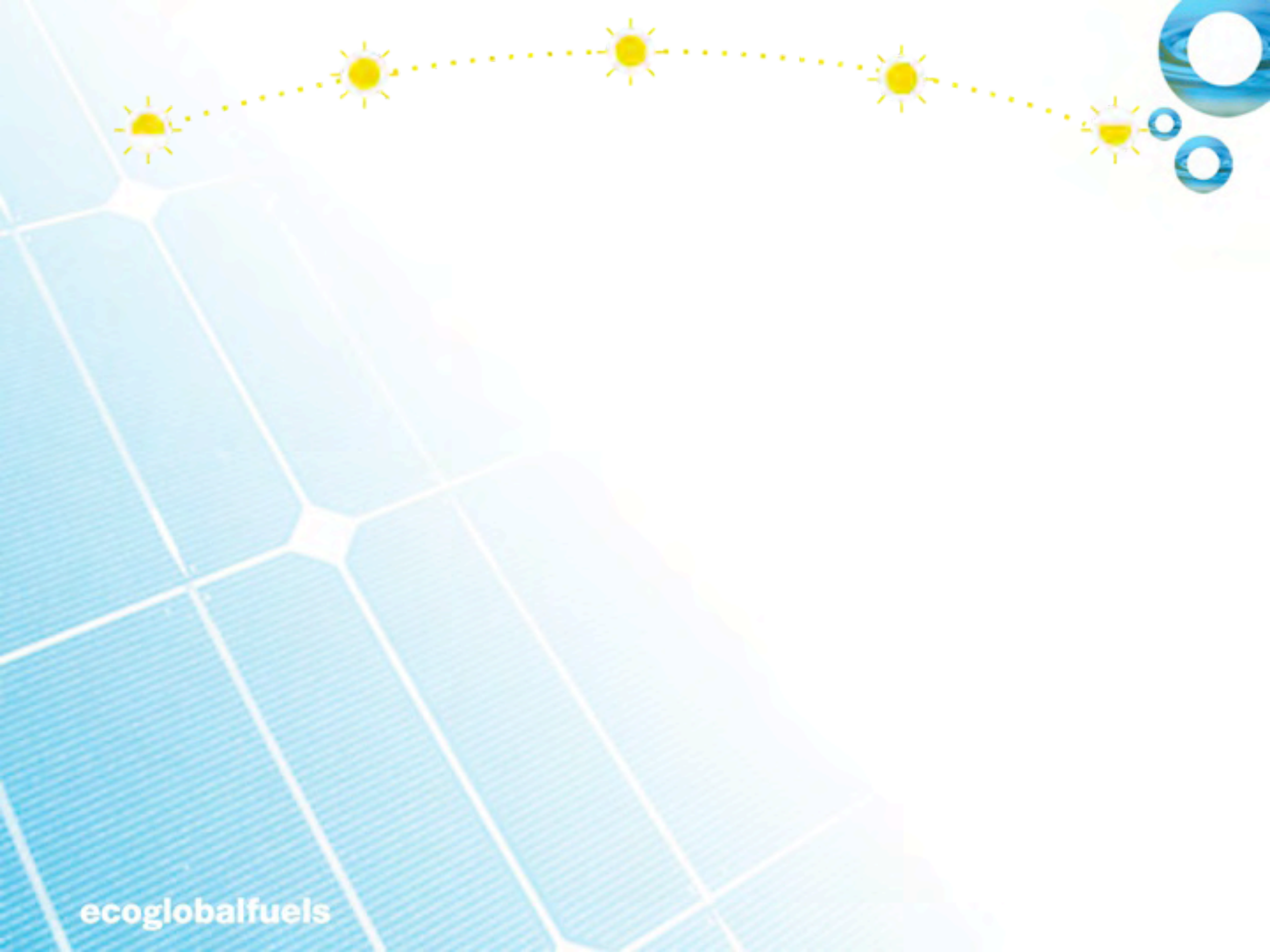
Cost competitive

Governments all over the world are demanding ethanol production to replace fossil fuel imports and domestic use

Hazard free:

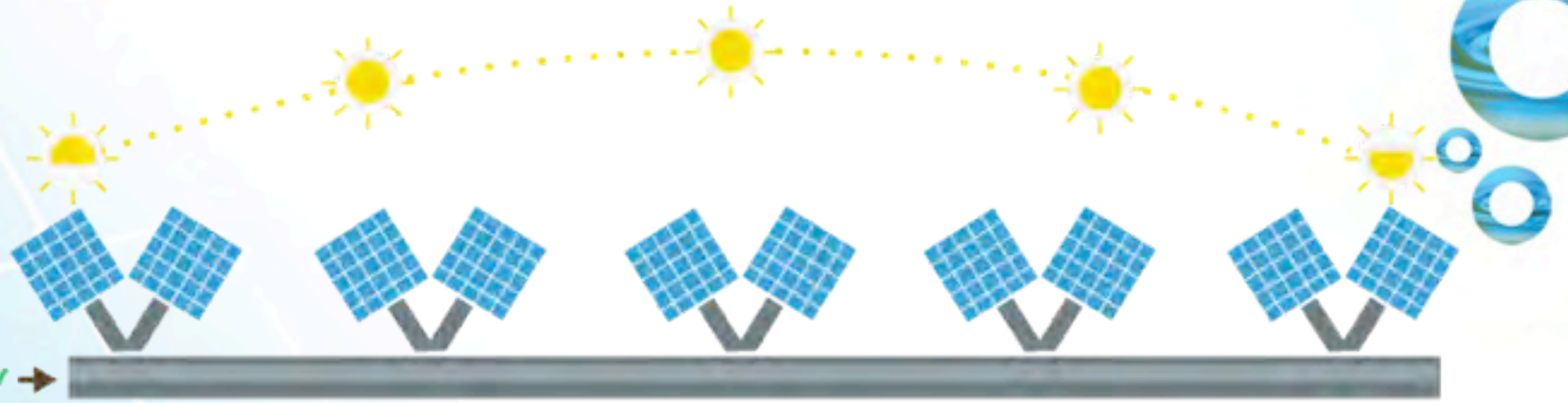
Completely bio-gradable will not effect the environment

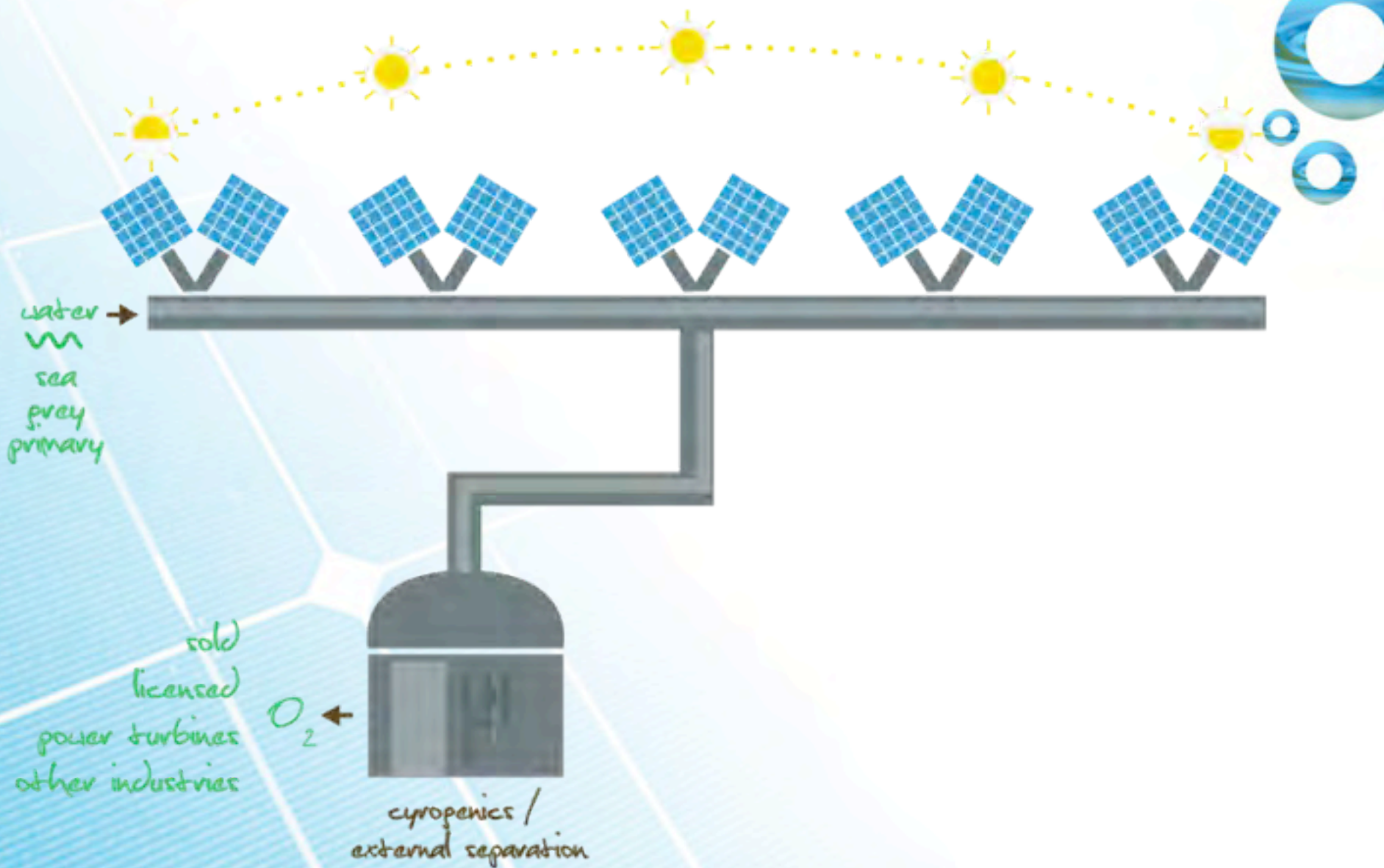




ecoglobalfuels

water
sea
prey
primary

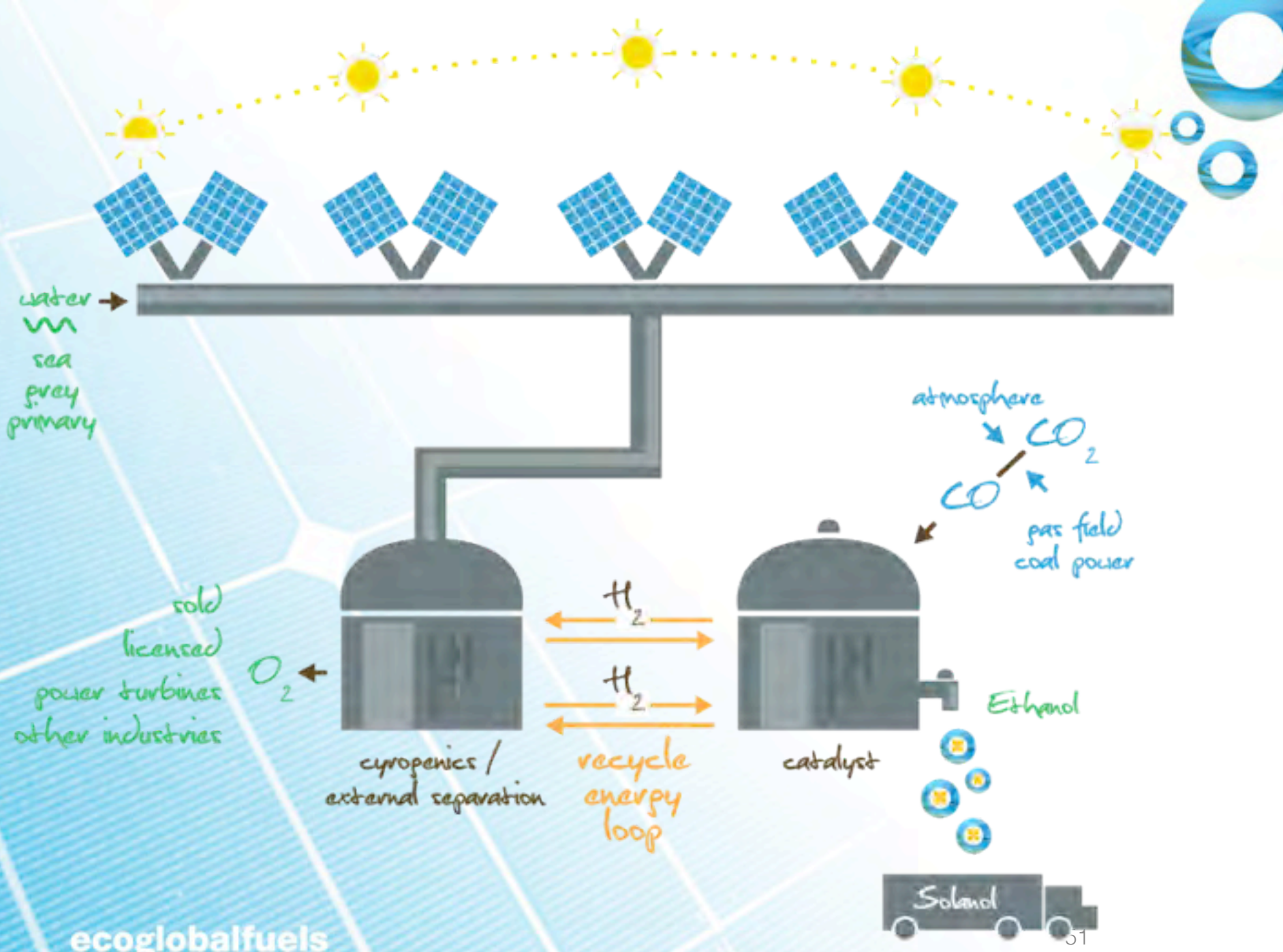




water
 sea
 grey
 primary

sold
 licensed
 power turbines
 other industries

cryogenics /
 external separation



EGF SOLANOL SOLUTION....

the new era in environmentally sustainable energy

Because we produce pure oxygen as a by-product of our hydroxy production from water....

We can inject pure oxygen into the coal/oil/gas rather than using AIR - which contains impurities and high amounts of NITROGEN

We will use pure oxygen, which makes a pure CO₂ stream for the production of SOLANOL

Which means the iron produced as a by produce can be utilized for growing algae for sequestering all CO₂ EMISSIONS



CO2 Sources

- ✿ Atmosphere; increased CO2 causes greenhouse effect
- ✿ Gas fields- massive emissions of relatively pure CO2
- ✿ 1000' s of coal stations, Over 370 in the USA
- ✿ Other polluting industries have conc. source of CO2:
 - ✿ Cement prod. Lime prod. Iron/steel prod.
 - ✿ Ammonia prod. make CO2
 - ✿ Bio-Fuels make CO2 in their 'cycle'
- ✿ All needing to be less CO2 producers: Carbon Taxes
Governments and Global Kyoto agreements



FOR EGF INVESTORS:

Cleans up the coal/gas/oil industries

Reduces green house effects

Creates massive carbon credits for EFG

Means governments can meet their Kyoto agreements without disruptive inflationary effects on their economies

Creates massive licensing fees and increased ROI for EGF investors

**All of this from our by-product:
the cheapest pure oxygen on the planet and
by product iron**

PURE CO2 STREAM

**One hydroxy generator creates:
85 Litres of oxygen per KW-hr**

Because of our unique, cheap production of OXYGEN, It is utilized to produced a pure CO2 stream for the production of Solanol.



SEQUESTERING

Iron by product used in algae growth

Possible Future technologies

PURE CO₂ CONVERTED INTO STABLE CARBON PRODUCTS :

- Olefins-plastics
- Formaldehyde, paints etc
- Carbon black - e.g. car and truck tires
- Carbon fertilizers
- Carbon graphite

Keeps the carbon / CO₂ on the ground and not in the atmosphere

National market requires 718 million tons of EGF O₂ annually for all industries





24 hr base load energy producer

Night time generation of electricity

We can store the sun's energy in a liquid fuel matrix, such as butanol, high in energy density, to be combusted at night for the production of electricity

This turns PV energy into a base load producer, never achieved before !

MAY WE REMIND YOU ...

- ✿ 28 Billion tonne is a big number
- ✿ It is the amount of sediment eroded each year from all mountains
- ✿ And it is the amount of carbon dioxide (CO₂) we pump into atmosphere each year
- ✿ Enough to cover Australia in a blanket two metres thick
- ✿ Each year 28 Billion Tons of CO₂ induces heating
- ✿ Oceans now heating at a rate of 300 trillion watts
- ✿ Equivalent to denoting 5 Hiroshima A-bombs every second
- ✿ Every day of every year inducing the greenhouse effect
- ✿ Energy use is increasing exponentially

So how will we cater for our future energy needs?



Risk Management



RISK MANAGEMENT

Producing hydrogen and oxygen
Used extensively in
Chemical production
Fertilizers
Mining and mineral separations
Steel making
New hydrogen economy

Solar renewable electricity
combined with producing H₂ and O₂ provides a
rock solid
risk management strategy

RISK MANAGEMENT

- Oxygen is currently selling at US \$300 per tonne
- EGF creates Oxygen at a ratio of 8:1
- 8 parts Oxygen to one part Hydrogen



Photovoltaic solar panels for our DC energy input



- ✿ Excellent government subsidies
- ✿ Use of cheap arid land anywhere in the world
- ✿ DRAMATICALLY improved performance/efficiency
- ✿ Long lasting (25 years)
- ✿ Hugely reduced cost of manufacture

Because of the above it is NOW feasible to convert the SUN energy into a liquid matrix transportation fuel

SOLANOL

Mining and Mineral Ore Separation

A well known Professor at a Sydney based University has recently identified an application to extract nickel, copper and chromium from refractory ore which is currently not amenable to acid leaching processes.

Mining and Mineral Ores Separation



- Huge potential for using hydrogen for the purification and separation of metal ores
- Hydrogen reaches elevated temperatures needed for the hydrogenation process
- Mineral mines in Australia and in other countries left idle because of the scale of economics involved
- The type of mines we use our hydrogen is the oxide mineral ores
- EGF hydroxy generators are portable, easy to construct and we produce the cheapest Hydrogen and Oxygen.
- The power source for mining would be mains power supply for a greater ROI.

Mining and Mineral Ores Separation

- EGF proposes to buy appropriate mines (cheaply)
- Install our hydrogen production on-site for mineral oxide ore separation
- At current market prices- produce an estimated ROI up to 21 %
- EGF proposes a safe, environmental, economical process for the following metal ores:
 - Copper (Cu_2O)
 - Nickel (NiO)
 - Chromium (CrO)



Mining and Mineral Ores Separation

Current Commodity Prices:

- Refractory Nickel ore \$US 20,000 per ton
- Refractory Copper ore \$US \$9000 per ton
- Refractory Chromium ore \$US 6400 per ton

- Different grades of mineral ores will consume:

Between one tonne of Hydrogen per tonne of mineral ores
to 10 tonnes of Hydrogen per tonnes of mineral ores

- It is estimated to produce a ROI depending on ore type and energy input for the extraction of mineral ores by the use of EGF Hydrogen.

RISK MANAGEMENT SUMMARY

Sale of carbon neutral electricity

Government subsidies, rebates and tax concessions

Sale of hydrogen and oxygen to industry

Steel making

mining

Chemicals

Carbon credits and sequestering

Sale of Solanol renewable fuels





Market place value

Hydrogen + Oxygen Production $H_2 + O_2$



per Kg of Hydrogen

- $H_2 = 1$ Kg
- $O_2 = 8$ Kg
- we require 9kg water (H_2O)
- we need 70 kWh to produce 1kg of pure Hydrogen
- we also produce 8kg of pure Oxygen

- Enviro-Hydrogen value is US \$6 per kg
- Enviro-Oxygen value is \$0.30 cents per kg

Solanol 'Compounds' Production $\text{CO} + \text{H}_2$ Ethanol Catalyst reaction

Efficiency of 100kg $\text{CO}_2 > \text{CO}$ 63.64 kg with H_2 11.31 kg

Ethanol Synthesis Catalyst conversion:

Solanol Compounds	H ₁	C ₁	AtomicWeight	%	Produced Kg	Litres STP	Wholesale Cost	MJ	kWh	H2 kg
Ethanol	6	2	46	31.8	23.38	28	25.3	694	193	3.04
Methanol	4	1	32	32.3	23.60	28.32	11.30	536	149	2.94
Methane	4	1	16	20.2	17.22	24,017	4	920	256	4.29
Propanol's	8	3	60	7.7	5.68	6.82	11.4	191	53	0.75
Butanol's	10	4	74	1.6	0.90	1	2.5	45	13	0.14
Pentanol's	12	5	88	0.2	0.20	0.24	0.5	3	2	0.15
Carbon Dioxide	0	1	44	6.2	3.97	3,955	0	0	0	0
1 Year Total current				100	74.95		US \$55	2395	665	11.31
2 Year projections							US\$80			
3 Year Total projections							US\$100			
4 Year Total projection							US\$120			
5 Year Total projections							US\$150			

Marketplace Applications



- 60 MW applications
- 100 MW
- either photoV, natural gas turbines and waste off-peak electricity
- producing Hydrogen, Oxygen and Solanol
- current price and 2-3-4-5 year projections

IMPORTANT NOTES

These projections are based on NO government subsidies, rebates or grants whatsoever.

Further research needs to be undertaken to validate all Government subsidies this technology is entitled to.

Calc and Projections are within +_ 15 %

Calculations and Projections are based on :

162 litres hydrogen plus 81 Oxygen flow rate per kWh (University Validation trials)

In house trial have produced 195 litres hydrogen plus 97.5 litres oxygen flow rate per kWh

Which means all calc and projections can be modestly increased by $195/162 = 1.2 = 20\%$ increase on ROI

NB: Calc do not include any performance increases from solanol catalytic reactions being improved by CSIRO

60 MW applications



Using PhotoV producing H2 and O2

- H2 = 6000 tonnes per year = current \$36 M, 39 M (2 yr) 42 M (3 yr) 45 M (4 yr) 48M (5 yr)
- O2 = 48,000 tonnes per year = current \$14.4 M, 16.8 (2yr) 19.2 (3 yr) 21.6 (4yr) 24 (5 yr)
- current total of H2 and O2 turnover for 1 year valve = \$US 50.4 M
- Costs:
- Construction total current @\$2 per watt : decrease as photoV goes down
- 450 M , 400 (2yr) 350 (3yr) 300 (4 yr) 260 (5 yr)
- Maintenance 6 M
- current ROI : $50.4 - 6 = 44.4 \times 100 \text{ div } 450 = 10 \%$
- 2 year ROI: $55.8 - 6 = 49.8 \times 100 \text{ div } 400 = 13 \%$
- 3 year ROI : $61.2 - 6 = 55.2 \times 100 \text{ div } 350 = 16 \%$
- 4 year ROI : $66.6 - 6 = 60.6 \times 100 \text{ div } 300 = 20 \%$
- 5 year ROI: $72 - 6 = 66 \times 100 \text{ div } 260 = 25\%$

60 MW applications



Using photo V producing SOLANOL

hydrogen 6000 tonnes

- oxygen 48,000 tonnes
- Solanol production based on 15.86 kg per hour of hydrogen = 64.38 litres per hour of solanol
- value = \$55 = (55 divided by 64.38= 0.85 per litre)
- 563,969 litres per year x 0.85 = \$ 480,000 per year (scale 1) x 39= 18.7 M
- 1536 kWh = 64.38 litres per hour of solanol derived from 100 kg CO2
- 60,000 kWh divided by 1536 = 39 x larger
- Volume of solanol per year = **22 M litres** = value per current year 480,000 x 39= **18.7 M**
- Solanol increases from \$55 to \$80 to \$100 to \$120 to \$150
- current turnover 18.7
- Construction costs: current 450 M , 400 (2yr) 350 (3yr) 300 (4yr) 260 (5yr)
- Operational + maintenance costs 6 M
- current ROI: $18.7 \text{ SOL} - 6 = 12.7 \times 100 \text{ div } 450 = 3 \%$
- 2 year Projection ROI : $27.3 \text{ M SOL} - 6 = 21.3 \times 100 \text{ div } 400 = 5 \%$
- 3 year ROI: $34.7 \text{ M SOL} - 6 = 28.7 \times 100 \text{ div } 350 = 8 \%$
- 4 year ROI: $41 \text{ M SOL} - 6 = 35 \times 100 \text{ div } 300 = 12\%$
- 5 year ROI: $51.3 \text{ M SOL} - 6 = 45.3 \times 100 \text{ div } 26 = 17\%$

60 MW applications



Using Natural Gas Producing H2 and O2

•Hydrogen 10,000 tonnes per year @ \$6000 per tonne (\$6 per kg) = \$60 M

Hydrogen @ 6.50 per kg (2 yr) @ 7.00 (3 yr) @ 7.50 (4 yr) @ 8.00 (5 yr)

•Oxygen 80,000 tonnes @ \$300 per tonne = \$24 M

Oxygen @ \$325 (2 yr) @ \$350 (3 yr) @ \$375 (4 yr) @ \$400 (5 yr)

•Current Turnover = Total 84 M (24 + 60 H2 and O2)

•Cost of Natural Gas per year 21 M (0.04 cents per kWh)

•Current + projected NG costs: 21 M, 22.1 M (2 yr), 23.1 M (3yr), 24.2 (4yr), 25.2 (5yr)

•Construction costs: Current + projected turbines + hydroxy +ranknine +cryogenics+ storage etc :

NG turbine elec power generation (60 M) +hydroxy sys (35 M)+Rankine cycle (15 M)+ cryogen(16 M) + storage/pipeline (4 M) and contingencies (13 M)

• 143 M, 144 M (2yr), 145 (3yr), 146 (4yr), 147 (5yr)

•Operation / overheads / maintenance / labour= \$6 M per year

•Current ROI : $84 - 21 - 6 = 57 \times 100 \text{ div } 143 = 40 \%$

•2 year projection: $65 \text{ M (H)} + 26 \text{ M (O)} = 91 - 22.1 - 6 = 63 \times 100 \text{ div } 144 = 44 \%$

•3 year projection: $70 \text{ M (H)} + 28 \text{ (O)} = 98 - 23.1 - 6 = 69 \times 100 \text{ div } 145 = 48 \%$

•4 year projection: $75 \text{ (H)} + 30 \text{ (O)} = 105 - 24.2 - 6 = 75 \times 100 \text{ div } 146 = 51 \%$

•5 year projection: $80 \text{ (H)} + 32 \text{ O} = 112 - 25.2 - 6 = 80 \times 100 \text{ div } 147 = 54 \%$

60 MW

Using Natural Gas Producing Solanol

- producing hydrogen 9500 tonnes for solanol production and oxygen 77,000 tonnes
- Solanol production based on 15.86 kg per hour of hydrogen = 64.38 litres per hour of solanol
- value = \$55 = (55 divided by 64.38= 0.85 per litre)
- 563,969 litres per year x 0.85 = \$ 480,000 per year (scale 1) x 62.5= 30 M
- 969 kWh = 64.38 litres per hour of solanol derived from 100 kg CO2
- 60,000 kWh divided by 969 = 62.5 x larger
- Volume of solanol per year = **35 M litres** = value per current year 480,000 x 62.5= **35 M**
- Solanol increases from \$55 to \$80 to \$100 to \$120 to \$150 : Current + projected turnover(35 M) (43.8) (54.8) (65.7)
- Current + projected NG costs: 21 M, 22.1 M (2 yr), 23.1 M (3yr), 24.2 (4yr), 25.2 (5yr)
- Construction costs: Current + projected turbines + hydroxy +ranknine +cryogenics+ Catayst + storage etc :
NG turbine elec power generation (60 M) +hydroxy sys (35 M)+Rankine cycle (15 M)+ cryogen(16 M) + catayst (10M) + storage/
pipeline (4 M) and contingencies (3 M)
- 143 M, 144 M (2yr), 145 (3yr), 146 (4yr), 147 (5yr) and Operational costs 6 M

ROI

- Current ROI : $35 - 21 - 6 = 8 \times 100 \text{ div } 143 = 6\%$
- 2 year: $43.8 - 22.1 - 6 = 15.7 \times 100 \text{ div } 144 = 11\%$
- 3 year: $54.8 - 23.1 - 6 = 25.7 \times 100 \text{ div } 145 = 18\%$
- 4 year: $65.7 - 24.2 - 6 = 35.5 \times 100 \text{ div } 146 = 24\%$
- 5 year: $82.1 - 25.2 - 6 = 51 \times 100 \text{ div } 147 = 35\%$

60 MW using Off Peak

producing H₂ and O₂ @ 0.0675 cents kWh

- H₂ = 7000 tonnes per year = current value \$42 M, 45.5 M (2 yr) 49 M (3 yr) 52.5 M (4 yr) 56 M (5 yr)
- O₂ = 56,000 tonnes per year = current value \$16.8 M, 18.2 M (2yr) 19.6 M (3 yr) 21 M (4yr) 22.4(5 yr)
- current total of H₂ and O₂ turnover for 1 year value = 58.8 (63.7) (68.6) (73.5) (78.4)
- Construction costs: Current + projected : hydroxy +ranknine +cryogenics+ CO₂ furnace (retro fit)+ storage etc :
hydroxy sys (35 M)+Rankine cycle (15 M)+ cryogen (16 M) + CO₂ Furnace (10M) + storage/pipeline (4 M) and contingencies (3 M) = Total = 83 M

Projected construction costs: current 83 M, 84 M (2yr), 85 M (3yr), 86 M (4yr), 87 M (5yr)

- **IF we pay for Electricity (TARIFF)** : 60,000 x 0.0675 = 35.5 M
- Projected costs of electricity: 35.5 M current , 37 (2yr), 38.2 (3yr), 39.9 (4yr), 41.4 M (5yr)
- operational costs 6 M

ROI:

- Current ROI: $58.8 - 35.5 - 6 = 17.3 \times 100 \text{ div } 83 = 21 \%$
- 2 year ROI: $63.7 - 37 - 6 = 20.7 \times 100 \text{ div } 84 = 25 \%$
- 3 year ROI: $68.6 - 38.2 - 6 = 24.4 \times 100 \text{ div } 85 = 29 \%$
- 4 year ROI: $73.5 - 39.9 - 6 = 27.6 \times 100 \text{ div } 86 = 32\%$
- 5 year ROI: $78.4 - 41.4 - 6 = 31 \times 100 \text{ div } 87 = 36 \%$

60 MW using Off Peak

producing Solanol @ 0.0675 cents kWh (with and without tariff ROI)

- producing hydrogen 6500 tonnes for solanol production and oxygen 52,000 tonnes
- Solanol production based on 15.86 kg per hour of hydrogen = 64.38 litres per hour of solanol
- value = \$55 = (55 divided by 64.38= 0.85 per litre)
- 563,969 litres per year x 0.85 = \$ 480,000 per year (scale 1) x 46.7 = 22.4 M
- 1286 kWh = 64.38 litres per hour of solanol derived from 100 kg CO2
- 60,000 kWh divided by 1286 = 46.7 x larger
- Volume of solanol per year = 26.3 M litres = value per current year 480,000 x 46.7= 22.4 M
- Solanol increases from \$55 to \$80 to \$100 to \$120 to \$150 : projected turnover (22.4 M) (32.7) (40.9) (49) (61.4)
- Projected costs of electricity: 35.5 M current , 37 (2yr), 38.2 (3yr), 39.9 (4yr), 41.4 M (5yr)
- Construction costs: Hydroxy sys (35 M)+Rankine cycle (15 M)+ cryogen (16 M) + CO2 Furnace (10M) + Catalyst (10M)+ storage/pipeline (4 M) and contingencies (3 M) = Total = 93 M Projected 93, 94,95,96,97
- operational costs 6 M

ROI:

- Current ROI $22.4 - 35.5 - 6 = -19.1 \times 100 \text{ div } 93 =$ with tariff (- 20 %) and without: **18 %**
- 2 year: $32.7 - 37 - 6 = -10.3 \times 100 \text{ div } 94 =$ with tariff (-11%) without tariff: **28 %**
- 3 year: $40.9 - 38.2 - 6 = -3.3 \times 100 \text{ div } 95 =$ with tariff (-4 %) without tariff: **37 %**
- 4 year: $49 - 39.9 - 6 = 3.1 \times 100 \text{ div } 96 =$ with tariff (3%) without tariff: **45 %**
- 5 year: $61.4 - 41.4 - 6 = 14 \times 100 \text{ div } 97 =$ with tariff (15 %) without tariff: **57%**

Note: does not include carbon credits from iron fertilization, and exemptions from carbon taxes



100 + MW
Solanol production
Will increase ROI due to
Economies of Scale



PROTOTYPE details

size 300 kWh

Needs 300 kWh min. size to allow catalyst process to function

- 200 Hydroxy Generators
- Hydroxy Production is 50,000 litres per hour
- Hydrogen production is 3kg per hr: $3 \times 24 \times 365 = 26,280 \text{ kg} \times \$6 = 0.158 \text{ M}$ (34,000 litres per yr)
- Solanol needs hydrogen component of 12 litres per hour
- Oxygen is 16,700 litres per hour
- Solanol is 0.85 cent per litre wholesale current price (2011)
- Solanol $12 \times .85 = 10.00 \text{ hr} \times 24 \times 365 = \$90,000$
- Oxygen per year is 210 tonnes $\times \$300 = \$63,000$
- Gross turnover \$153,000
- Construction costs: Hydroxy 3M, Cryogenics 3 M, Catalyst 3 M, Storage 0.1M = 9.1 M
- PHOTOV: 300 kWh : 4.8 M Construction, plus land + store 0.2= 5M
- 14.2M total construction for suns energy converted into fuel.
- Operational, Business plans, scale up technology, IT, patents : 5.8 M
- Note: if use mains power : 0.2 M (3 months)

Government Subsidies

Government has rebates for renewable energy such as solar

Carbon reduction / emissions

Government tariff / tax \$23 tonne for Carbon reduction / emissions

Solanol production fits in with Government policy to reduce carbon emissions and to promote renewable energy

Iron fertilization incentives



SOCIAL ECONOMICAL BENEFITS

- High public and government support
- Reduces dependence on imported oil
- Reduces greenhouse emissions
- Makes western economics more stable
- Reduces inflation, energy costs
- Kyoto agreements can be honestly meet

Putting nature's balance back on track



Eco Global Fuels Development Fund



- 20 M to be raised
- for prototype
- for business development
- for national and global development



MOVING FORWARD

Preproduction Prototype carbon neutral solar refinery will mean **demonstration showing the ability to produce Solanol** for investors in all EGF refineries globally





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