EcoGlobalFuels
renewable sustainable energy transport fuels

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60MW Mains Electric @ 0.0675 off peak

producing SOLANOL

The key information is:

"Input Formula is based on the kWh necessary for the production of CO 63.64kg per hour:

1.1kg CO_2 per 0.83kg coal per1kWh requiring 1kg O_2 for per hour for total combustion."

We took this information and applied it to our solanol production

Below are the calculations proving up our process

Step 1, is obviously producing hydroxyl gas safety

Step 2, is separating the gases (cryogenics)

Step 3, take the hydrogen and CO2 produced in a pure conc. form and compress it into a solanol catalyst. The oxygen by product is utilized to produce a pure concentrated carbon dioxide stream (via a coal "burner")

Step 4, we are utilizing one turbine output at 60 MW to produce 65 litres per hour which is 27 Million litres per year

Our conclusions are:

Based on off-peak power, if we utilized 60 MW produced by one turbine, we can produce enough solanol to justify a good return on investment. In fact, it is an excellent ROI: within 2 years the sale of solanol equates to 44 %ROI. (ref to end of document)

Environmental advantage:

You require 15 tonnes of OXYGEN from the air: you stated your 60 MW turbine required 4 coal burners to supply the heat for your boilers to produce 60 MW per hour. For each coal burner you require 15 tonnes of oxygen from the air, which produced 16.5 tonnes of CO2, burning 12.5 tonnes of coal (one burner)

One burner produces the heat energy for the generation of 15,000 KWh

This requires 15 tonnes of oxygen per hour

But 60 MW of power can only produce 0.87 tonnes of hydrogen and 7 tonnes of oxygen

Therefore we can use 7 tonnes of oxygen for one specially designed burner being 2.2 times smaller than currently used for the production of the necessary pure carbon dioxide concentrate stream (for our production of solanol)

This will incorporate 11.4 percent of carbon dioxide from your emissions from one turbine into the solanol production.

If you desire to remove and sequest all of your CO2 emissions and earn carbon credits, from one turbine (as a first stage) we can achieve this by the well known and proven process of ocean fertilization.

What is ocean fertilization?

This is the process of distributing iron oxide into the ocean, which encourages the growth of algae, which sequests CO2 from the atmosphere. The good news is we have free iron oxide from our hydroxyl electrolysis process, equivalent to the level necessary to sequest all the CO2 produced by a 60 MW turbine. We produce the necessary iron oxide as a by-produce of the hydroxy electrolysis process, required for iron fertilization of the ocean, to sequest all carbon dioxide emissions.

Ref:

0.5 Tonne Iron oxide	**100 km^2 ocean**	**350 Tonne CO_2 absorbed**

Carbon Credits

This in terms of carbon credits is worth in current European payback is 7.84 Euro per tonne of carbon (or 29 tonnes of CO2)

We sequest 580,000 tonnes of CO2 per year per turbine

580,000 divided by 29 x 7.9 Euro= 158,000 Euro per turbine

Which would contribute to the cost of the transportation and distribution into the ocean

NOTE: the pure iron oxide produced by the electrolysis process has a commodity value of $US 200 per tonne which equates to US$168,000 per annum per turbine (per 60 MW)

Refer to “Ocean Fertilization” for more details

DETAILS

The electrical Mains **off- peak** power equates to **60MW** per hour for the **Hydroxy Electrolysis System** to produce **7,600 Tonne of Hydrogen per annum** with **60,000 Tonne of Enviro-oxygen per annum.**

Hydrogen gas @ 0°C / @ one Atmosphere or STP (See Att, http://columbia.thefreedictionary.com/hydrogen).	**= 0.08988 grams per Litre.**
Oxygen gas @ 0°C / @ one Atmosphere or STP (See Att, http://www.answers.com/topic/oxygen).	**= 1.429 grams per Litre.**
(H_2O) + {580kJ/ input/ Mole} **{including H_2 + O_2 Separation}**	**> (H_2) + [O] a by-product}.** **+ {343kJ/Loss/Mole**
{I.17kW/h or 4.2 MJ**}** **+ {**H_2O130.31 grams**}**	**= {**H_2 12.87 grams, 138 Lph**}.** **+ {**O_2 102.32 grams,69 Lph**}.** **+ {2.5MJ Loss}.**

To produce **7,600 Tonne of Enviro-Hydrogen per annum** plus **60,000 Tonne of Enviro-oxygen per annum** requires **72,000 Tonne of water per annum**, which includes Reverse Osmosis losses **(**Reverse Osmosis filtration cost **$1 million**).

Construction costs per 60MWh;

Hydroxy Electrolysis System construction costs	= **{**$35 Million**}**
Rankine cycle	= **{**$15 Million**}**
Hydroxy gas separation	= **{**$16 Million**}**
CO **+** H_2 Ethanol Catalyst	= **{**$10 Million**}**
Storage and pipeline	= **{**$4 Million**}**
Contingencies	= **{**$3 Million**}**.
Total construction cost current	**= {US$83 Million}.**
Total construction cost 2 years	**= {US$84 Million}.**
Total construction cost 3 years	**= {US$85 Million}.**
Total construction cost 4 years	**= {US$86 Million}.**
Total construction cost 5 years	**= {US$87 Million}.**

The benign non-polluting nature of a connected and combined ***Solanol*** carbon neutral **refinery**, that will initially use ***normally vented carbon dioxide,*** **sea water or bore-site** water, as the ***feed stock*** elements to create a natural ***carbon neutral*** fuel matrix. The normally vented ***carbon dioxide*** from natural gas fields, exhausted outputs from natural gas turbines and coal-fired power stations is "borrowed" to produce ***Solanol fuel*** and when combusted via the emissions, the **same** "borrowed" carbon dioxide is released to the atmosphere and is **balanced** and does not attract any **"*carbon tax"*.**

The endothermic heat input for the catalytic reaction to produce carbon monoxide can be supplied from the hydroxy electrolysis process equating to 780kJ heat losses for the production of 6 hydrogen atoms.

The calculations below establish the necessary molecules for the production of carbon monoxide utilizing the necessary hydrogen to cause an endothermic reaction producing carbon monoxide:

THE NECESSARY HYDROGEN ATOMS FOR THE PRODUCTION VIA CATALYST TO BE DEVELOPED BY THE CSIRO OF 3 MOLES OF CARBON MONOXIDE

$3(CO_2) + 3(H_2)$ > $3(H_2O) + 3(CO)$ + {711kJ/hr heat input}.

CO_2 100kg) + H_2 4.55kg > H_2O 40.9 kg + CO 63.64 kg + {1.6GJ/hr heat input}.

The calculations below are based on the necessary energy for the **conversion of 100kg CO_2 into CO for the feed stock input to the Ethanol Synthesis Catalyst:**

CO + H_2 Ethanol Catalyst reaction

Efficiency of 100kg CO_2 > CO 63.64 kg with H_2 11.31 kg Ethanol Synthesis Catalyst conversion:

Solanol Compounds	H_1	C_1	Atomic Weight	%	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
Propanols	8	3	60	7.7	5.68	6.82	11.4	191	53	0.75
Butanols	10	4	74	1.6	0.90	1	2.5	45	13	0.14
Pentanols	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				**100**	**74.95**		**US$55**	**2395**	**665**	**11.31**
2 Year Total							**US$80**			
3 Year Total							**US$100**			
4 Year Total							**US$120**			
5 Year Total							**US$150**			

1.80 **US** = 34.69 **CZKv**
The above cost reflects the price of the current cost of petrol in the Czech Republic

1 Year Total				**100**	**74.95**		**US$60**	**2395**	**665**	**11.31**
2 Year Total							**US$90**			
3 Year Total							**US$120**			
4 Year Total							**US$140**			
5 Year Total							**US$170**			

The above adjustment in cost of Solanol is calculated by the cost of fuel in the Czech Republic. Therefore, all my calculations over a five year period now will be adjusted to reflect the above cost of fuel.
Natural Gas
38.3 MJ = 717gr = M^3
Cost of per GJ/ NG = US$3.8
Cost of CNG turbine generated electricity per kWh = US$0.04
The curious oil and natural gas price differential | Bulletin of the Atomic Scientists

100kg CO_2 > CO 63.64kg with H_2 11.31kg Ethanol Synthesis Catalyst conversion into Methane 920MJ or 17.22kg per hour > 47.36kg CO_2.
An additional 36.5 kg coal > **CO_2** 48.67 + 3.97kg = **CO_2** 100kg to produces **> CO 63.64 kg**

CH_4 68 grams per hour	= 3.6 MJ	= 1 kWh
CH_4 68 grams per hour @ turbine 80% losses		= CH_4 272 grams per hour
CH_4 272 grams per hour	= 14.4 MJ	= 1 kWh @ 20% turbine Eff
CH_4 136 grams per hour	= 7.2 MJ	= 1 kWh @ 60% turbine Eff

CH_4 136 grams per hour for total combusted with O_2 544 grams a by-product per hour, which will conservatively estimated will inc the efficiency of the turbine electricity production which approximately will produce to 60%:

Therefore: $\frac{920MJ/hour}{7.2MJ}$ = 127

127 x CH_4 136 grams per hour = CH_4 17.22kg

920MJ or 256kWh @ 60% NG turbine efficiency = 154kWh.

With 68.88kg of oxygen by-product from the hydroxy electrolysis process will fully combust the output of the Catalyst reaction, 17.22kg of NG.
This will produce approximately, with turbine generating losses of 40% 154kWh.
920MJ/hour or 256kWh @ 60% NG turbine efficiency = **154kWh.**

This will greatly improves the energy produced in the form of electricity from a gas turbine generating system at high efficiency due to the **higher temperatures** obtained when burning with oxygen input only for the total combustion of natural gas, which should increase the overall efficiency from 20% to 60%.

The utilizing NG turbine electrical power generation, producing **154kWh** from the Ethanol Synthesis Catalyst conversion into Methane 920MJ/hour.
Equates to **154kWh**, which equates to @ 60% NG turbine efficiency 9201MJ or 17.22kg NG requiring 68.8 kg **O_2** for per hour total combustion.

The utilization Enviro-oxygen coal fired will greatly improves the energy produced in the form of electricity from an Enviro-oxygen coal fired furnace turbo-generating system at high efficiency due to the **higher temperatures** obtained when burning with oxygen input only for the total combustion of coal, which should increase the overall efficiency from 30% to 60%.

The combustion of 36.7kg Coal per hour with 44 kg **O_2**,will produce **88 kW/h**, which equates to @ 60% overall efficiency requiring 44 kg **O_2** for per hour total combustion ultimately for the production of a pure concentrated carbon dioxide stream to be converted catalytically into carbon monoxide.

The amount of air consumed by each furnace per turbo-generator output 60 MW electrical 60 m3/sec at full load @ 30% efficiency.

$\frac{60\ M^3/sec\ at\ full\ load.}{5}$ = 12 M^3/sec Enviro-oxygen

$\frac{12\ M^3/sec\ Enviro\text{-}oxygen}{4\ coal\ burners}$ = 3 M^3/sec Enviro-oxygen

The utilization of a pure concentrated carbon dioxide stream produced from a turbo-generator with an output of 60 MWh requiring 61.7 Tonne O_2 per hour producing 66 Tonne of CO_2 per hour or 15.43 Tonne O_2 per coal burner per hour producing 16.5 Tonne of CO_2 per hour.

Oxy-fuel combustion process - Wikipedia, the free encyclopedia

The utilization of amount of CO_2 **produced per kWh equates to 1.1 kg** CO_2 **per 0.83kg coal per 1kWh** of electrical produced therefore an additional CO_2 48.67 kg equates to 88 kWh @ 60% efficiency requiring 44kg O_2 for per hour total combustion is necessary for the production of Solanol requiring a pure concentrated carbon dioxide stream to be converted catalytically into carbon monoxide for the production of Solanol.

Input Formula is based on the kWh necessary for the production of CO 63.64kg per hour:

1.1kg CO_2 **per 0.83kg coal per1kWh requiring 1kg** O_2 for per hour for total combustion.

Therefore O_2 required for the manufacture of carbon dioxide for the catalytic production of carbon monoxide required by the ethanol catalyst @ **CO 63.64 kg**:

100kg CO_2 **> CO 63.64kg with** H_2 **11.31kg** Ethanol Synthesis Catalyst conversion into Methane 920MJ or 17.22kg per hour > 47.36kg CO_2 + flu gas from coal
CO_2 48.67 + 3.97kg = CO_2 100kg to produces **> CO 63.64 kg**

36.7kg Coal +CH_4 17.22 kg > O_2 **113kg** per hour > CO_2 96.03kg.

CO_2 96.03kg + CO_2 3.97kg ethanol catalyst output = CO_2 **100kg per hour**

THE CALCULATIONS BELOW SHOW THE NECESSARY HYDROGEN TO BE PRODUCED FOR THE DISASSOCIATION OF CARBON DIOXIDE AND FOR THE PRODUCTION OF HYDROGEN FOR FEEDSTOCK TO THE ETHANOL CATALYST

H_2 **4.55kg for endothermic reaction producing CO from** CO_2:
+ H_2 **11.31kg for Ethanol Synthesis Catalyst reaction** **=** H_2 **15.86kg**

{1,442 kW/h or 5.2GJ**} + {**H_2O 160.6 kg**}** **= {**H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

O_2 **127 kg —** O_2 **113kg** **=** O_2 **14 kg per hour**

The surplus O_2 **14 kg per hour** can be utilised to increase oxygen levels of 14% will produce an oxidizing effect in the combustion of coal.

Additionally, the sulfur content in the coal can be converted into **pure** sulfuric acid and sold as a commodity. The extraction of sulfur from the pure concentrated carbon dioxide flue gases produced by the oxy-fired combustion of coal can easily be achieved by passing the flue gases through a water cooling tower. This will produce sulfuric acid and cool down the flue gases to be pumped to the ethanol catalyst with hydrogen for the production of Solanol.

H_2SO_4 volumes to be determined in the make-up of the **12.5 Tonne per hour coal** being combusted. The cost of sulfuric acid equates to US$70 per tonne. This now becomes another commercial commodity which also must be considered.

THE NECESSARY COMPRESSION FOR THE CATALYTIC REACTION TO BE MAINTAINED PRODUCING THE ABOVE COMPOUNDS

Additionally the oven that compresses the CO 63.64kg H_2 11.31 kg and holds the 1500psi or 10.45MPa or 102 Atm:

(CO 63.64kg + 9.48 kg H_2)	**= 73.12 kg**
H_2 11.31kg	**= 125,835itre**
CO 63.64kg	**= 35,355 Litre**
Total **160,000 Lph**	**= 160,000Lph** **= 300kWh Ethanol Catalyst Pumping power.**

{1,442 kW/h or 5.2GJ**}** **+ {**H_2O 160.6 kg**}**
{+ 300kWh Ethanol Catalyst Pumping power**}**

= {H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

{1,742 kW/h or 6.3GJ**}** **+ {**H_2O 160.6 kg**}**

= {H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

This reduction in input power is due to the electrical energy generated via NG gas turbine by the NG output of the ethanol catalyst looped and for the production of the added necessary carbon dioxide from coal flue gases, energy equates to **242kWh:**

{1,742 kW/h or 6.3GJ**}** **+ {**H_2O 160.6 kg**}**
{— 242kWh electrical power**}**

= {H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

{1,500 kW/h or 5.4GJ**}** **+ {**H_2O 160.6 kg**}**

= {H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

The greatly improved energy produced in the form of electricity from a coal fired furnace turbo-generating system utilizing the principle of the Rankine cycle which will increase efficiency approximately to 40% by utilizing the waste steam energy exhausted from the primary turbine. This should increase the overall efficiency from 30% to 40% (see link below). This upgrade of coal-fired power stations must be mandated to reduce carbon dioxide emissions globally.

The Rankine cycle gives a theoretical **Carnot efficiency of about 63%** compared with an actual efficiency of **42% for a modern coal-fired power station.** This low turbine entry temperature (compared with a gas turbine) is why the Rankine cycle is often used as a bottoming cycle in combined-cycle gas turbine power stations.

Rankine cycle - Wikipedia, the free encyclopedia

{1,500 kW/h or 5.4GJ} x 60% secondary Rankine cycle losses
70% primary steam turbine losses **= 1,286kWh**

{1,286kW/h or 4.6GJ**}** **+ {**H_2O 160.6 kg**}**

= {H_2 15.86kg, 176,458 Lph**}.**
+ {O_2 **127 kg**, 88,229 Lph**}.**
+ {3.1 GJ heat loss}.

The combustion of coal utilizes four coal burners per boiler as described below with inputs and outputs:

60,000kW/h / 4 coal burners	= 15,000kW/h

1.1 kg CO_2 per 0.83kg coal per kWh 1kg O_2 for per hour for total combustion:

O_2 1 kg x 15,000kW/h	**= O_2 15 Tonne per hour**
CO_2 1.1 kg x 15,000kW/h	**= CO_2 16.5 Tonne per hour**
Coal 0.83 kg **x** 15,000kW/h	**= Coal 12.5 Tonne per hour**

Unfortunately, the production of oxygen via a conventional coal burner requires O_2 15 Tonne per hour, the maximum O_2 produced equating to O_2 7 Tonnes per hour only:

O_2 15 Tonne / O_2 7 Tonne	= 2.2 times

Therefore, a coal burner must be reduced 2.2 times smaller to utilize the output of the necessary 7 Tonnes per hour of oxygen available for the production of approximately **6 tonne per hour of complete concentrated carbon dioxide output** and when this carbon dioxide is combined with 0.87 Tonnes of hydrogen in a Solanol catalyst. The catalyst will produce approximately 4,000 litres of Solanol per hour.

The horrific global production of carbon dioxide can only be neutralized by iron fertilization as a necessary futuristic remedy to the sequestration of carbon dioxide

Iron fertilization of the oceans is an old concept and if utilised can sequested carbon dioxide from the atmosphere, below are different examples researched from the Internet, these examples will be summarized and an average on all examples will be calculated on the items under consideration below:

1. Tonnages of iron oxide necessary.
2. Tonnages of algae produced.
3. Square kilometers of ocean necessary.
4. Tonnages of carbon dioxide absorbed and sequested.
5. Tonnages of oxygen produced via the photosynthesis process.
6. Tonnages of sodium hydroxide also released into the oceans improving the pH in the oceans.
7. Also increases the volume of marine life (increase in fish stocks globally) due to the increase of algae being top of the food chain.

The current MACU University validation is based on eff. derived utilizing lower amps

{I.17kW/h or 4.2 MJ**}** + **{**H_2O130.31 grams**}**	**= {**H_2 12.87 grams, 138 Lph**}.** **+ {**O_2 102.32 grams,69 Lph**}.** **+ {2.5MJ Loss}.**
34.2 Amps x 18 Volts	= 0.616 kWh
426.6 gr steel was converted to iron oxide	= 426.6 gr iron oxide
426.6 gr oxide	= 787 hours

The calculations below are based on efficiencies derived utilizing projected higher amps efficiencies are as follows:

{I.17kW/h or 4.2 MJ**}** **+** **{**H_2O153 grams**}**	**=** **{**H_2 17 grams, 190 Lph**}.** **+** **{**O_2 136 grams, 95.5Lph**}.** **+** **{**1.75MJ Loss**}.**

The new upgraded hydroxy cell configuration for the creation of iron oxide a by-product of the hydroxy electrolysis process configuration of 12 cells equates to 20% more iron oxide produced utilizing higher amps described below:

85 Amps x 21.6 Volts	= 1.84 kWh per hydroxy tube
85 Amps / 34.2 Amps	= 2.5 Times more
2.5 x 426.6 gr iron oxide x 20%	= 1,272 gr iron oxide per hour
1,272 gr iron oxide / 787hours	= 1.6 gr iron oxide per hour
US$0.52 per kilogram of Steel / 1.6 gr iron oxide kWh	= US$0.0008 kWh
US$0.0008 kWh x 60,000 kWh	= US$48 kWh
1.6 gr iron oxide per hour x 60,000 kW x 24 x 365	= 840 Tonne per annum
840 Tonne iron oxide x commodity price AU$200	= AU$168,000 per annum

http://www-formal.stanford.edu/jmc/progress/iron.txt

By spreading and/or utilising the global circulating currents, just half a tonne of iron oxide across 100 square kilometres of ocean, the oceanographers had stimulated enough plant growth to soak up some 350,000 kilograms of carbon dioxide from the seawater. If performed on a grand scale, iron fertilization of ocean water could absorb billions of tonnes of carbon dioxide from the air, enough to slow the rate of greenhouse warming, according to some rough estimates.

0.5 Tonne Iron oxide	**100 km^2 ocean**	**350 Tonne CO_2 absorbed**

Iron fertilization - Wikipedia, the free encyclopediaThe potential of iron fertilization as a geoengineering technique to tackle global warming is illustrated by the following figures. If phytoplankton converted all the nitrate and phosphate present in the surface mixed layer across the entire Antarctic circumpolar current into organic carbon, the resulting carbon dioxide deficit could be compensated by uptake from the atmosphere amounting to about 0.8 to 1.4 gigatonnes of carbon per year. This quantity is comparable in magnitude to annual anthropogenic fossil fuels combustion of approximately 6 gigatonnes. It should be noted that the Antarctic circumpolar current region is only one of several in which iron fertilization could be conducted—the Galapagos islands area being another potentially suitable location.

Estimated averages calculated for the iron fertilization of the oceans in two days:

0.5 Tonne Iron oxide	**100 km^2 ocean**	**350 Tonne CO_2 absorbed**	**in 48 hours**

0.5 Tonne Iron oxide 100 km^2 ocean 7.3 Tonne CO_2 absorbed in 1 hour

1.1 kg CO_2 per 0.83kg coal per 1kWh requires 1kg O_2 for per hour for total combustion:

66 Tonne CO_2 per 50 Tonne coal per 60 MWh 60 Tonne O_2 for **per hour** for total combustion:

Therefore, the calculations below reflect the necessary criteria for the growth of algae over two days as described in the link below:

"Lifespans differ for each species of algae, with an average life expectancy ranging from a few days to a year or two."**Life Cycle of Algae | eHow.com**

4.5 Tonne Iron oxide 900 km^2 ocean 66 Tonne CO_2 absorbed in 1hour

1.6 gr iron oxide per 1kWh x 60,000kWh x 48 hours = 4.6 Tonne Iron oxide

AU$0.0008 kWh x 60,000 kWh = AU$48 per hour @ no cost

Iron Ore - Monthly Price - Commodity Prices - Price Charts, Data, and News - IndexMundi

According to the search above the cost of iron ore-iron- oxide is currently **US$150.00** per tonne, and with additional cost of distributed, which means iron fertilization of the ocean is an expensive exercise, which would depend on pay back from **carbon credits**, if considered commercially.

Therefore, the obvious supply of the necessary iron oxide can easily be produced via the denigration of the steel electrodes during the hydroxy electrolysis process as a byproduct at no cost. This iron oxide can be utilised for iron fertilization for the production of algae to sequest all the carbon dioxide produced by fossil fuel combustion.

4.5 Tonne Iron oxide	**900 km^2 ocean**	**66 Tonne CO_2 absorbed**	**in 1hour**
4.5 Tonne Iron oxide	**900 km^2 ocean**	**3,168 Tonne CO_2 absorbed**	**in 48 hours**
4.5 Tonne Iron oxide	**900 km^2 ocean**	**0.58 million Tonne CO_2 absorbed**	**in 1 year**

60MW@ 0.58 million Tonne CO_2 absorbed x AU$8.00 = AU$4.7 million carbon credits per annum

The area of the World Oceans is 361 million square kilometres (139 million square miles). Obviously, utilization of the world's oceans in their entirety would not be possible. It is envisaged that only **one tenth** of the oceans can be utilised for the international iron fertilization programme.

361 million km^2 ocean
900 km^2 ocean x 10 = 40,111 times

60MW x 40,111 = 2,406,666 MW

40,111 x 0.58 million Tonne CO_2 absorbed = 23 billion Tonne CO_2 absorbed annum

Ocean - Wikipedia, the free encyclopedia

840 Tonne iron oxide x commodity price AU$200 = AU$168,000 per annum

Current ATM CO_2 18 billion Tonne CO_2 absorbed
x AU$8.00 = AU$144 billion carbon credits annum

Emissions of CO2 by human activities are currently more than 130 times greater than the quantity emitted by volcanoes, amounting to about **27 billion tonnes per year.**

The above 23 billion tonnes of CO_2 sequestered utilizing 10% of the world's oceans caters for only the flue gases exhausted from coal-fired power stations. The amount of CO_2 produced by the burning of fossil fuels equates to a staggering 27 billion tonnes per year. Obviously, a further 5% of the world's oceans must be also subjected to iron fertilisation to sequest the balance and any increase of CO_2 emissions due to human activity.

[Carbon dioxide - Wikipedia, the free encyclopedia]

As can be concluded with the ROI utilizing the iron oxide for the production of algae to sequest carbon dioxide and earning carbon credits is a much more lucrative ROI compared with the sale of the iron oxide for the production of steel.

[Carbon credit - Wikipedia, the free encyclopedia]

The 2009 average is 387.35 ppm. For the past decade (2001-2010) the average annual increase is 2.04 ppm per year. Annual data for 2010 was posted September 8, 2011, by the National Oceanic and Atmospheric Administration in the US.

[Global warming - Wikipedia, the free encyclopedia]

Earth's average surface temperature increased by about 0.8 °C (1.4 °F) with about two thirds of the increase occurring over just the last three decades.

The increase of concentration from pre-industrial concentrations of 280 ppm has again doubled in just the last 33 years.

[Carbon dioxide in Earth's atmosphere - Wikipedia, the free encyclopedia]

In just the last 33 years:

CO_2 387.35 ppm — **CO_2** 280 ppm = **CO_2** 107.35 ppm increase = 0.8 °C increase global temperature.

Therefore:

$$\frac{0.8\ °C \text{ increase global temperature}}{CO_2\ 107.35 \text{ ppm increase}} = 0.0075\ °C \text{ increase per 1ppm.}$$

[CO2 Now | CO2 Home]

SAN FRANCISCO—A mantra that has driven global negotiations on carbon dioxide emissions for years has been that policy-makers must prevent warming of more than **two degrees Celsius** to prevent apocalyptic climate outcomes. And, two degrees has been a point of no return, a limit directly or indirectly agreed to by negotiators at international climate talks.
James Hansen, director of the NASA Goddard Institute for Space Studies in New York, whose data since the 1980s has been central to setting that benchmark, said today that two degrees is too much.

2 °C — 0.8 °C increase global temperature = 1.2 °C

$$\frac{1.2\ °C}{0.0075\ °C} = CO_2\ 160\ \text{ppm increase}$$

Current CO_2 387.35 ppm + CO_2 160 ppm increase = CO_2 547.35 ppm point of no return

2-Degree Global Warming Limit Is Called a "Prescription for Disaster" | Observations, Scientific American Blog Network

China's exceedingly high energy demand has pushed the demand for relatively cheap coal-fired power. Each week, another 2GW of coal-fired power is put online. While there are other sources of power generation available, China's ready access to domestic coal reserves means it is significantly cheaper to extract and transport than other fuel.

The amount of megawatts creating 18 billion Tonne per year of carbon dioxide by coal-fired power stations equates to 1.9 Million MW. Ten percent of the world's oceans can sequester carbon dioxide produced by 2.4 Million MW in totality.

After subtracting 1.9 Million MW electrical power produced from existing coal-fired power stations, equates to 0.5 Million MW remaining only utilizing 10% of the world's oceans.

The totality of coal-fired power stations in use in the world today equates to a staggering 510 with China constructed an incredible one coal-fired power station per week with an average size of 2,000MW.

List of coal power stations - Wikipedia, the free encyclopedia

$$\frac{\textbf{2.4 Million MW}}{\textbf{2,000MW}} = \textbf{1,200 coal-fired power stations utilizing 10\% World's Oceans.}$$

The calculations below are based on efficiencies derived utilizing projected higher amps efficiencies are as follows:

{60,000kW/h or 180 GJ**}** + **{**H_2O 6.3 Tonne**}** = **{**H_2 870 kg, 10 million Lph**}**
+ {O_2 7,000 kg, 5 million Lph**}**
+ {120 GJ heat loss}.

The calculations below are based on efficiencies derived utilizing projected lower amps efficiencies are as follows:

{60,000kW/h or 180GJ**}** + **{**H_2O 6.3 Tonne**}** = **{**H_2 740 kg, 8 million Lph**}.**
+ {O_2 5,900 kg, 4 million Lph**}.**
+ {145 GJ heat loss}.

The above power input can reliably produce the necessary hydrogen and oxygen to produce:

Therefore, the scaling up of the carbon neutral refinery equates to increased ROI:

$$\frac{60{,}000\ \text{kWh}}{1{,}286\ \text{kWh (input electrical power)}} = 46.7$$

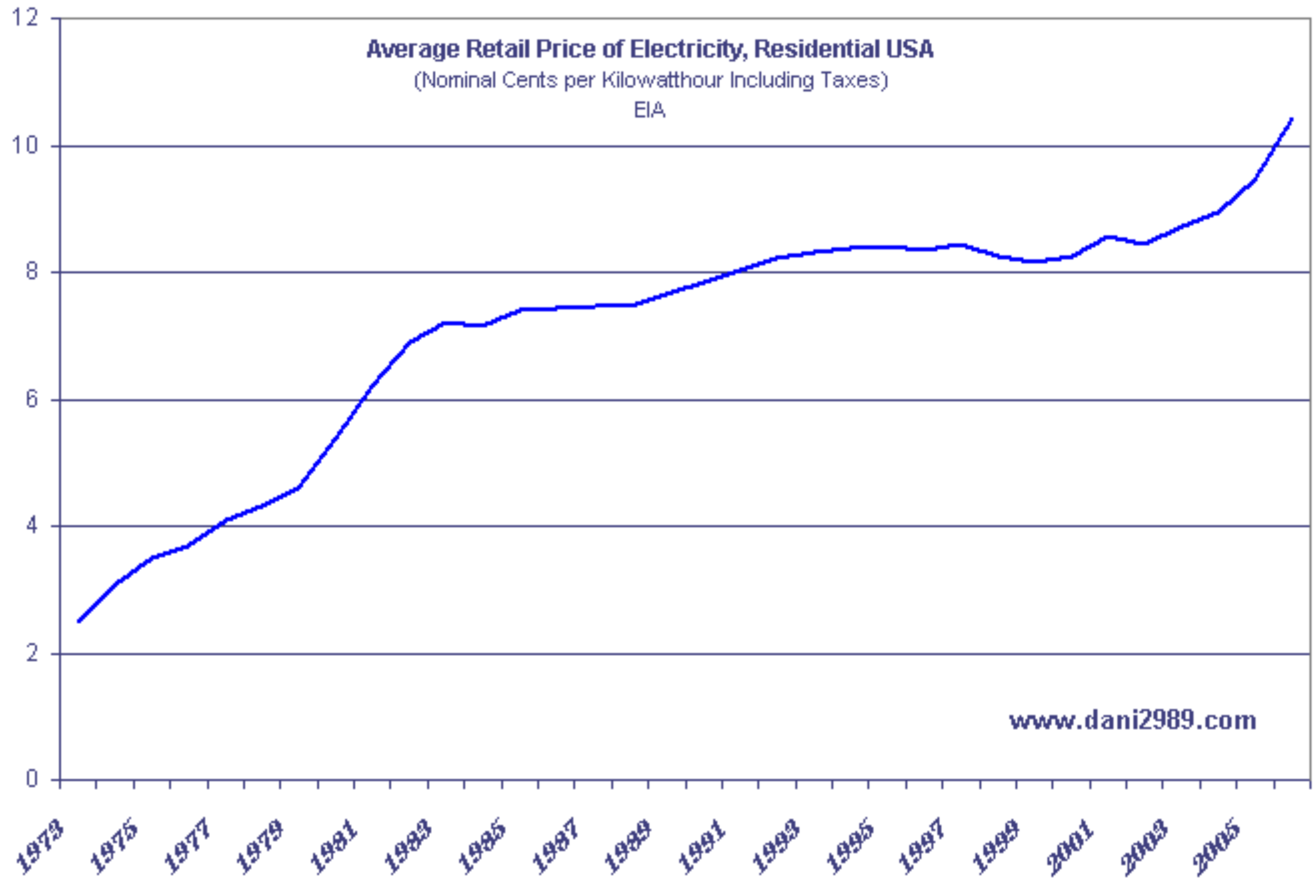
US$60 profit per hour x 46.7 = US$2,802 profit per hour.

Solanol compound commodities per annum = US$24.6 million

60,000 kWh x 0.0675 Current x 24 x 365 = **{US$35.5 Million per annum}.**

Total SOLANOL cost = **— {US$35.5 Million per annum}.**

Total SOLANOL profit = **— {US$10.9 Million per annum}.**



Cost of electrical increases by approx. $0.0028 per annum = **$0.014 in 5 years the USA**

60,000 kWh x **US$0.0675 Current** = **$4,050 per hour**
60,000 kWh x **US$0.0703 2 Year** = **$4,218 per hour**
60,000 kWh x **US$0.0731 3 Year** = **$4,386 per hour**
60,000 kWh x **US$0.0759 4 Year** = **$4,554 per hour**
60,000 kWh x **US$0.0787 5 Year** = **$4,722 per hour**

Running costs

{I.17kW/h or 4.5 MJ**}** + **{**H_2O130.31 grams**}** = **{**H_2 12.87 grams, 162 Lph**}.**
+ {O_2 102.32 grams,81 Lph**}.**
+ {2.5MJ Loss**}.**

Therefore cost of per {H_2/1kg/hr **+** O_2/8kg/hr**}**

{1000 grams**}**
{H2 18 grams**}** = **{**55.55**}.**

{55.55**}** x **{**I.17kW/h**}** = **{**65 kW/h**}.**

{65 kW/h**}** = **{**H^2/1kg/hr **+** O_2/8kg/hr**}.**

H_2O130.31 grams x 55.55 = H_2O 7.23kg

(Reverse Osmosis filtration cost **$0.02 million**)

Requiring twice the volume	**=** H_2O 15 kg
AU Current cost $2 012	= 1000
AU Current cost per kg	= $0.002012 per kg
{Water @ $0.002012 per kg x 15**}**	**= {**$0.03/hr**}**
{Water $0.03/hr**}**	**= {**H_2/1kg/hr **+** O_2/8kg/hr**}.**

Maintenance costs of tube hydroxy generators & production cost equates to US$0.007 per kWh;

{$0.007 per kWh**} x {**65 kW/h**}**	**= {**$0.46/hr**}**
{$0.46/hr**} + {**$0.03/hr**}**	**= {**$0.49/hr**}**
{H_2**/1kg/hr}**	**= {US$0.49/hr}**
{H_2 **455 /kg/hr} x {$0.49/hr}**	**= {US$223/hr}**
6,000 Tonne of Hydrogen per annum	**= {US$3 million per annum}.**

The recent trials have been successful and proven reliable where 500 grams of steel was consumed/converted to an oxide over a 10 cell tube hydroxy generator. . The current cost of steel is $0.52 per kilogram, which equates to $0.26 per hydroxy cell configuration over a 34 day period 24/7. The steel consumed/converted to an oxide can easily be recycled to produce high grade steel again. The lifespan has been verified by Macquarie University at 10 years. To place the cells alone after 10 years which consist of mild steel only and polymer insulation equates to:

Ongoing hydroxy generators & water costs = $2 Million annum

Complete safety of the production and utilization of hydroxy gas

The kilojoule value of hydroxy gas per litre equates to 10.79kJ. The amount of hydroxy gas at 414 kPa in the output tubes and scrubbers per 10 hydroxy tube generator module, is only 30 litres which equates to only 324 kJ in the system at any one time, which means if fully detonated the containment of the explosion can easily be managed with current technology.

Additionally, as advised by Macquarie University self-compressed hydroxy gas at 414kPa is relatively stable, safe mixture in small quantities.

Specifically, current steel tube containment technologies and for the modular containment of the detonated hydroxy gas, current welding technology sintered stainless steel back flash arresters accompanied with heat sensors and solenoid complete volume output shutdown of hydroxy gas protecting all other connected tube generator modules.

Energy density - Wikipedia, the free encyclopedia

The current technology of eliminating static electricity is complete grounding of the hydroxy tube generator module, which was successfully tested at Macquarie University and all static electricity was eliminated, which was proven by the fact that the hydroxy tube generator thoroughly tested over 34 days 24/7 had no detonations caused by static electricity in any way whatsoever.

The modulisation of the hydroxy tube generator configuration currently surmised is 10 hydroxy gas tube generators connected to one hydroxy tube scrubber which is isolated from all other 10 hydroxy tube generator modules via current technology back flash arrestors which consist of sintered stainless steel accompanied with heat sensors and a complete shutdown of output compartmentised hydroxy gas mechanism.

The explosion proof nature in the inherent design feature which makes up the hydroxy tube generator modules will be thoroughly tested to acceptable parameters by an Australian test safe authority and will issue a report under recognized international standards which will make this modular configuration the safest and most reliable hydroxy production in the world. See link TestSafe |

Maintenance costs **= — {$3 Million annum}.**

Labor running costs etc **= — {$3 Million annum}.**

Total overheads **= — {$6 Million annum}.**

The current ROI does not apply because the pre-production prototype must be funded, constructed and tested with all governmental approvals and all construction manuals which will take approximately 12 months.

Current @ US$0.0675 tariff per kWh **= US$35.5 million per annum**
Current, including off-peak tariff:
Current — {US$10.9 Million per annum}
— {US$6 Million per annum}** **= — {US$16.9 Million per annum}.

{100 x — US${16.9 Million}
{US$83 Million} **= — {20% ROI}.**

{I.17kW/h or 4.2 MJ**} + {**H_2O153 grams**}** **= {**H_2 17 grams, 190 Lph**}.**
+ {O_2 136 grams, 95.5Lph**}.**
+ {1.75MJ Loss**}.**

Projected higher amps efficiencies are as follows:

{— 20% ROI} x 1.2 Projected increase in hydroxy flow rate **= — 15% ROI}**

Current, not including the cost of off-peak tariff:
{$24.6 Million per annum}
— {US$6 Million per annum}** **= {US$18.6 Million per annum}.

{100 x US$18.6 Million}
{US$83 Million} **= {22% ROI}.**

Projected higher amps efficiencies are as follows:

{22% ROI} x 1.2 Projected increase in hydroxy flow rate **= 27% ROI}**

2 year @ US$0.0703 tariff per kWh **= US$36.9 million per annum**
2 year, including off-peak tariff:
2 year — {US$0.1 Million per annum}
— {US$6 Million per annum}** **= — {US$6.1 Million per annum}.

{100 x — US$6.1 Million}
{US$84 Million} **= — {7% ROI}.**

Projected higher amps efficiencies are as follows:

{— 7% ROI} x 1.2 Projected increase in hydroxy flow rate= — 5% ROI}

2 year, not including the cost of off-peak tariff:
{US$36.8 Million per annum}
— {US$6 Million per annum} = {US$30.8 Million per annum}.

{100 x US$30.8 Million}
{US$84 Million} = {37% ROI}.

Projected higher amps efficiencies are as follows:

{37% ROI} x 1.2 Projected increase in hydroxy flow rate = 44% ROI}

3 year @ US$0.0731 tariff per kWh = US$38.4 million per annum
3 year, including off-peak tariff:
3 year {US$10.7 Million per annum}
— {US$6 Million per annum} = {US$4.7 Million per annum}.

{100 x US$4.7 Million}
{US$85 Million} = {6% ROI}.

Projected higher amps efficiencies are as follows:

{6% ROI} x 1.2 Projected increase in hydroxy flow rate = 7% ROI}

3 year, not including the cost of off-peak tariff:
{US$49.1 Million per annum}
— {US$6 Million per annum} = {US$43.1 Million per annum}.

{100 x US$43.1 Million}
{US$85 Million} = {51% ROI}.
Projected higher amps efficiencies are as follows:

{51% ROI} x 1.2 Projected increase in hydroxy flow rate = 61% ROI}

4 year @ US$0.0759 tariff per kWh = US$39.9 million per annum
4 year, including off-peak tariff:
4 year {US$17.4 Million per annum}
— {US$6 Million per annum} = {US$11.4 Million per annum}.

{100 x US$11.4 Million}
{US$86 Million} = {13% ROI}.

Projected higher amps efficiencies are as follows:

{13% ROI} x 1.2 Projected increase in hydroxy flow rate = 16% ROI}

4 year, not including the cost of off-peak tariff:
{US$57.3 Million per annum}
— {US$6 Million per annum} = {US$51.3 Million per annum}.

{100 x US$51.3 Million}
{US$86 Million} = {60% ROI}.

Projected higher amps efficiencies are as follows:

{60% ROI} x 1.2 Projected increase in hydroxy flow rate = 72% ROI}

5 year @ US$0.0787 tariff per kWh = US$41.4 million per annum
5 year, including off-peak tariff:
5 year {US$28.2 Million per annum}
— {US$6 Million per annum} = {US$22.2 Million per annum}.

{100 x US$22.2 Million}
{US$87 Million} = {26% ROI}.

Projected higher amps efficiencies are as follows:

{26% ROI} x 1.2 Projected increase in hydroxy flow rate = 31% ROI}

5 year, not including the cost of off-peak tariff:
{US$69.6 Million per annum}
— {US$6 Million per annum} = {US$63.6 Million per annum}.

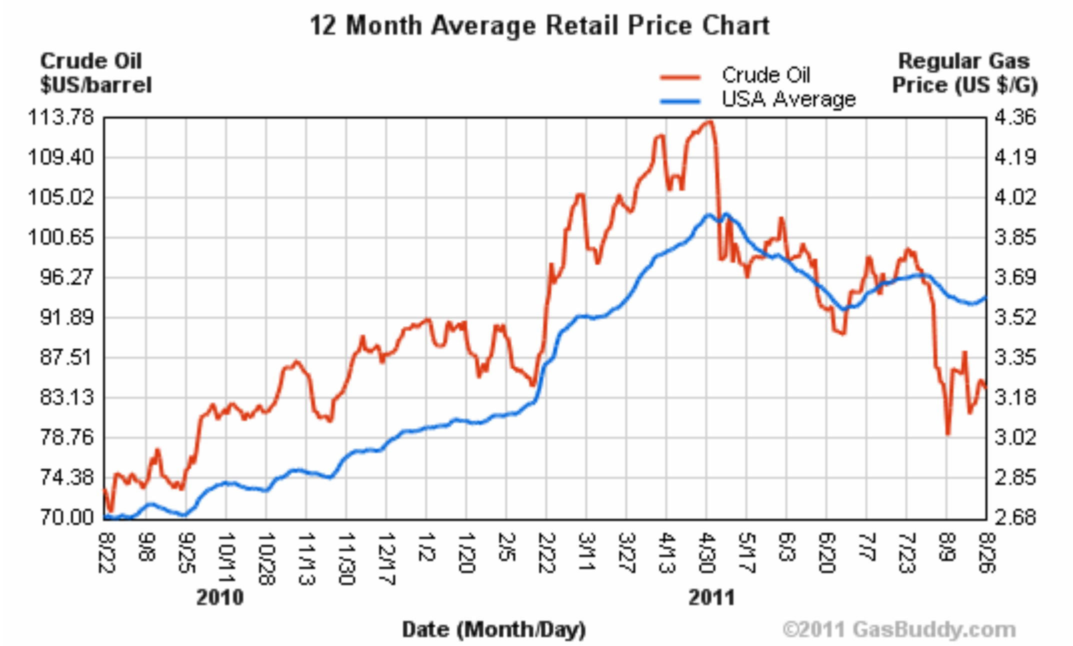
{100 x US$63.6 Million}
{US$87 Million} = {73% ROI}.

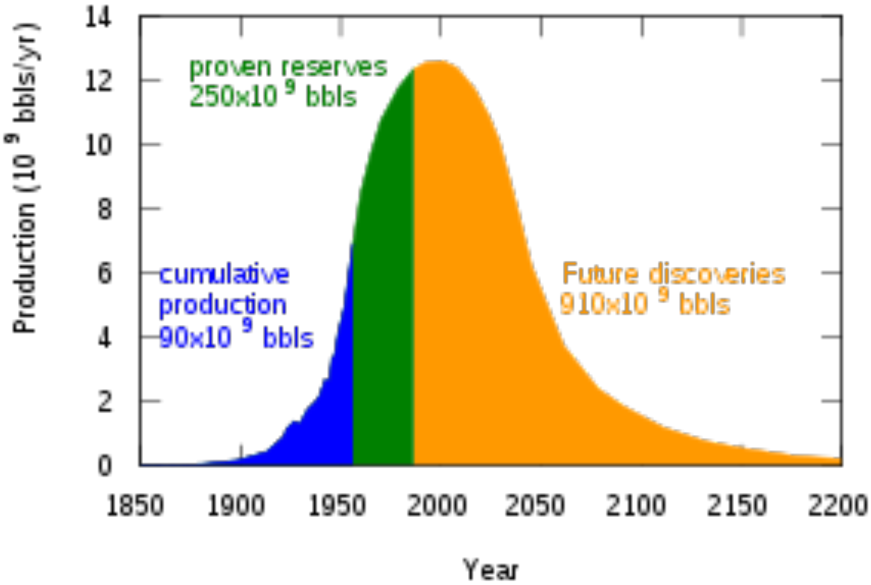
Projected higher amps efficiencies are as follows:

{73% ROI} x 1.2 Projected increase in hydroxy flow rate = 88% ROI}

Also, when the scaling up process reaches 200MW/h the ROI will also again increase due to economies of scale up to **100% ROI.**

The reason why the production of Solanol commodities is attractive is due to the fact that fossil based fuels have slowly increased over the years due to the fact we reached Hubbert's peak in the year 2000 which is the peak production rate of crude oil around the world and now being 2011 the production rate is starting to reduce and consequently due to supply and demand the price of oil per barrel is now US$97.00. See graph below





Also, as you can see with the graph above the only direction the cost of fossil fuels can go is up, of course, the fossil fuel community will try and convert coal into oil because currently we have 700 years in coal reserves around the world, but obviously the production of oil from coal will be completely detrimental to the atmosphere and fortunately the cost of production of Solanol commodities will be at least 50% cheaper. This will protect nature and substantially reduce carbon dioxide emissions in the atmosphere.

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