



Eco Global Fuels releases its technology with Natural Gas using unique energy efficient loop with projected ROI

50MW Natural Gas Electric @ \$0.04kWh power producing Hydrogen with Enviro-oxygen



The electrical power required **50 MW** Natural gas turbine electrical power generation will generate **1,200MW** per day for the **Hydroxy Electrolysis System** to produce **5,028 Tonne of Hydrogen per annum** with **40,224 Tonne of Enviro-oxygen per annum**.

{H₂O} + {580kJ/ input/ Mole}
{including H₂ + O₂ Separation}

> (H₂) + [O] a by-product}.
+ {343kJ/Loss/Mole}

{1.17kW/h or 4.2 MJ} + {H₂O 130.31 grams}

= {H₂ 12.87 grams, 138 Lph}.
+ {O₂ 102.32 grams, 69 Lph}.
+ {2.5MJ Loss}.

To produce **5,0280 Tonne of Hydrogen per annum** plus **40,224 Tonne of Enviro-oxygen per annum** requires **90,500 Tonne of water per annum**, which includes Reverse Osmosis losses (Reverse Osmosis filtration cost \$1 million).

Construction costs:

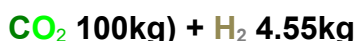
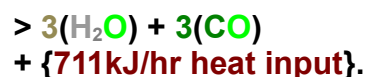
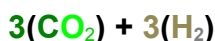
Natural gas turbine electrical power generation	= {\$50 Million}
Hydroxy Electrolysis System construction costs	= {\$35 Million}
Hydroxy gas separation	= {\$16 Million}
Storage and pipeline	= {\$4 Million}
Contingencies	= {\$3 Million}.
<u>Total construction cost current</u>	= {US\$108 Million}.
<u>Total construction cost 2 years</u>	= {US\$109 Million}.
<u>Total construction cost 3 years</u>	= {US\$110 Million}.
<u>Total construction cost 4 years</u>	= {US\$111 Million}.
<u>Total construction cost 5 years</u>	= {US\$112 Million}.

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



THE CALCULATIONS BELOW ARE TAKEN FROM THE ETHANOL CATALYST.

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:

$\text{CO} + \text{H}_2$ Ethanol Catalyst reaction

Efficiency of 100kg $\text{CO}_2 > \text{CO}$ 63.64 kg with H_2 11.31 kg Ethanol Synthesis Catalyst conversion:T

Solanol Compo unds	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			



THE CALCULATIONS BELOW EQUATE TO THE NECESSARY NATURAL GAS REQUIRED FOR THE PRODUCTION OF 1 KWH

Natural Gas

$$\begin{aligned}
 38.3 \text{ MJ} &= & 717\text{gr} & & = \text{M}^3 \\
 \text{Cost of per} & & 1.055 \text{ GJ Natural gas} & & = \text{US\$4.5} \\
 \text{Cost of Natural gas turbine generated electricity kWh} & = & \text{US\$0.04} & &
 \end{aligned}$$

$$\begin{aligned}
 \text{CH}_4 68 \text{ grams per hour} & & = 3.6 \text{ MJ} & & = 1 \text{ kWh} \\
 \text{CH}_4 68 \text{ grams per hour @ turbine 80\% losses} & & & & = \text{CH}_4 272 \text{ grams per hour} \\
 \text{CH}_4 272 \text{ grams per hour} & & = 14.4 \text{ MJ} & & = 1 \text{ kWh @ 20\% turbine Eff} \\
 \text{CH}_4 136 \text{ grams per hour} & & = 7.2 \text{ MJ} & & = 1 \text{ kWh @ 60\% turbine Eff}
 \end{aligned}$$

CH₄ 136 grams per hour for total combusted with O₂ 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%:

$$\begin{aligned}
 \text{Therefore: } \frac{920\text{MJ/hour}}{7.2\text{MJ}} & & = 127 \\
 127 \times \text{CH}_4 136 \text{ grams per hour} & & = \text{CH}_4 17.22\text{kg} \\
 920\text{MJ or } 256\text{kWh @ 60\% Natural gas turbine efficiency} & = & 154\text{kWh.}
 \end{aligned}$$

With 68.88kg of oxygen by-product from the hydroxy electrolysis process will fully combust the output of the Catalyst reaction, 17.22kg of Natural gas.

This will produce approximately, with turbine generating losses of 40% 154kWh.
920MJ/hour or 256kWh @ 60% Natural gas turbine efficiency = **154kWh.**

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

The utilization of Natural gas turbine electrical power generation, producing **154kWh** from the Ethanol Synthesis Catalyst conversion into Methane 920MJ/hour.
Equates to **154kWh**, which equates to @ 60% Natural gas turbine efficiency 920MJ or 17.22kg Natural gas requiring 68.88 kg O₂ for per hour total combustion.

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

Therefore O₂ required for the manufacture of carbon dioxide for the catalytic production of carbon monoxide required by the ethanol catalyst @ **CO 63.64 kg**:

$$\begin{aligned}
 100\text{kg CO}_2 > \text{CO } 63.64\text{kg with H}_2 11.31\text{kg Ethanol Synthesis Catalyst conversion into Methane} \\
 920\text{MJ or } 17.22\text{kg per hour} > 47.36\text{kg CO}_2 + \\
 \text{Natural gas } 17.7\text{kg} > \text{CO}_2 48.67 + 3.97\text{kg} = \text{CO}_2 100\text{kg to produces} > \text{CO } 63.64 \text{ kg}
 \end{aligned}$$

$$\begin{aligned}
 \text{CH}_4 17.7\text{kg} + \text{CH}_4 17.22\text{kg ethanol catalyst output} & = \text{CH}_4 34.92\text{kg per hour} \\
 \text{CH}_4 34.92\text{kg} > \text{O}_2 139.68\text{kg per hour} > \text{CO}_2 96.03\text{kg.} \\
 \text{CO}_2 96.03\text{kg} + \text{CO}_2 3.97\text{kg ethanol catalyst output} & = \text{CO}_2 100\text{kg per hour}
 \end{aligned}$$



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

H₂ 4.55kg for endothermic reaction producing CO from CO₂:
+ H₂ 11.31kg for Ethanol Synthesis Catalyst reaction = H₂ 15.86kg

{1,587kW/h or 5.7GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.
 + {O₂ 139.68 kg, 97,130 Lph}.
 + {3.4 GJ heat loss}.

The surplus H₂ 1.6kg can be looped back and converted back to electricity when the H₂ is combined with the Natural gas turbine gas input:

H₂ 17.46kg — H₂ 15.86kg = H₂ 1.6kg per hour.
 H₂ 141.8MJ per kg x H₂ 1.6kg = 227MJ
 227MJ x @ 60% H₂ + Natural gas turbine = 136MJ or 38kWh

{1,587kW/h or 5.7GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.
 {— 38kWh @ 60% H₂ + Natural gas turbine} + {O₂ 139.68 kg, 97,130 Lph}.
 + {3.4 GJ heat loss}.

{1,549kW/h or 5.6GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.
 + {O₂ 139.68 kg, 97,130 Lph}.
 + {3.4 GJ heat loss}.

CATALYST. THIS INFORMATION IS FROM THE NECESSARY COMPRESSION FOR THE CATALYTIC REACTION TO BE MAINTAINED PRODUCING THE ABOVE COMPOUNDS

Additionally the oven that compresses the CO 63.64kg H₂ 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	= 125,835litre
CO 63.64kg	= 35,355 Litre
Total	= 160,000Lph

160,000 Lph = **300kWh Ethanol Catalyst Pumping power.**
 {1,549kW/h or 5.6GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.
 {+ 300kWh Ethanol Catalyst Pumping power} + {O₂ 139.68 kg, 97,130 Lph}.
 + {3.4 GJ heat loss}.
 {1,849kW/h or 6.7GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.
 + {O₂ 139.68 kg, 97,130 Lph}.
 + {3.4 GJ heat loss}.



This reduction in input power is due to the electrical energy generated via Natural gas turbine by the Natural gas output of the ethanol catalyst looped energy equates to **154kWh**:

{1,849kW/h or 6.7GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.

{— 154kWh Natural gas turbine electrical power} + {O₂ 139.68 kg, 97,130 Lph}.
+ {3.4 GJ heat loss}.

{1,695kW/h or 6.1GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.

+ {O₂ 139.68 kg, 97,130 Lph}.
+ {3.4 GJ heat loss}.

The greatly improved 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%:

{1,695kW/h or 6.1GJ}x 40% turbine generating losses

80% turbine generating normal losses = 848kWh

{848kWh or 3.1GJ} + {H₂O 176.8 kg} = {H₂ 17.46kg, 194,259 Lph}.

+ {O₂ 139.68 kg, 97,130 Lph}.
+ {3.4 GJ heat loss}.

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

{50,000kW/h or 180 GJ} + {H₂O 5.81 Tonne} = {H₂ 574kg, 6 million Lph}

+ {O₂ 4,589 kg, 3 millionLph}
+ {112 GJ heat loss}.

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

50,000 kW/h
848 kWh (input electrical power) = 59

Input Formula is based on the kWh necessary for the production of CO 63.64kg per hour now 59 times larger due to the 50MW power supplied:

US\$55 profit per hour x 59 = US\$1,623 profit per hour.

Solanol compound commodities per annum = US\$28.4 million

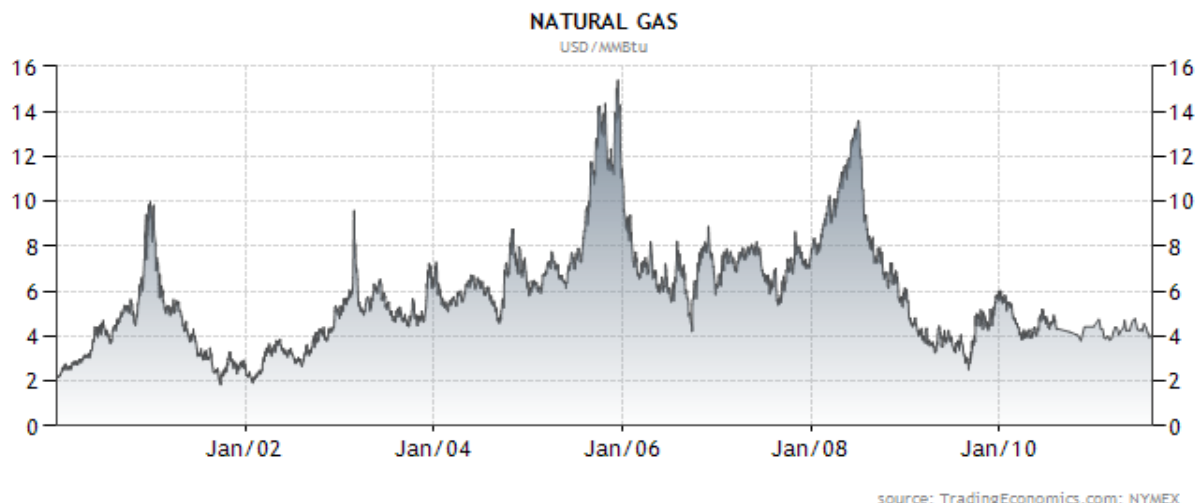


The enviro-oxygen in this closed loop combustion of Natural gas produces all the necessary carbon dioxide output from the Natural gas combustion turbine generating system to facilitate the necessary carbon dioxide to be catalytically converted into carbon monoxide for the total input requirements of the ethanol catalyst for the production of Solanol.

The benign non-polluting nature of a Solanol carbon neutral refinery that will initially use normally vented carbon dioxide, as the feed stock to create a carbon neutral fuel matrix. The normally vented carbon dioxide from the Natural gas turbine generating system is utilised to produce Solanol fuel in a closed looped system and when combusted via the emissions, the same absorbed carbon dioxide is released into the atmosphere and does not increase the carbon dioxide levels, which does not attract any “carbon tax”.

The calculations below determine the equivalent cost of oxygen which is paid by the reduction in tariff due to the facility of producing a pure carbon dioxide output when combusting Natural gas as a fuel source.

Enviro-oxygen 40,224 Tonne @ \$300 Tonne = {US\$12 Million per annum}.
Total cost = — {\$12 Million per annum}.
Total SOLANOL profit = {\$3.3 Million per annum}.



Additionally, Natural gas cost per GJ has only doubled in the last 10 years which is marginal when compared to petroleum products.

Cost of Natural gas increases by approx \$0.2 per annum = **\$2 in 10 years to \$4.50 per GJ currently.**
 The conversion of Natural gas to electricity is calculated below:

Cost of Natural gas increases by approx \$0.002 per annum = **\$0.02 in 5 years to 0.048 kWh**

50,000 kWh x 0.04 Current	= \$2,000 per hour
50,000 kWh x 0.042 2 Year	= \$2,100 per hour
50,000 kWh x 0.044 3 Year	= \$2,200 per hour
50,000 kWh x 0.046 4 Year	= \$2,300 per hour
50,000 kWh x 0.048 5 Year	= \$2,400 per hour



Discounted

50,000 kWh x 0.0275 Current	= \$1,375 per hour
50,000 kWh x 0.0303 2 Year	= \$1,515 per hour
50,000 kWh x 0.0331 3 Year	= \$1,655 per hour
50,000 kWh x 0.0359 4 Year	= \$1,795 per hour
50,000 kWh x 0.0387 5 Year	= \$1,935 per hour

Running costs

{1.17kW/h or 4.5 MJ} + {H ₂ O 130.31 grams}	= {H ₂ 12.87 grams, 162 Lph}. + {O ₂ 102.32 grams, 81 Lph}. + {2.5MJ Loss}.
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Therefore cost of per {H₂/1kg/hr + O₂/8kg/hr}

{1000 grams}	
{H ₂ 18 grams}	= {55.55}.
{55.55} x {1.17kW/h}	= {65 kW/h}.
{65 kW/h}	= {H ₂ ² /1kg/hr + O ₂ /8kg/hr}.
H ₂ O 130.31 grams x 55.55	= H ₂ O 7.23kg

(Reverse Osmosis filtration cost \$0.02 million)

Requiring twice the volume	= H ₂ O 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 ₂ 574 /kg/hr } x { \$0.49/hr }	= { US\$281/hr }
5,000 Tonne of Hydrogen per annum	= { US\$2.46 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 photovoltaic, hydroxy generators & water costs = \$0.4 Million annum

Maintenance costs	= — { \$3 Million annum }.
Labor running costs etc	= — { \$3 Million annum }.
Total overheads	= — { \$6 Million annum }.

Current) { \$16.4 Million per annum }	
— { US\$6 Million per annum }	= { \$10.4 Million per annum }.
{ 100 x \$10.4 Million }	
{ US\$118 Million }	= { 9% ROI }.



The current return on investment is based on efficiencies derived utilizing lower amps.
Projected higher amps efficiencies are as follows:

{9% ROI} x 1.2 Projected increase in hydroxy flow rate = 11% ROI}

2 Year {\$28 Million per annum}
— {US\$6 Million per annum} = {\$22 Million per annum}.
{100 x US\$22 Million}
{US\$119 Million} = **{19% ROI}**.

The current return on investment is based on efficiencies derived utilizing lower amps.
Projected higher amps efficiencies are as follows:

{19% ROI} x 1.2 Projected increase in hydroxy flow rate = {22% ROI}

3 Year) {\$37.2 Million per annum}
— {US\$6 Million per annum} = {\$31.2 Million per annum}.
{100 x US\$31.2 Million}
{US\$120 Million} = **{26% ROI}**.

The current return on investment is based on efficiencies derived utilizing lower amps.
Projected higher amps efficiencies are as follows:

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

4 Year {\$46.3 Million per annum}
— {US\$6 Million per annum} = {\$40.3 Million per annum}.
{100 x US\$40.3 Million}
{US\$121 Million} = **{33% ROI}**.

The current return on investment is based on efficiencies derived utilizing lower amps.
Projected higher amps efficiencies are as follows:

{33% ROI} x 1.2 Projected increase in hydroxy flow rate = {40% ROI}

5 Year {\$60.5. Million per annum}
— {US\$6 Million per annum} = {\$54.5 Million per annum}.
{100 x US\$54.5 Million}
{US\$122 Million} = **{45% ROI}**.

The current return on investment is based on efficiencies derived utilizing lower amps.
Projected higher amps efficiencies are as follows:

{45% ROI} x 1.2 Projected increase in hydroxy flow rate = {54% ROI}

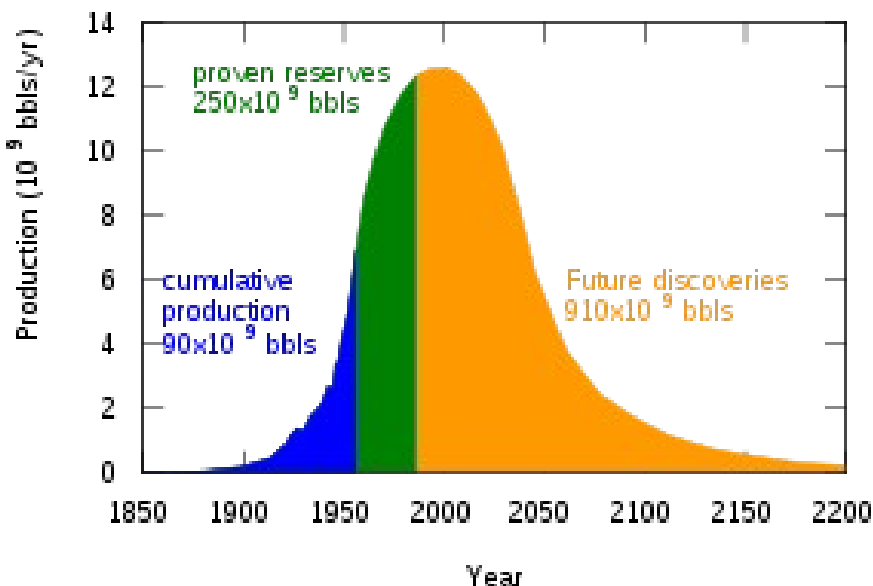
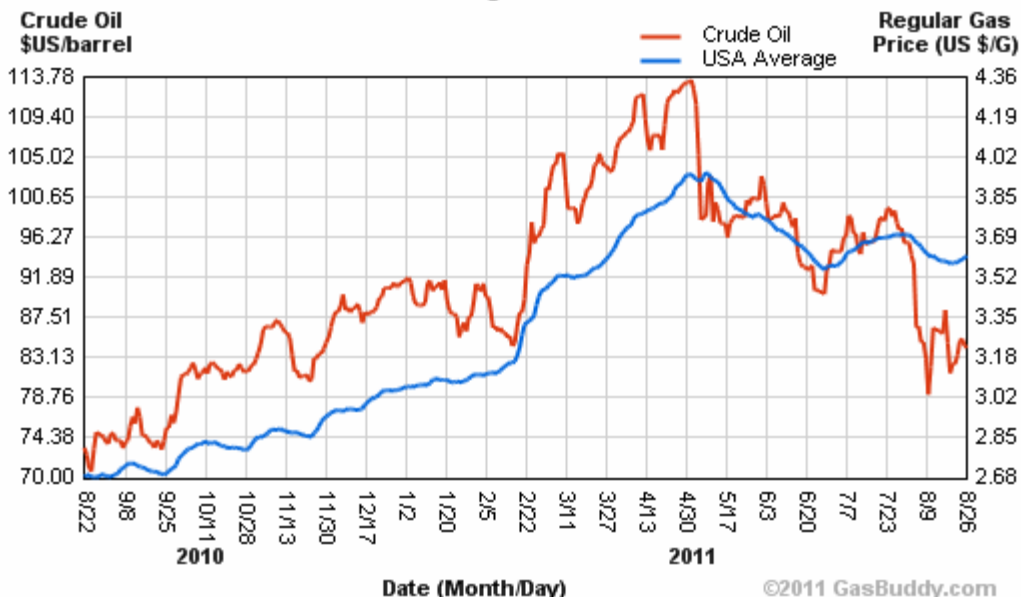
Also, when the scaling up process reaches 100MW/h the ROI will also again increase due to economies of scale up to **60% ROI**.

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.

12 Month Average Retail Price Chart



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.