E-Cat Australia PTY LTD
A new age of energy production

Cost Comparisons

Basic Competitive Advantages: Why The Customer Will Buy This NOW.

Currently the E-Cat is used as a hot water generator below 100 degrees C or saturated steam at 101 degrees C. This means initially we are in the marketplace in competition with industrial boilers or steam. These usually work on electricity, steam, coal, #2 heating oil. Obviously, none of these are renewable, and emit greenhouse gases.

The charts in the following pages amortize how much the customer is paying in running costs in comparison to other systems. The E-cat is cost competitive with several other technologies, most of which are not ecologically sound.

Introduction

LENR/cold fusion has been recognized by the scientific community for decades, but only now has one managed to generate energy continuously, stable and with an output of several kilowatts. Rossi's E-Cat will go down in history as the solution to the global "energy problem" with a completely green technology that neither leave toxic nor radioactive waste.

The energy source is nickel and hydrogen where no combustion process takes place but instead the hydrogen is merged with nickel and forms small amounts of copper. The energy density is a factor of 100,000 or more compared to the combustion processes of today's fuels. The E-cat technology is working with high density fuel to produce sustainable, clean, and cheap energy (currently in the form of thermal heat/steam), based on fusion not fission.

The E-cat operates at a high COP, which means combined with the low cost of the fuel, means that the consumer will pay a comparatively lower cost to what they currently experience with commercial heat (power) generation.

Anatomy of the E-cat

The E-Cat technology works by taking a small amount of micron sized nickel powder, applying a catalyst, putting it all in a pressurized hydrogen atmosphere, and applying heat to the setup. Truly novel nuclear reactions start to take place between the nickel and hydrogen atoms, and the result is a huge release of energy. The nickel and hydrogen fuel is cheap, and only tiny amounts are utilized. To give you an idea of just how powerful this technology can be, consider the fact that a reactor core with a volume of only fifty cubic centimeters can produce a maximum safe output of ten kilowatts of heat. Utilizing the same few grams of nickel and only tiny amounts of hydrogen, the same reactor core could produce ten kilowatts continually for six months, or longer.

In addition to being powerful, the technology is completely safe. It uses no radioactive materials, produces no nuclear waste, emits no radioactivity into the environment, and releases no pollution. Unlike conventional nuclear reactors, E-Cat reactor cores cannot melt down. If the temperature of the core grows too high, the nickel powder melts and all of the reaction sites are destroyed, and the core becomes "dead" until new fuel is added.

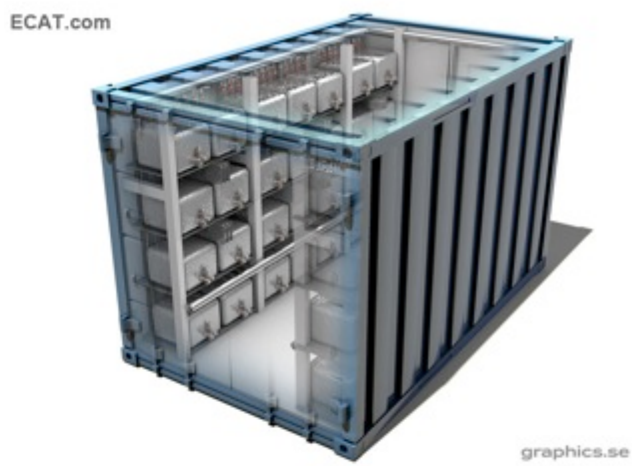
Since we do not have access to the internal design of the central fuel container and no information on the external lead shielding and the cooling water system we can only make very general comments. The central container is about 50 cm^3 in size and it contains 0.11-gram hydrogen and 50 grams nickel. The enthalpy from the chemical formation of nickel and hydrogen to nickel hydride is 4850 joule/mol. If it had been a chemical process, a maximum of 0.15 watt-hour of energy could have been produced from nickel and 0.11-gram hydrogen, the whole hydrogen content of the container. On the other hand, 0.11 gram hydrogen and 6 grams of nickel (assuming that we use one proton for each nickel atom) are about sufficient to produce 24 MWh through nuclear processes assuming that 8 MeV per reaction can be liberated as free energy. For comparison, 3 liters of oil or 0.6 kg of hydrogen would give 25 kWh through chemical burning. Any chemical process for producing 25 kWh from any fuel in a 50-cm^3 container can be ruled out. The only alternative explanation is that there is some kind of a nuclear process that gives rise to the measured energy production.

Definition: LENRs are weak interactions and neutron-capture processes that occur in nanometer-to-micron-scale regions on surfaces in condensed matter at room temperature. Although nuclear, LENRs are not based on fission or any kind of fusion, both of which primarily involve the strong interaction. LENRs produce highly energetic nuclear reactions and elemental transmutations but do so without strong prompt radiation or long-lived radioactive waste

Exothermic nuclear reactions

The elements in nature consist of molecules formed from atoms. The atoms are characterised by a positively-charged nucleus and by peripheral negative electrons, which determine their species. The nucleus in turn is formed of neutrons and protons – collectively known as nucleons – held together by extremely intense forces within a short range of action. The mass of the nucleus is less than the sum of the masses of the nucleons (protons and neutrons) that form it. The mass difference (Δm), which is related to the binding energy according to the mass-energy equivalence principle $\Delta E = \Delta mc2$, is called the mass defect. What about nuclear fuels? The nuclei that have the lowest binding energy per nucleon provide nuclear energy by fusion if they have low atomic mass and by fission if their atomic mass is high. Nuclear binding energy vs. mass

Let us now look at the nuclear reactions that are accompanied by the production of energy: **The fusion reaction**: two light nuclei fuse together and form a heavier nucleus. Here the energy is released because the mass of the resulting nucleus is lower than the mass of the two reacting nuclei. **The fission reaction**: a very heavy nucleus splits into two lighter nuclei. In this case, too, the total mass of the components is less than the mass of the original nucleus. For the same amount of reactants, the energy released during a nuclear reaction is millions of times the energy released during chemical reactions (combustion).



106 modules consisting of 10kW E-Cats
No handling of reaction products
Control panel for individual monitoring
20‘ container (2.4mx2.6mx6m)
No exhaust
Plug'n'Serve

E-Cat technical and financial data:

- E-Cat Australia has the Exclusive license
- Sell price 1.5m US
- Delivery 3 months after order
- Payment of 1/3 US$ at time of order
- Payment of 2/3 US$ after performance test at factory
- Delivery from factory to Customer, Customer's responsibility and cost
- Shipping costs for container 1 MW approx 3000-5000 US $
- Installation by local licensee trained by manufactures "Leonardo Corporation" at customer expense. (approx. 2 days installation @$1500 per day)

The following pages are cost comparisons of the E-cat to other fuels, over 1-10 years

OPERATIONAL & MAINTENANCE COST E-CAT TECHNOLOGY

Description - material	Unit Rate - USD		Required for per MWh Heat output		Cost per day (24Hrs) of MW Heat output	Cost per year (8766Hrs) of MW Heat output	Remarks	
Electricity input COP 6:1	$0.11	Per KW	3.33		$440.00	$160,710.00	This is based on cheap Dubai Tariff, with a COP of 6.	
Water Calculations Sydney Water Price	$0.03	Per Liter	5.2	liter	$0.16	$1,367.00	Cost per Year @ Standard Boiler leakage Rates NOT an e-cat expense	
Operation & Maintenance per Published Specs	$0.50	Per MWh	$0.50	USD	$12.00	$4,383.00	Per Published Specs.	
Recharge Cost	$10.00	Per module	0.24	USD	$5.80	$2,120.00	Per Published Specs.	
Hydrogen	5	Liters				$1.00	Very small amount- not even in the equation	
Actual Variable Cost						$168,580.50		
Capital Cost	1.5	Million			$410.68	$150,000.00	Amortized at 1MW per hour for 8766 hours per year for 10 years.	
Variable & Amortized Capital Cost for 10 year operation	1.5	Million			$872.23	$318,580.50	Actual per day cost including amortization	
Variable & Amortized Capital Cost over 20 years Operation	1.5	Million			$436.11	$159,290.25	Actual Per day cost including Amortization	

Description	Price	Unit Rate	Required for Per MWh Heat Output	Cost Per Day	Cost Per Year	Remarks
Electricity Input COP 6.0	$0.11	166.6666667	$18.33	$440.00	$160,710.00	
Water Calculations - Price Per Liter @ 5.2 Ltrs Consumed	$0.030	5.2	$0.16	$3.74	$1,367.50	
Operation & Maintenance per Published Specs	$0.50	per MWh	$0.50	$12.00	$4,383.00	
Recharge Cost - 106 Units	$10.00	Per Module	$0.24	$5.80	$2,120.00	
Capital Cost - Amortized Over 10 Yr. Period	$1,500,000.00	USD	$17.11	$410.68	$150,000.00	
Total Cost			$36.34	$872.23	$318,580.50	
Total Variable Cost					$168,580.50	
Capital Cost per KWh						
Net KW per hour: Capital Cost Only	$0.017					
Net KW per hour w/o Capital Cost Included	$0.019					
Net Total KW cost per hour:	$0.036					
Ratio of Electricity input cost vs. Net Cost:	3.026738963					
Loopback Calculations:						
Net KW per hour: Capital Cost Only	$0.017					

Net KW per hour w/o Capital Cost Included	$0.011					
Net Total KW cost per hour:	$0.028					
Ratio of Electricity input cost vs. Net Cost:	3.979513836					
				% of E-Cat	**% of E-Cat**	**Cost Per Day**
Cost Comparisons:	**Cost**	**BTU**	**Per KW**	**COP 6.0**	**COP 12.0**	**1MW Plant**
Dubai Natural Gas	$5.00	1000000	$0.0171	46.96%	93.91%	$206.61
Dubai Electricity	$0.11		$0.1100	302.67%	605.35%	$1,331.77
Kerosene	$23.97	1000000	$0.0818	225.11%	450.21%	$990.47
#2 Fuel Oil	$19.73	1000000	$0.0673	185.29%	370.57%	$815.26
Propane	$34.04	1000000	$0.1162	319.67%	639.35%	$1,406.57
US Natural Gas	$14.71	1000000	$0.0502	138.14%	276.29%	$607.83
US Electricity - Resistance	$32.24	1000000	$0.1100	302.77%	605.54%	$1,332.19
US Electricity - Heat Pump @ COP of 2.0	$16.12	1000000	$0.0550	151.39%	302.77%	$666.10
Coal	$10.18	1000000	$0.0347	95.60%	191.20%	$420.65
Firewood - Hard Wood	$13.89	1000000	$0.0474	130.44%	260.89%	$573.95
Wood Pellets	$20.96	1000000	$0.0715	196.84%	393.68%	$866.09
Shelled Corn	$13.66	1000000	$0.0466	128.28%	256.57%	$564.45
Ethanol	$24.74	1000000	$0.0844	232.34%	464.67%	$1,022.28
Ethanol Subsidy	$5.92	1000000	$0.0202	55.60%	111.19%	$244.62
Powder River Basin Coal	$0.56	1000000	$0.0019	5.26%	10.52%	$23.14
Northern Appalachia	$2.08	1000000	$0.0071	19.53%	39.07%	$85.95

Coal						
Petroleum	$13.56	1000000	$0.0463	127.34%	254.69%	$560.31
Diesel	$16.21	1000000	$0.0553	152.23%	304.46%	$669.81
Gasoline	$18.16	1000000	$0.0620	170.54%	341.09%	$750.39
Australian Coal	$4.45	1000000	$0.0152	41.79%	83.58%	$183.88
Chinese Coal	$7.82	1000000	$0.0267	73.44%	146.88%	$323.13

E-Cat Cost Comparison

	E-Cat	**Dubai Electricity**	**Kerosene**	**#2 Fuel Oil**	**Propane**
Price Per Million BTUs	**$10.65**	$32.24	$23.97	$19.73	$34.04
Price Per Megawatt Hr.	**$36.35**	$110.04	$81.81	$67.34	$116.18
Cost Per Day	**$872.36**	$2,640.84	$1,963.43	$1,616.12	$2,788.28
Cost Per Month	**$26,170.88**	$79,225.29	$58,902.92	$48,483.71	$83,648.53
Cost Per Year	**$318,630.51**	$964,567.86	$717,143.04	$590,289.20	$1,018,420.91
Cost For 10 Yrs Op.	**$3,186,305.13**	$9,645,678.62	$7,171,430.41	$5,902,892.03	$10,184,209.06
Cost For 20 Yrs Op.	**$6,372,610.25**	$19,291,357.24	$14,342,860.83	$11,805,784.07	$20,368,418.13

	US Natural Gas	**US Electricity - Resistance**	**US Electricity - Heat Pump @ COP 2.0**	**Firewood - Hard Wood**	**Wood Pellets**	**Ethanol**
Price Per Million BTUs	$14.71	$32.24	$16.12	$13.89	$20.96	$24.74
Price Per Megawatt Hr.	$50.21	$110.04	$55.02	$47.41	$71.54	$84.44
Cost Per Day	$1,204.93	$2,640.84	$1,320.42	$1,137.76	$1,716.88	$2,026.50
Cost Per Month	$36,147.77	$79,225.29	$39,612.64	$34,132.73	$51,506.27	$60,795.09
Cost Per Year	$440,099.05	$964,567.86	$482,283.93	$415,565.99	$627,088.78	$740,180.18
Cost For 10 Yrs Op.	$4,400,990.46	$9,645,678.62	$4,822,839.31	$4,155,659.93	$6,270,887.84	$7,401,801.77
Cost For 20 Yrs Op.	$8,801,980.92	$19,291,357.24	$9,645,678.62	$8,311,319.85	$12,541,775.67	$14,803,603.54

	Petroleum	Diesel	Gasoline	Chinese Coal	Dubai Natural Gas	Coal	Ethanol Subsidy
Price Per Million BTUs	$13.56	$16.21	$18.16	$7.82	$5.00	$10.18	$5.92
Price Per Megawatt Hr.	$46.28	$55.32	$61.98	$26.69	$17.07	$34.74	$20.20
Cost Per Day	$1,110.73	$1,327.79	$1,487.52	$640.55	$409.56	$833.86	$484.92
Cost Per Month	$33,321.80	$39,833.81	$44,625.66	$19,216.56	$12,286.80	$25,015.92	$14,547.57
Cost Per Year	$405,692.93	$484,976.58	$543,317.38	$233,961.56	$149,591.79	$304,568.88	$177,116.68
Cost For 10 Yrs Op.	$4,056,929.34	$4,849,765.83	$5,433,173.81	$2,339,615.60	$1,495,917.90	$3,045,688.84	$1,771,166.79
Cost For 20 Yrs Op.	$8,113,858.69	$9,699,531.66	$10,866,347.63	$4,679,231.19	$2,991,835.80	$6,091,377.69	$3,542,333.59

	Powder River Basin Coal	Northern Appalachia Coal	Australian Coal
Price Per Million BTUs	$0.56	$2.08	$4.45
Price Per Megawatt Hr.	$1.91	$7.10	$15.19
Cost Per Day	$45.87	$170.38	$364.51
Cost Per Month	$1,376.12	$5,111.31	$10,935.25
Cost Per Year	$16,754.28	$62,230.18	$133,136.69
Cost For 10 Yrs Op.	$167,542.80	$622,301.85	$1,331,366.93
Cost For 20 Yrs Op.	$335,085.61	$1,244,603.69	$2,662,733.86

Fuel increases calc at 5 %, E-Cat decrease in price at 2 % comparisons over 10 years

Fuel Cost Increase Projections @ 5% Per Year:	E-Cat Decrease 2% in price	Dubai Electricity	Kerosene	#2 Fuel Oil
1 Year	**$10.44**	$33.85	$25.17	$20.72
2 Years	**$10.23**	$35.54	$26.43	$21.75
3 Years	**$10.02**	$37.32	$27.75	$22.84
4 Years	**$9.82**	$39.19	$29.14	$23.98
5 Years	**$9.63**	$41.15	$30.59	$25.18
6 Years	**$9.43**	$43.20	$32.12	$26.44
7 Years	**$9.25**	$45.36	$33.73	$27.76
8 Years	**$9.06**	$47.63	$35.41	$29.15
9 Years	**$8.88**	$50.01	$37.19	$30.61
10 Years	**$8.70**	$52.52	$39.04	$32.14

	Propane	US Natural Gas	US Electricity - Resistance	US Electricity - Heat Pump @ COP 2.0	Firewood - Hard Wood
1 Year	$35.74	$15.45	$33.85	$16.93	$14.58
2 Years	$37.53	$16.22	$35.54	$17.77	$15.31
3 Years	$39.41	$17.03	$37.32	$18.66	$16.08
4 Years	$41.38	$17.88	$39.19	$19.59	$16.88
5 Years	$43.44	$18.77	$41.15	$20.57	$17.73
6 Years	$45.62	$19.71	$43.20	$21.60	$18.61
7 Years	$47.90	$20.70	$45.36	$22.68	$19.54
8 Years	$50.29	$21.73	$47.63	$23.82	$20.52
9 Years	$52.81	$22.82	$50.01	$25.01	$21.55
10 Years	$55.45	$23.96	$52.52	$26.26	$22.63

	Wood Pellets	Ethanol	Petroleum	Diesel
1 Year	$22.01	$25.98	$14.24	$17.02
2 Years	$23.11	$27.28	$14.95	$17.87
3 Years	$24.26	$28.64	$15.70	$18.77
4 Years	$25.48	$30.07	$16.48	$19.70
5 Years	$26.75	$31.58	$17.31	$20.69
6 Years	$28.09	$33.15	$18.17	$21.72
7 Years	$29.49	$34.81	$19.08	$22.81
8 Years	$30.97	$36.55	$20.03	$23.95
9 Years	$32.52	$38.38	$21.04	$25.15
10 Years	$34.14	$40.30	$22.09	$26.40

	Gasoline	Chinese Coal	Dubai Natural Gas	Coal
1 Year	$19.07	$8.21	$5.25	$10.69
2 Years	$20.02	$8.62	$5.51	$11.22
3 Years	$21.02	$9.05	$5.79	$11.78
4 Years	$22.07	$9.51	$6.08	$12.37
5 Years	$23.18	$9.98	$6.38	$12.99
6 Years	$24.34	$10.48	$6.70	$13.64
7 Years	$25.55	$11.00	$7.04	$14.32
8 Years	$26.83	$11.55	$7.39	$15.04
9 Years	$28.17	$12.13	$7.76	$15.79
10 Years	$29.58	$12.74	$8.14	$16.58

	Ethanol Subsidy	Powder River Basin Coal	Northern Appalachia Coal	Australian Coal
1 Year	$6.22	$0.59	$2.18	$4.67
2 Years	$6.53	$0.62	$2.29	$4.91
3 Years	$6.85	$0.65	$2.41	$5.15
4 Years	$7.20	$0.68	$2.53	$5.41
5 Years	$7.56	$0.71	$2.65	$5.68
6 Years	$7.93	$0.75	$2.79	$5.96
7 Years	$8.33	$0.79	$2.93	$6.26
8 Years	$8.75	$0.83	$3.07	$6.57
9 Years	$9.18	$0.87	$3.23	$6.90
10 Years	$9.64	$0.91	$3.39	$7.25

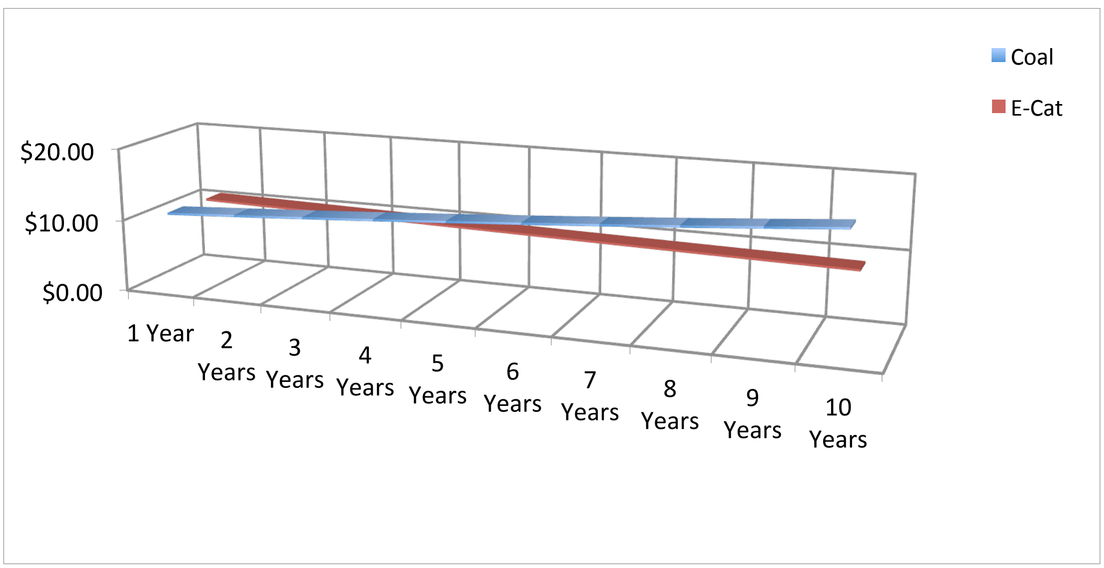


Chart above show coal as our strongest competitor

As E-Cat technology decreases over time and coal prices will increase, the projected cross-over point is 3-4 years. We did not calculate the carbon CO2 emission taxes and associated health costs and environmental impact of fossil non –renewable coal. Nor did we calculate the carbon foot print credits and government subsidies for the E-Cat green technology benefits for the customer (also if customer replaces coal, they get rebates / subsidies etc)

Bottom Line

What the above charts prove is that in the final analysis, over time the E-Cat gives a substantial cost savings over conventional fuels. In the analysis, a cost reduction of 2% per annum is assumed in the E-Cat, while at the same time, a 5% cost increase is occurring in the price of conventional fuels. Another important consideration is the price of nickel, which over the past five years has remained flat. This means that the cost of the fuel for the E-Cat does not substantially increase in cost, while at the same time, as the technology improves, the price of the E-Cat decreases.

Comparisons

In the beginning, we see that on the first line, the price per million BTUs after the first year's operation of the E-Cat is $10.44. This 2% reduction represents the improvement in the technology. Substantial savings are seen across the board at this time except for Chinese coal at $8.21, Dubai natural gas at $5.25, Ethanol subsidy at $6.22, Powder River Coal at $0.59, Northern Appalachia coal at $2.18, and Australian Coal at $4.67.

NOTE- in Australia and many other countries you cannot use coal for boiler hot water production

When one runs this forward in time, at the end of 10 years the E-Cat is now down to $8.70 per million BTUs, and the only remaining competitors are Dubai natural gas at $8.14, Powder River coal at $0.91, Northern Appalachia coal at $3.39, and finally Australian coal at $7.25. Anticipated projections would show that these, except for Powder River coal, would be more expensive than the E-Cat for a 20-year period.

The further into the future you go, the cheaper the E-Cat becomes to operate compared to conventional fuels. At some point, the technology curve will flatten for the E-Cat, and the price will stabilize. However, the cost for the conventional fuels will not, and will continue on their upward curve.

The future is biased toward the E-Cat, as this technology is more cost effective when compared with conventional fuels. One important factor is the proposed carbon taxes, which are not taken into consideration in this table, and the possible rebates or subsidies for clean energy technologies, which is even more in favor of the E-Cat. As with interest rates, the savings with investment in clean, cost effective technologies are cumulative.

Right now coal is cheaper form a purely heating standpoint.

However let's go through the calculations:

Let's take Australian coal at $4.45 per million BTUs. It looks much cheaper than the E-Cat, which runs at $10.65 per million BTUs, **at least at first glance**. And it is much cheaper, **BUT ONLY AS A SOURCE OF HEAT**! OK, so let's start our conversions. First we convert heat to mechanical energy in a conventional turbine. That is 33% efficient, throwing more than 66% of the energy away. So now our net price is triple, or $13.35. But wait, we need to convert that into electricity, and generators at best get about 80% efficiency. Now we get $16.69 per million BTUs.

This shows us that the more efficient a conversion, the cheaper the process becomes.

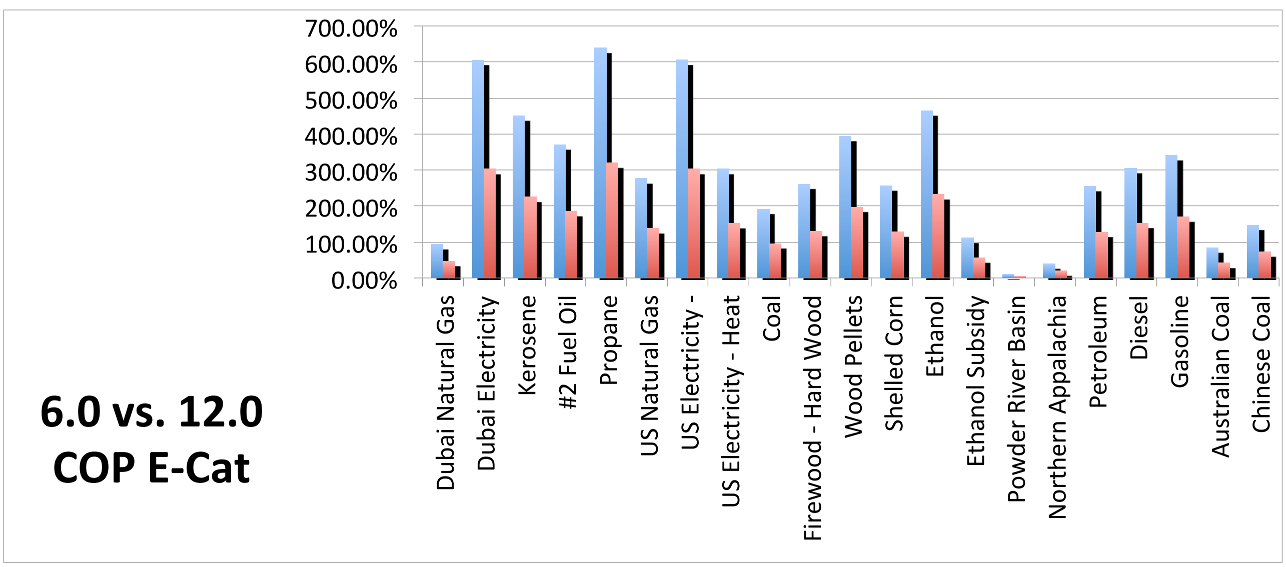
Now let's look at the E-Cat. With some technologies being developed, the conversion can be as high as 80%. That means the reciprocal gives us a multiplier of 1.25, and $10.65 times that is now $13.31 per million.

Now let's convert it using a highly efficient alternator, again at 80%. This is another 1.25 multiplier, so now it's $16.64 per million BTUs.

See how quickly the gap closes up?

Now we have a difference of $0.05 between Australian coal and the E-Cat. The "gap", unfortunately, would be the same with conventional turbines and generators. The only way we can beat it, is with either nonconventional mechanical or solid-state conversion regimes. Or, we can wait 4 years, and the gap closes up all by itself with the economics.

Enclosing the system in a pressure vessel is ultimately the way to go. High temp heat transfer fluids (oils) can get as high as 400 degrees C for input into heat exchangers. That has been used for years in conventional boiler technology. Once again, we need to think about working fluids. A low temp system has horrible thermodynamic efficiency with steam, so we need to look at a different liquid for a conventional Carnot or Rankine cycle system.



The Chart above describes the economics of the operation of the E-cat versus various fuels by percentage. For example, Chinese coal is 73.44 percent of the operating cost of the 6.0 COP E-Cat, and Petroleum is 254.69% of the operating cost of the 12.0 COP E-Cat.

Contact: info@E-catAustralia.com