

Energy Technology Comparison Report



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Introduction

This report is about two comparisons of energy technologies. We have calculated the expected rate of return on the invest opportunity based on the best information available in 07/08. The expected rate of return is like the interest rate you could expect on the money you put in. We will see that the older polluting technologies in Australia are a bad investment in the current market place as well as being a threat to the environment.

One comparison is of Azure Microgrid Solar Energy Technology in

- Australia
- Germany
- Italy
- USA (California) and
- Japan

The difference between these locations is the value of energy in each place and the sunlight available. For example Southern Germany has 2/3 of the sunlight of Sydney. All these things have been taken in to account in our evaluation

Also a comparison in Australia of

- Dirty Coal PowerStation's
- Clean Coal PowerStation's (if it can be done)
- Dirty Gas PowerStation's
- Clean Gas PowerStation's (if it can be done)
- Nuclear PowerStation's
- Azure Microgrid Solar Technology

These types of energy technology have been chosen for comparison because they can all supply energy on demand. Other renewable energy sources like wind and tidal are not currently used with storage systems so they will only provide an intermittent energy supply. Solar panels of the photovoltaic (PV) type are not used with storage system on a large scale either and PV is twice the cost of the Azure's system even with no energy storage, so was not considered in the comparison. There are sources of geothermal energy in Australia which could be cheap at the point of generation in Central Australia but we have no data on the infrastructure cost to get the energy to the cities so we will omit this for now.

Azure Microgrid Solar Technology

AZURE MICROGRID ASSETS PORTFOLIO	% INVESTED IN EACH COUNTRY	INTERNAL RATE OF RETURN
Germany, Azure MICROGRID	30.0%	11%
Italy, Azure MICROGRID	40.0%	12%
California, Azure MICROGRID	15.0%	10%
Japan, Azure MICROGRID	10.0%	10%
Australia, Azure MICROGRID	5.0%	7%
Combined International Portfolio of Azure MICROGRID assets		11%

The table above shows the return you can expect from the Azure Microgrid Solar Technology in each country. It assumes no inflation in the value of electricity. Inflation would make the system a better investment. It shows the proportion Azure Energy would put in each country to make a diverse portfolio.

You will notice in the detailed source data that we have calculated a high low and average scenario and then used the probability of each to arrive at one value of return. We have done this in all our examples

The average carbon credits included were at the European rates at the end of 2007. We have included no government subsidies other than the carbon trading system.

A capital raising cost or flotation cost of 10% was added to the cost of all the systems.

In Australia

The table below has all the data uses to estimate the return of the Microgrid in Australia. The electricity price is the retail rate. We are using the retail rate because the equipment will be installed on buildings as apposed to in the country where it will require the use of a distribution grid, Azure's technology needs no distribution grid. The average hydrogen value was based on a petrol price of \$1.40/L and we have just exceeded that price.

AZURE MICROGRID IN AUSTRALIA		COMMENTS / SOURCES	
Electricity price - low	\$0.1593	\$/kWh	Energy Australia standard rate in mid 2007 with three 8% price increase allowed by NSW government
Electricity energy price	\$0.2253	\$/kWh	Energy Australia green energy rate for old generation source in mid 2007 with three 8% price increases allowed by NSW government
Electricity price - high	\$0.2468	\$/kWh	Energy Australia green energy rate for new generation source in mid 2007 with three 8% price increases allowed by NSW government x 1 + rate of return
Non-electrical energy at home - low price	\$0.1593	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home	\$0.2253	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home - high price	\$0.2468	\$/kWh	Energy rate assume same as electricity
Excess hydrogen price - low	\$0.1500	\$/kWh	Based on petrol price of \$1.20/L
Excess hydrogen price	\$0.1725	\$/kWh	Based on petrol price of \$1.40/L
Excess hydrogen price - high	\$0.3450	\$/kWh	Based on petrol price of \$2.80 for fuel cell car which uses half the fuel
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	651,000	kWh/year	Based on calculations from microgrid model
Electricity percentage	48.1%		Based on calculations from microgrid model
Non-electrical percentage	11.5%		Based on calculations from microgrid model
Hydrogen percentage	40.4%		Based on calculations from microgrid model
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Labour	-\$4,000	/year	
Materials	-\$300	/year	
Flotation cost	10%		
Initial cost - worst	-\$1,400,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - average	-\$1,300,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - best	-\$1,200,000	/microgrid	Estimate from microgrid construction cost estimates

In Germany

German researchers reported the cost of petrol and electricity to us in late 2007. We use this data and allowed for the low sun level of Germany. Costs used are before VAT, their version of GST, which is much high then in Australia.

AZURE MICROGRID IN GERMANY			COMMENTS / SOURCES
Electricity price low	\$0.2839	\$/kWh	Report from http://www.manager-magazin.de/unternehmen/artikel/0,2828,465850,00.html before VAT
Electricity energy price	\$0.3279	\$/kWh	Report from http://www.manager-magazin.de/unternehmen/artikel/0,2828,465850,00.html + 4.4 for green rate before VAT
Electricity price high	\$0.3499	\$/kWh	Report from http://www.manager-magazin.de/unternehmen/artikel/0,2828,465850,00.html + 6.6 green rate before VAT
Non-electrical energy at home - low price	\$0.2839	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home	\$0.3279	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home - high price	\$0.3499	\$/kWh	Energy rate assume same as electricity
Excess hydrogen price - low	\$0.2130	\$/kWh	Commissioned report before VAT
Excess hydrogen price	\$0.3195	\$/kWh	Commissioned report average before VAT
Excess hydrogen price - high	\$0.4260	\$/kWh	Commissioned report X2 for efficient cars before VAT
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	651,000	kWh/year	Based on calculations from microgrid model
Electricity percentage	18.5%		Based on calculations from microgrid model
Non-electrical percentage	11.5%		Based on calculations from microgrid model
Hydrogen percentage	70.0%		Based on calculations from microgrid model
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Labour	-\$4,000	/year	
Materials	-\$300	/year	
Flotation cost	10%		
Initial cost - worst	-\$1,500,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - average	-\$1,400,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - best	-\$1,300,000	/microgrid	Estimate from microgrid construction cost estimates

In Italy

The energy price data is from a EUROSTAT report. Italy has had the highest electricity price in Europe. Costs used are before VAT, their version of GST, which is much high then in Australia.

AZURE MICROGRID IN ITALY		COMMENTS / SOURCES	
Electricity price - low	\$0.2579	\$/kWh	EUROSTAT 93/2006 - 14 July 20
Electricity energy price	\$0.3019	\$/kWh	EUROSTAT 93/2006 - 14 July 20 + 4.4c green rate
Electricity price - high	\$0.3239	\$/kWh	EUROSTAT 93/2006 - 14 July 20 +6.6c green rate
Non-electrical energy at home - low price	\$0.2579	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home	\$0.3019	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home - high price	\$0.3239	\$/kWh	Energy rate assume same as electricity
Excess hydrogen price - low	\$0.2516	\$/kWh	Eurostat
Excess hydrogen price	\$0.3775	\$/kWh	Eurostat average
Excess hydrogen price - high	\$0.5033	\$/kWh	Eurostat x 2 for high efficiency fuel cell car
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	651,000	kWh/year	Based on calculations from microgrid model
Electricity percentage	18.5%		Based on calculations from microgrid model
Non-electrical percentage	11.5%		Based on calculations from microgrid model
Hydrogen percentage	70.0%		Based on calculations from microgrid model
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Labour	-\$4,000	/year	
Materials	-\$300	/year	
Flotation cost	10%		
Initial cost - worst	-\$1,400,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - average	-\$1,300,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - best	-\$1,200,000	/microgrid	Estimate from microgrid construction cost estimates

In USA (California)

Out data for California is from Southern California Edison who is a Utility there. The Gasoline price is from October 2007 so may have increased since then.

AZURE MICROGRID IN CALIFORNIA			COMMENTS / SOURCES
Electricity price - low	\$0.2666	\$/kWh	Southern California Edison - 5%
Electricity energy price	\$0.2806	\$/kWh	Southern California Edison
Electricity price - high	\$0.3466	\$/kWh	Southern California Edison + \$0.66 for green rate
Non-electrical energy at home - low price	\$0.2666	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home	\$0.2806	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home - high price	\$0.3466	\$/kWh	Energy rate assume same as electricity
Excess hydrogen price - low	\$0.0920	\$/kWh	Regular Gasoline in California on 14-10-07
Excess hydrogen price	\$0.0996	\$/kWh	Premium Gasoline in California on 14-10-07
Excess hydrogen price - high	\$0.1046	\$/kWh	Premium Gasoline in California on 14-10-07 + 5%
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	651,000	kWh/year	Based on calculations from microgrid model
Electricity percentage	88.5%		Based on calculations from microgrid model
Non-electrical percentage	11.5%		Based on calculations from microgrid model
Hydrogen percentage	0.0%		Based on calculations from microgrid model
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Labour	-\$4,000	/year	
Materials	-\$300	/year	
Flotation cost	10%		
Initial cost - worst	-\$1,400,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - average	-\$1,300,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - best	-\$1,200,000	/microgrid	Estimate from microgrid construction cost estimates

In Japan

The electricity price data for Japan is old so the prices may have increased since 2000 when the report used was prepared for government. Their petrol prices seem similar to Australia.

AZURE MICROGRID IN JAPAN			COMMENTS / SOURCES
Electricity price - low	\$0.3016	\$/kWh	Data Source: Ministerial Inquiry Issues Paper, February 2000
Electricity energy price	\$0.3456	\$/kWh	Data Source: Ministerial Inquiry Issues Paper, February 2000 +4.4c green rate
Electricity price - high	\$0.3676	\$/kWh	Data Source: Ministerial Inquiry Issues Paper, February 2000 +6.6c green rate
Non-electrical energy at home - low price	\$0.3016	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home	\$0.3456	\$/kWh	Energy rate assume same as electricity
Non-electrical energy at home - high price	\$0.3676	\$/kWh	Energy rate assume same as electricity
Excess hydrogen price - low	\$0.0156	\$/kWh	Based on petrol price of \$1.36 for fuel cell car which uses half the fuel
Excess hydrogen price	\$0.0234	\$/kWh	Average
Excess hydrogen price - high	\$0.0313	\$/kWh	Based on petrol price of \$1.36 for fuel cell car which uses half the fuel
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	651,000	kWh/year	Based on calculations from microgrid model
Electricity percentage	70.0%		Based on calculations from microgrid model
Non-electrical percentage	12%		Based on calculations from microgrid model
Hydrogen percentage	18%		Based on calculations from microgrid model
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Labour	-\$4,000	/year	
Materials	-\$300	/year	
Flotation cost	10%		
Initial cost - worst	-\$1,400,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - average	-\$1,300,000	/microgrid	Estimate from microgrid construction cost estimates
Initial cost - best	-\$1,200,000	/microgrid	Estimate from microgrid construction cost estimates

Other energy sources in Australia

The electricity price used on the nuclear and coal power stations are the same assuming the produce base load power. The value used is the highest we could find on the market at the time of calculation. One utility reported an average price of 3.6cents/kWh and we have assumed an increase to an average of 5.3cents/kWh to account for some expected price rises.

Comparison of Energy Technologies	Internal rate of return
Combined International portfolio of Azure MICROGRID assets	11%
Nuclear Power	4%
Dirty Coal (no carbon trading)	6%
Geosequestered Coal	5%
Dirty Gas (no carbon trading)	8%
Geosequestered Gas	6%

Nuclear Power

The cost of a Nuclear power station comes from some historical prices and from an Australian Government report obtained from the Australian Nuclear Science and Technology Organization (ANSTO). The report compared the estimates of the cost of a Nuclear Power Stations from many other similar reports and those values were used here. The projected cost of a new reactor appears to be very similar all over the world.

NUCLEAR POWER			COMMENTS / SOURCES
Electricity price - low	\$0.0490	\$/kWh	Energy Australia standard rate in mid 2007 with three 8% price increase allowed by NSW government
Electricity energy price	\$0.0530	\$/kWh	Energy Australia green energy rate for old generation source in mid 2007 with three 8% price increases allowed by NSW government
Electricity price - high	\$0.0570	\$/kWh	Energy Australia green energy rate for new generation source in mid 2007 with three 8% price increases allowed by NSW government x 1 + rate of return
Non-electrical energy at home - low price	\$0.0000	\$/kWh	
Non-electrical energy at home	\$0.0000	\$/kWh	
Non-electrical energy at home - high price	\$0.0000	\$/kWh	
Excess hydrogen price - low	\$0.0000	\$/kWh	
Excess hydrogen price	\$0.0000	\$/kWh	
Excess hydrogen price - high	\$0.0000	\$/kWh	
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Stern report of the cost of pollution divided by 2
Total energy sold per year by microgrid	na	kWh/year	A nuclear power station only produces electricity
Electricity percentage	100.0%		
Non-electrical percentage	0.0%		
Hydrogen percentage	0.0%		
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Operating and Maintenance cost	-\$6,843	/year	Operating and maintenance cost from (Gittus) 1.5% of investment
Variable operating cost	-\$0.01	/kWh	Variable operation and maintenance cost 5.55/MWh (Gittus)
Plant cost - worst	\$5,244	/kW	Clinton http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/clinton.html
Plant cost	\$4,045	/kW	Average cost of Clinton and Gittus
Plant cost - best	\$2,846	/kW	Gittus report from ANSTO Capital cost JHG 2006 2843 table 1 p53
Power equal to microgrid	87	kW	
Flotation cost	10%		
Initial cost - worst	-\$1,400,000	/microgrid	
Initial cost - average	-\$1,300,000	/microgrid	
Initial cost - best	-\$1,200,000	/microgrid	

Dirty Coal

The power station cost was from a new plant being proposed in Victoria and is similar to one being built in Western Australia. We have assumed no carbon credit costs.

DIRTY COAL		COMMENTS / SOURCES	
Electricity price - low	\$0.0490	\$/kWh	September average price in 2007
Electricity energy price	\$0.0530	\$/kWh	Average of September peak average price and average price in 2007
Electricity price - high	\$0.0570	\$/kWh	September average peak price in 2007
Non-electrical energy at home - low price	\$0.0000	\$/kWh	
Non-electrical energy at home	\$0.0000	\$/kWh	
Non-electrical energy at home - high price	\$0.0000	\$/kWh	
Excess hydrogen price - low	\$0.0000	\$/kWh	
Excess hydrogen price	\$0.0000	\$/kWh	
Excess hydrogen price - high	\$0.0000	\$/kWh	
Value of carbon credit	\$0.00	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$0.00	tonne	Chicago exchange in 2007
Value of carbon credit	\$0.00	tonne	
Total energy sold per year by microgrid	na	kWh/year	
Electricity percentage	100.0%	\$/kWh	A coal power station only produces electricity
Non-electrical percentage	0.0%		
Hydrogen percentage	0.0%		
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Operating and Maintenance cost	-\$3,426	/year	Assumed the same as Nuclear Power - http://www.theaustralian.news.com.au/story/0,20867,21349233-643,00.html
Coal price	-\$70.00	/tonne	Coal price
Geosequestration cost - worst	\$0.00	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Geosequestration cost	\$0.00	/tonne	Average
Geosequestration cost - best	\$0.00	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Enthalpy of combustion of coal	33,500	kJ/kg	
Energy conversion efficiency	38%	tonne	
Energy price	-\$0.0198	/kWh	
Cost per kilowatt - worst	\$2,625	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/ x 1.4
Cost per kilowatt	\$2,250	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/ x 1.2
Cost per kilowatt - best	\$1,875	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/
Power equal to microgrid	87	kW	
Flotation cost	10%		
Initial cost - worst	-\$228,375		
Initial cost - average	-\$195,750		
Initial cost - best	-\$163,125		

Clean Coal

Everything is the same here as in the Dirty Coal with the inclusion of a cost for carbon storage underground (geosequestration). Note the carbon storage technology is just a theory not a real thing. The cost of the carbon storage was from a federal government report late in 2007 and ranged from \$17 to \$88 tonne, which is very broad range.

GEOSEQUENCED COAL		COMMENTS / SOURCES	
Electricity price - low	\$0.0490	\$/kWh	September average price in 2007
Electricity energy price	\$0.0530	\$/kWh	Average of September peak average price and average price in 2007
Electricity price - high	\$0.0570	\$/kWh	September average peak price in 2007
Non-electrical energy at home - low price	\$0.0000	\$/kWh	
Non-electrical energy at home	\$0.0000	\$/kWh	
Non-electrical energy at home - high price	\$0.0000	\$/kWh	
Excess hydrogen price - low	\$0.0000	\$/kWh	
Excess hydrogen price	\$0.0000	\$/kWh	
Excess hydrogen price - high	\$0.0000	\$/kWh	
Value of carbon credit	\$8.50	tonne	Chicago exchange in 2007
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Half Stern report of the cost of pollution
Total energy sold per year by microgrid	na	kWh/year	
Electricity percentage	100.0%	\$/kWh	A coal power station only produces electricity
Non-electrical percentage	0.0%		
Hydrogen percentage	0.0%		
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Operating and Maintenance cost	-\$3,426	/year	Assumed the same as Nuclear Power - http://www.theaustralian.news.com.au/story/0,20867,21349233-643,00.html
Coal price	-\$70.00	/tonne	Coal price
Geosequestration cost - worst	-\$88.75	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Geosequestration cost	-\$53.13	/tonne	Average
Geosequestration cost - best	-\$17.50	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Enthalpy of combustion of coal	33,500	kJ/kg	
Energy conversion efficiency	38%	tonne	
Energy price	-\$0.0198	/kWh	
Cost per kilowatt - worst	\$2,625	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/ x 1.4
Cost per kilowatt	\$2,250	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/ x 1.2
Cost per kilowatt - best	\$1,875	/kW	http://larvatusprodeo.net/2007/03/13/sort-of-clean-coal-in-victoria/
Power equal to microgrid	87	kW	
Flotation cost	10%		
Initial cost - worst	-\$228,375		
Initial cost - average	-\$195,750		
Initial cost - best	-\$163,125		

Dirty Gas

Our gas power station price was based on an Origin Energy gas power station and gas field combined. Gas power stations provide energy at times of peak demand when the electricity price is highest and can easily shut down when the energy price is low, along with demand. For this reason they can get an higher average price.

DIRTY GAS		COMMENTS / SOURCES	
Electricity price - low	\$0.0490	\$/kWh	September average price in 2007
Electricity energy price	\$0.0530	\$/kWh	Average of September peak average price and average price in 2007
Electricity price - high	\$0.0000	\$/kWh	September average peak price in 2007
Non-electrical energy at home - low price	\$0.0000	\$/kWh	
Non-electrical energy at home	\$0.0000	\$/kWh	
Non-electrical energy at home - high price	\$0.0000	\$/kWh	
Excess hydrogen price - low	\$0.0000	\$/kWh	
Excess hydrogen price	\$0.0000	\$/kWh	
Excess hydrogen price - high	\$0.0000	\$/kWh	
Value of carbon credit	\$0.00	tonne	Half Stern report of the cost of pollution
Value of carbon credit	\$0.00	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$0.00	tonne	Chicago exchange in 2007
Total energy sold per year by microgrid	na	kWh/year	
Electricity percentage	100.0%	\$/kWh	A coal power station only produces electricity
Non-electrical percentage	0.0%		
Hydrogen percentage	0.0%		
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Operating and Maintenance cost	-\$7,428	/year	Assumed the same as Nuclear Power - http://www.theaustralian.news.com.au/story/0,20867,21349233-643,00.html
Gas price	na	/tonne	Coal price
Geosequestration cost - worst	\$0.00	/tonne	Australian Federal government report US\$14 to US\$71 / tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Geosequestration cost	\$0.00	/tonne	Average
Geosequestration cost - best	\$0.00	/tonne	Australian Federal government report US\$14 to US\$71 / tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Enthalpy of combustion of coal	33,500	kJ/kg	
Energy conversion efficiency	38%	tonne	
Energy price	na	/kWh	
Cost of plant with gas field - worst	\$2,843	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas x 1.4
Cost of plant with gas field	\$2,437	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas x 1.2
Cost of plant with gas field - best	\$2,031	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas
Power equal to microgrid	87	kW	
Flotation cost	10%		
Initial cost - worst	-\$247,376		
Initial cost - average	-\$212,036		
Initial cost - best	-\$176,697		

Clean Gas

Here we have added the same carbon storage cost to the dirty gas power station as to the clean coal power station on a per tonne bases.

GEOSEQUESTED GAS			COMMENTS / SOURCES
Electricity price - low	\$0.0490	\$/kWh	September average price in 2007
Electricity energy price	\$0.0530	\$/kWh	Average of September peak average price and average price in 2007
Electricity price - high	\$0.0570	\$/kWh	September average peak price in 2007
Non-electrical energy at home - low price	\$0.0000	\$/kWh	
Non-electrical energy at home	\$0.0000	\$/kWh	
Non-electrical energy at home - high price	\$0.0000	\$/kWh	
Excess hydrogen price - low	\$0.0000	\$/kWh	
Excess hydrogen price	\$0.0000	\$/kWh	
Excess hydrogen price - high	\$0.0000	\$/kWh	
Value of carbon credit	\$8.50	tonne	Half Stern report of the cost of pollution
Value of carbon credit	\$36.67	tonne	European/Kyoto rate in 2007
Value of carbon credit	\$39.00	tonne	Chicago exchange in 2007
Total energy sold per year by microgrid	na	kWh/year	
Electricity percentage	100.0%	\$/kWh	A coal power station only produces electricity
Non-electrical percentage	0.0%		
Hydrogen percentage	0.0%		
Tonnes of carbon avoided	215	t/year	Based on calculations from microgrid model
Operating and Maintenance cost	-\$7,428	/year	Assumed the same as Nuclear Power x2 to run gas field - http://www.theaustralian.news.com.au/story/0,20867,21349233-643,00.html
Gas price	na	/tonne	Coal price
Geosequestration cost - worst	-\$88.75	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Geosequestration cost	-\$53.13	/tonne	Average
Geosequestration cost - best	-\$17.50	/tonne	Australian Federal government report US\$14 to US\$71 /tonne http://www.aph.gov.au/house/committee/scin/geosequestration/report/chapter6.pdf
Enthalpy of combustion of coal	33,500	kJ/kg	
Energy conversion efficiency	38%	tonne	
Energy price	na	/kWh	
Cost of plant with gas field - worst	\$2,843	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas x 1.4
Cost of plant with gas field	\$2,437	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas x 1.2
Cost of plant with gas field - best	\$2,031	/kW	SMH.com.au 12-6-07 Origin Energy opts for coal seam gas
Power equal to microgrid	87	kW	
Flotation cost	10%		
Initial cost - worst	-\$247,376		
Initial cost - average	-\$212,036		
Initial cost - best	-\$176,697		

Conclusion

The rate of return that is expected by investors is related to the risk of the venture. The lowest return of you can get in Australia is ~6% and is for a government bond which is considered in the finance industry as zero risk. The rate of return expected for non-zero risk ventures was 7% above the zero risk rate, before the credit crunch of 07/08. That would make the expected return 13% for non zero risk. The power systems discussed in this paper should be expect to return over 6% plus 2.5% to pay back the principle to be viable. Therefore 8.5% in the minimum return and more may be required.

Nuclear should not be able to obtain any debt and neither would clean coal. Dirty coal and clean gas could cover the interest on a zero risk loan but they are not zero risk and they would not be able to pay back the principle of the loan. Dirty gas is just viable but only with no carbon trading scheme and with a 40year contract to a purchaser of power.

The Azure Microgrid Solar Technology returned 11% as an international portfolio. The small module nature means small investments can be put in different markets around the world spreading the market risks. The other technologies are massive projects that can require \$billion's for the smallest unit which is stuck in one marketplace.

We believe Azure's solar technology is the best investment in the energy market in Australia today. We have proven here it is superior to coal, gas and nuclear energy financially. The environmental benefits of the solar energy system are now widely accepted also