Origin Energy

Time to leave its origins behind.

Prepared for Lock the Gate by
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ORG will never be, and can never be, a preferred hydrocarbon company - so, shareholders would be better served if it sold its gas interests.

Rejecting the 2008 takeover bid from BG was a brave step and one that has ultimately cost investors dearly. Still, that is history and markets live in the future. What investing in APLNG did do, by virtue of the various equity issues that have followed, is to make ORG a largish company with a market capitalization of $8 bn. That market cap provides it with some optionality for the future.

ORG's simple problem is that hydrocarbon investors will always see it as a second best. They always have and they always will. ORG is to oil and gas investors as Malcolm Turnbull is to right wing coalition members.

Equally, utility investors - particularly the increasing majority focused on clean and green - will always be put off by the gas business and ORG's apparent willingness to keep on touting its gas credentials.

Even ignoring the carbon argument, the simple financial problem is that two of ORG's main assets, APLNG and Eraring power station, both suppliers of thermal energy, have finite lives of 17 and 10 years respectively. ORG needs investments to replace the operating profits those assets supply.

There has only ever been one way out of this. Despite the relative success of APLNG the ever-increasing carbon pressure means that ORG's fence-sitting is becoming more of an issue.

In this note we argue that the window for ORG to get set for a decent medium-term future is relatively narrow. It means selling cash-generative APLNG and the prospects such as they may be in the Beetaloo, and committing to a future that a majority of investors will reward more highly than oil and gas. What is clear is that what ORG is doing isn't working for investors. It may be a slower death than that of AGL, but it just isn't good enough. The strategy has been wrong for many years and the share price tells you it's still a dud. There is a window in Australia where the Federal Government's enthusiasm for gas carries part of corporate Australia with it. Equally, Asian interest in gas remains high. That is the selling opportunity.

ORG's share of APLNG may be worth around A$8 bn to ORG and that's enough to make a major impact in the "green fuel market". For instance, ORG could commit to a large program of wind and solar around its proposed Gladstone hydrogen hub. The wind and solar would be intended for a large 1 mtpa hydrogen electrolyser for export sales to Japan and South Korea. However, the hydrogen risk is abated because markets exist in Australia for the wind and solar.

On top of that, we argue ORG investors would be well served by the company selling its relatively-well-performed gas retailing assets, taking advantage of the current Government's favourable attitude to gas and the fact that there are still buyers, and reinvesting in green electricity. The opportunity exists for ORG to invest in a brand that actually means something to consumers and to become the first large scale gentailer to offer a genuinely differentiated product.

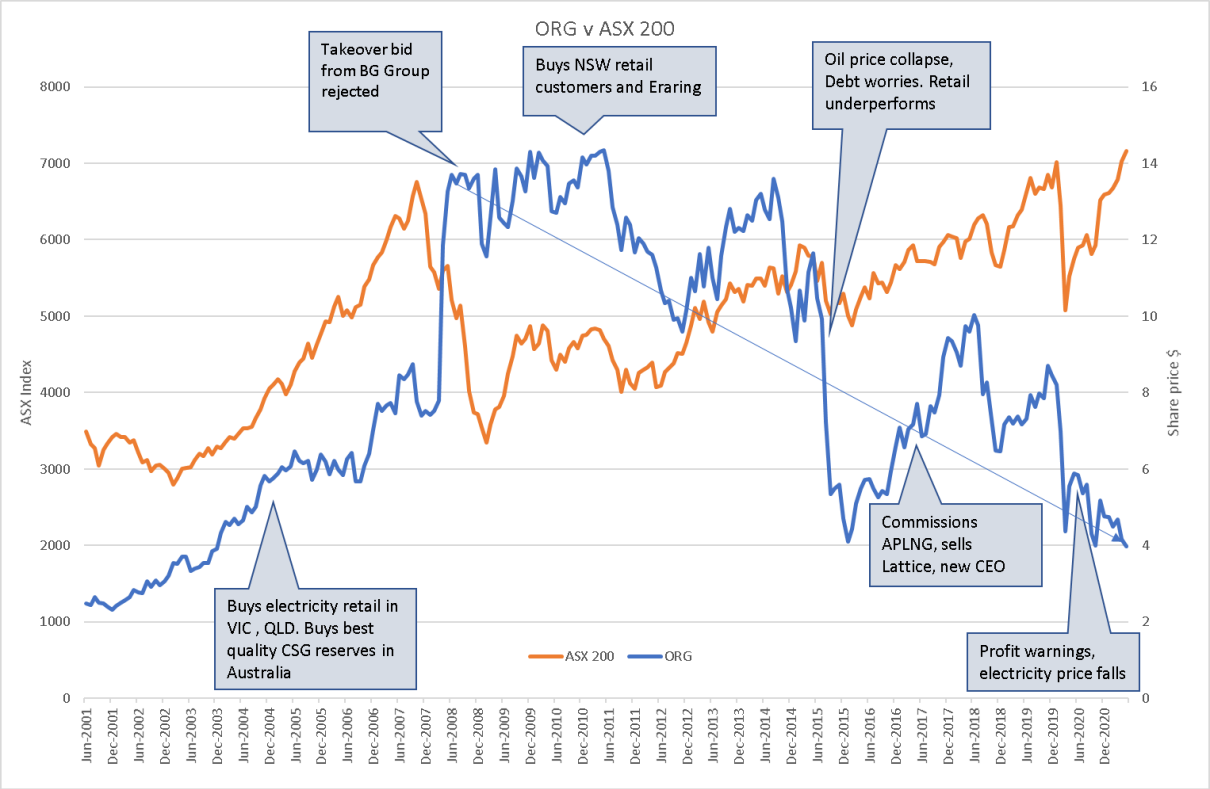

Figure 1. ORG share price. Source: Factset

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Summary

- Origin can never claim to be decarbonizing so long as gas and oil exploration is part of the strategy. Gas alone contributed 44% of the growth in annual global carbon emissions ex land clearing between 2010 and 2019. Oil was the largest part of the other 56%. Gas is around 21% of annual global emissions and oil around 1/3. Advanced nations, other than Australia, are moving hard to get rid of oil, even as Origin is busy exploring for it. Gas is being banned in various "green" districts such as some towns in California. That's the extreme today but will be mainstream in an easily foreseeable future. To that extent any claim the company about decarbonsiation shows they don't really take climate change seriously. It is classic green washing. No one that takes climate change seriously thinks gas is a transition pathway. Companies investing in oil and gas are simply betting they can cash in before the window closes. That may make sense from a purely financial viewpoint, even if it's risky (see AGL), but it makes a nonsense of demonstrating a sustainable corporate culture to stakeholders, including employees.

- Alas, ORG is largely a gas company. Its antecedents are in gas, gas provides most of the cashflow. The current CEO based the energy markets strategy around domination of the corporate gas market, essentially buying the share away from AGL via paying up for wholesale contracts. The Federal Government is shouting its new-found love for gas from the soap box, and it's joined there by the Opposition. We argue that the friendly Federal environment provides a window for ORG to exit its increasingly mature, but cash flow generative gas assets and redeploy the funds into the seemingly cutthroat, profitless electricity market.

- APLNG, is the largest asset and easily largest source of cash flow in the ORG portfolio. ORG owns 37.5% of APLNG, the largest producer of LNG by nameplate capacity on the East Coast of Australia and with arguably the highest quality of reserves. APLNG now is essentially a mature asset where most of the cost out has already been achieved. ORG has done really well managing the upstream gas extraction for APLNG. The operation is managed in an efficient, environmentally conscious fashion and management have achieved great results at operating cost out and reducing drilling capex. But only about 35% of cost is controllable and the

work has been done. As far as reserves go, they have been held at reasonable levels. It may be that if oil prices are high enough, or technology improves, some contingent resource can be converted to reserves. Just as likely that some issue emerges with the reserve base towards the end of field life. Based on current 3P reserves the project has about 16 years of life left and once life gets below say 10 years, the focus will strongly shift to the clean-up liability and other end of life issues. For this reason, we think sale of the asset, arguably at an unknown pre-emptive discount to partners ConocoPhillips and Sinopec, is likely to be evaluated regularly. That said it's not clear that a sale to Sinopec would even be allowed in the current political climate.

- ORG is also the largest gas wholesaler and retailer in Australia, a position built up when AGL effectively decided to exit the business. Profits for this business are not that strong and we don't see a great long-term future unless there is a big payoff at say Beetaloo in the Northern Territory. But it's easy to be skeptical that fracked Northern Territory gas, even as an oil by-product, can ever be even the medium-term future for Southeastern Australia. Maybe it will be viable, but at a minimum there will be zero-to-negative demand growth as a result of the high cost.

- In our eyes, ORG faces a choice:

    - Firstly, continue down the gas and oil path and hope shareholders eventually warm up to ORG as a gas player. This seems unlikely to us. Every investor we know is going to buy a gas company if they want gas. They will buy Santos rather than ORG. It comes down to corporate culture and commitment. ORG is always half pregnant.

    - The second option is to decide it wants to be a clean, green utility. This route will undoubtedly be long and hard, and ORG's efforts to date have not inspired confidence. APLNG and the Beetaloo assets would be sold. The proceeds reinvested, perhaps partly into hydrogen, partly into VRE (wind and solar) and partly into products that address the behind-the-meter market. Over time ORG would exit its gas wholesaling and retailing role. The gas generation fleet would be converted to hydrogen which at a minimum would be expensive. Installed gas turbines can likely handle at most 40% by

volume of hydrogen which results in emissions reduction of say 20%. Quite possibly even that would be optimistic considering embrittlement - see GE white paper on using hydrogen in gas turbines.

- In this scenario, ORG would reengage in the VRE (wind and solar) market, something it's done its best to avoid for years. Nor has it done anything to provide fully decarbonized firming power. Even while down in the retail business, it's a big player in distributed solar installations and has various sideline businesses. In doing this, it has along with AGL and EnergyAustralia, opened the door to disrupters such as Neoen, Iberadola and PowAR which between them have captured significant market share and an increasing share of industry cash flow. This process is bound to continue. From ORG's perspective it's going to lose all the Eraring cash flows in NSW (but still have the clean-up costs) unless it takes some action to get a share of the NSW wind and solar market. This is hardly news, so we expect management has a plan.

- Retailing: ITK believes there likely is a large market for a pure green electricity retailer. There is lots of evidence for this, some of which is right in front of ORG's eyes and yet it ignores it. The evidence is for instance Octopus energy. Ironically ORG owns 20% of Octopus. ORG appears to believe that Octopus is a success because of its technology. In ITK's view that is only half the story. The other half is Octopus pushing its green credential to a younger, "switched on" audience. That younger audience will likely have a high degree of loyalty. Like a bank.

- Another advantage is that in Australia ORG would for the first time offer a clearly differentiated choice to the average consumer. At the moment the big three gentailers, AGL, ORG and EnergyAustralia really offer very limited product choice. It's left to the small retailers to chase something different. Of course, it would mean ORG burning its bridges, no retreat and therefore make the so far only modestly successful electricity retail business into a real winner. ORG could do that. It has the customer base and IT systems.

- Green hydrogen and/or ammonia offers a path to the future. ORG would transform its interest in APLNG into an export-focused business that ships hydrogen and or ammonia to Japan and South Korea. Imbalances between the VRE power source

and the electrolyser capacity could be fed into or drawn from the existing grid (subject to green certification). ORG is pursuing two such projects. There is a high level of risk. Hydrogen has numerous issues from the technical to the economic, but also plentiful Government support and a sense of urgency in that large scale green hydrogen plans are being pursued all over the world. Australia has natural advantages, specifically low cost VRE and existing strong energy export arrangements with both Japan and South Korea. ORG cannot fund large scale investment in hydrogen and pursue its gas business.

- The hydrogen market is current 70 mt globally, various estimates, including one from BNEF suggest that a market 10X that size (about 700 mt) is a reasonable prospect. In such a market projects of say 1 mtpa are likely to be of the appropriate scale. That's particularly because there is clear theory path to suggest that large scale projects will have significantly lower unit costs. But this requires electrolyser orders of magnitude larger than those of today. For instance, a 500 kt per year output is 57 tonnes per hour and at 50 KWh/kg that works to an electrolyser capacity of 2,800 MW and about 7 GW of VRE capacity. And even that assumes 100% capacity utilization. Working the numbers, that's maybe about a A$10 bn project. And you just can't buy electrolysers at that scale today.

- In our view good strategy would look like:
    - Disengagement from oil and gas over time
    - Reasserting a strong market share in generation by investing in or acquiring VRE and renewable firming
    - Continuing to pursue hydrogen/ammonia export to Asia

Some markers on that track would include selling the interest in APLNG, selling the interests in Beetaloo and investment in NSW and QLD VRE generation. As ORG owns lots of gas-fired power, it's going to be hard for it to follow the battery growth, but if it doesn't it will get squeezed in the VRE firming market as well as in the energy space.

At the global level, gas contributed 44% of growth in CO_2 fossil fuel emissions 2010-2019.

Although coal remains the largest single contributor to global warming and gas is "only" in third place, the fact is that gas has been the largest source of growth in global CO_2 emissions over the past 9 years. Furthermore, even over 50 years of both gas and cement have increased emissions at a greater rate that of either coal or oil.

Gas emissions have increased a cumulative 26% since 2010 and are 21% of total emissions. It's likely that when we eventually see the 2021 numbers, probably in about 14 months' time, coal will have enjoyed a resurgence.

We don't think it's any secret that when we look at coal and cement in the past 10-20 years, what you are really looking at is the growth of China and to a far lesser extent India and other countries in South East Asia. Global warming is a global problem.

Gas contributes 44% of global CO2 emissions growth since 2010

50-year view						
CO2 bn/t	**Coal**	**Oil**	**Gas**	**Cement**	**Total**	**Gas share**
1969	5.5	6.0	1.7	0.3	13.4	13%
2019	14.4	12.4	7.6	1.6	35.9	21%
Change	161%	107%	345%	483%	167%	
Change	8.9	6.4	5.9	1.3	22.4	26%
Most recent 9 years						
CO2 bn/t	**Coal**	**Oil**	**Gas**	**Cement**	**Total**	**Gas share**
2010	13.9	11.3	6.2	1.2	32.7	19%
2019	14.4	12.4	7.6	1.6	35.9	21%
Change	3%	9%	23%	26%	10%	
Change	0.4	1.1	1.4	0.3	3.2	44%

Figure 2. Fossil fuel carbon emissions globally. Source: Global Carbon Project

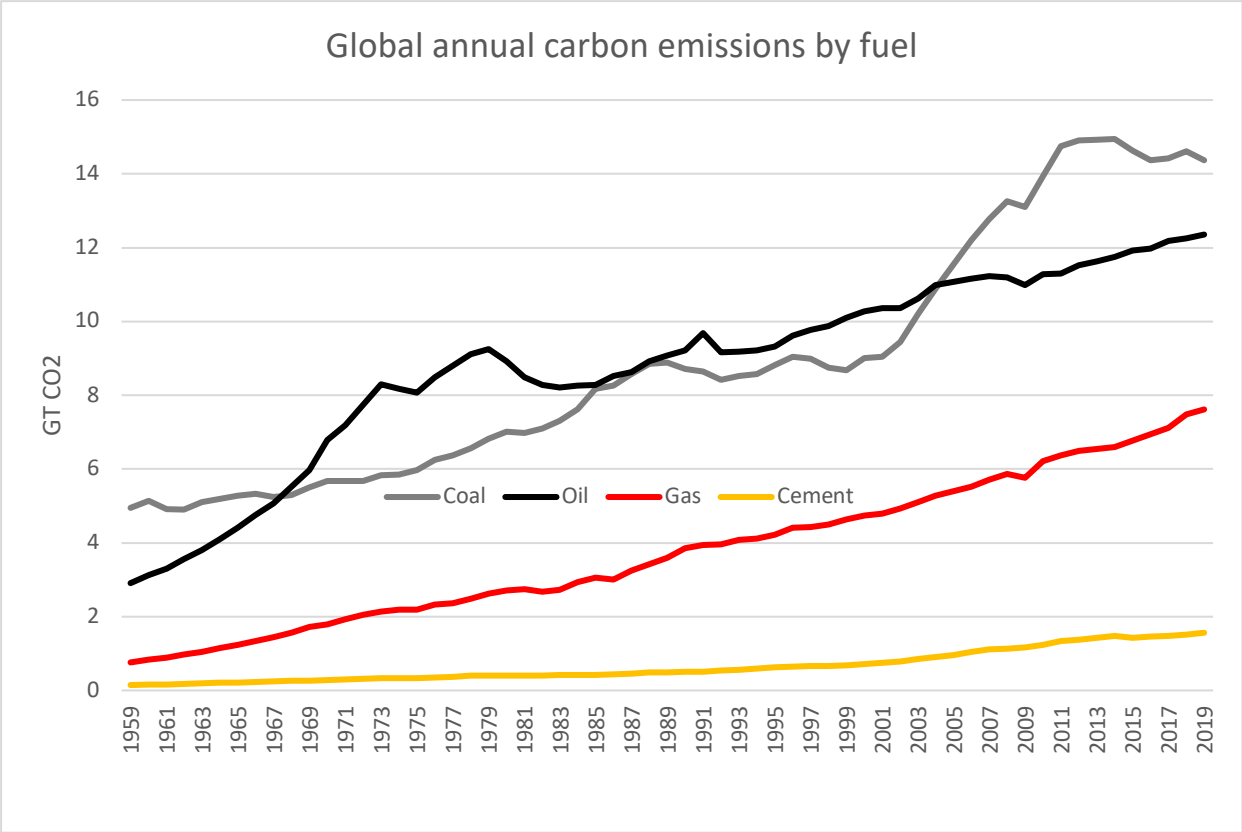


Figure 3. Global carbon emissions by fuel. Source: Global carbon project

Fight or flee? Management response to climate change threat.

Climate change is perhaps the most pressing area of ESG. Senior management all round the world, and superannuation funds alike, are conscious of the much greater weight given to ESG issues particularly as they concern large public companies. Not just climate change, but also discrimination, other environmental issues, wage performance ratios and so on. In general, large public companies occupy an important role in democratic, capitalist society and management are expected to discharge their responsibilities with that knowledge. Stakeholders also demand performance, appropriate cash flows, profitable investments and timely changes of direction as industries rise and fall.

One of the strongest groups pushing for climate change activity are large institutional investors. They are being pushed in that direction by their members and by their own inclinations.

For Origin management, a 20-year-old public company, with prior antecedents in the "SA Gas Co" but now a mixed energy retailer and minority investor in the largest LNG plant in Queensland, these pressures are felt already and are growing.

So, for us the issue is not whether ORG has a long-term future in gas (because no one does) the question is when ORG should exit its gas investments and fully commit to electricity and perhaps hydrogen/ammonia. In truth the main reason why anyone would be hesitant about this is that on the face of it, ORG's just done such a terrible job with electricity.

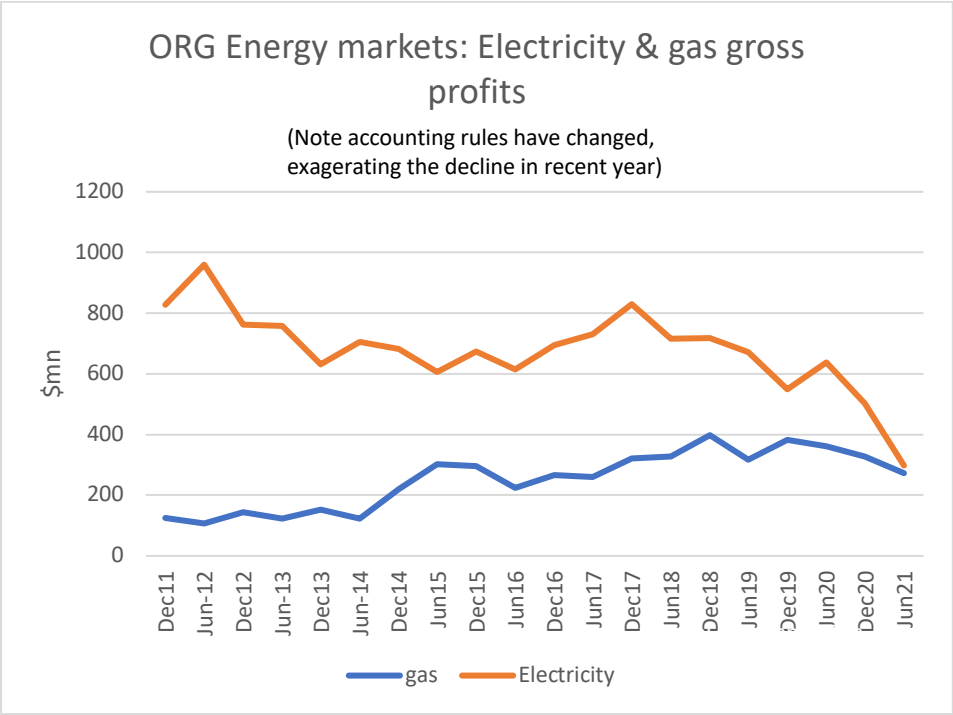


Figure 4. ORG gross profits, gas and electricity, Source: Company

The simplest view of the number is probably whole of company EBITDA. Even this requires allocating some energy markets overhead to gas.

Gas is 75% or more of EBITDA				
	FY19	FY20	FY21	FY22
Gas retail EBITDA	515	535	392	346
Integrated gas	1892	1741	1200	1740
Gas total	2407	2276	1592	2086
Consolidated EBITDA	3232	3141	2085	2300
Gas share total	74%	72%	76%	91%

Figure 5. Gas share of ORG EBITDA, Source: Company

Equally APLNG provides the vast majority of the free cash flow. That is the cash flow for reinvestment and dividends. We include Octopus funding within the capex deducted in calculating FCF.

Free cash flow $m	FY19	FY20
Ebitda	3232	3141
Less APLNG	-2123	-1915
Other non cash	-60	-430
Operating cash	1049	796
Interest paid	-373	-292
Capex	-341	-641
Disposals (Acquisitions)	-46	69
Free cash flow pre APLNG	289	-68
APLNG distributions	974	1275
Free cash flow	1263	1207
Dividends	165	443

Figure 6. ORG FCF, Source: Company

Investors questioned the APLNG concept from the beginning.

ORG's investment in APLNG has been questioned many times and on several grounds. Despite cost over runs, the project has been technically successful and has progressed to a mature cash-generative business, albeit one that is yet to pay any income tax.

As a reminder, the first question was about whether you could profitably turn CSG into LNG at all. The issue investors raised was that dry gas would not provide enough liquids by product revenue to juice the returns.

The second issue was around WACC. It remains true that oil and gas exploration is supposed to be a high risk-high return business. Utilities are supposed to be a low risk, low return business.

The third issue was LNG competition. APLNG was almost the last project to be financed before US shale gas to LNG became a thing. And the US shale gas to LNG process was priced on the basis of gas prices in the USA + a margin rather than a percentage of the oil price (13%-16%) that mostly formed the basis of historic LNG contracts. So, there was a wall of worry that cheap US LNG would be sold on a spot market. ORG in 2013 responded

to that by concluding a 20-year contract, starting in 2020, to buy 0.25 mt of LNG at the Henry Hub price + margin taking spot risk for sales into Asia. In FY20 that led to a write down in ORG's books as an onerous contract.

The fourth issue was just the cost of constructing LNG plants in Australia.

The fifth issue was around the strength of the CSG reserves. Unlike conventional traps CSG reserves were often valued on a "3p" and "2p" basis rather than the fully proved 1p basis of conventional plays.

The sixth issue and the one that is the starting point of this note: where does a 37.5% interest in one global scale LNG plant get you? Does it make you the new Conoco Philips? What happens as the field matures and investors start to focus more on the cleanup liability? What does ORG do with the cash flows from the project to build its future?

Giving investors a reason to own ORG.

The most common split in investor style is between growth and value investors although there are many variations. What is clear though is that oil and gas investors tend to focus on exploration achievement, that tends to be where the upside is. An oil or gas field is a finite life asset. Increasingly, for most modern forms of oil and gas extraction it's a relatively short-lived life. There is only so much gas contained in the coal seams that APLNG has access to.

Based on FY20 reported reserves and annual production of around 700 PJ, APLNG has about 16 years of life left. Reserve estimates change frequently, typically at least in the early years; reductions in costs and/or changes in commodity prices can lead to increases in reserves. Perhaps though towards the end of a project it may turn out to be less economic to produce the reserve tail. By that time well flow rates have dropped away, capital expenditure is low, but the cleanup expense becomes the focus.

We start with a view that once a ten-year remaining field life is reached the market will focus on what's next.

And in fact, long before that the market will come to a view that the bulk of cost reduction has been achieved, the field can be valued reasonably accurately, and it will go ex-growth.

ORG as upstream operator has done really well on moving capex and opex down at APLNG. It was always expected that costs would come down an experience curve but in our view ORG has outperformed.

APLNG likely near its peak valuation

We estimate to with a billion or so that ORG's share of APLNG is worth $8 bn. That's using a Brent oil price of US$60/b. Still there are many uncertainties. We allowed an arguably very excessive $4 bn clean up liability, on the basis that all the wells, processing plants and Curtis Island infrastructure needs to be removed and made whole.

APLNG NPV extract		FY22	FY23	FY24	FY25..	..FY33	FY35	FY36
EBITDA		4588	4822	4905	4986	5602	5751	5825
Ungeared tax					-956	-1141	-1185	-1207
Capex		-864	-872	-881	-890	-963	-200	0
Clean-up liability								-4000
Discountable cash flow		3725	3950	4024	3141	3498	4366	617
NPV8		29375	28000	26290	24369	10194	4572	572
Less debt		-7300	-6600	-5900	-5200			
Equity value		22075	21400	20390	19169	10194	4572	572
ORG share	mn	8278	8025	7646	7188	3823	1714	214
Shares on issue	mn	1700	1701	1702	1703	1711	1713	1714
Per ORG share	$	4.9	4.7	4.5	4.2	2.2	1.0	0.1
Change			-3%	-5%	-6%	-17%	-39%	-88%

Figure 7. APLNG NPV. Source: ITK

Other than oil price we don't see much further upside in the valuation of APLNG. Interest rates won't go materially lower, so there is no cost of capital upside. Eventually APLNG will move into a tax paying situation. That may not matter to ORG shareholders, but it will impact the net cashflows to Connoco and potentially Sinopec.

ORG doesn't control the majority of the opex, its either royalties - driven by the gas price achieved - or opex in non-controlled business or to a lesser extent downstream opex at the plant.

APLNG cash costs	$m	FY17	FY18	FY19	FY20	FY21
Purchases		146	262	235	89	20
Royalties and tariffs		187	239	433	502	158
Operated opex (upstream)		681	649	562	561	544
Non operated opex		204	199	197	202	182
Downstream opex		213	227	228	248	243
Corporate		36	43	126	105	107
Dewatering				101	106	108
Workovers				237	179	183
Total to P&L		1541	1673	2119	1992	2032
Tota cash opexper GJ	$/GJ	6.07	2.47	3.21	2.91	2.98
Royalty per GJ	$/GJ	0.74	0.35	0.64	0.71	0.23
Operated upstream % total		44%	39%	27%	28%	27%

Figure 8. APLNG Opex. Source: Company

ORG does control the upstream capex which primarily consists of new wells, well gathering and then as new areas are developed, new field compressors. ORG has reduced costs in this area in a major way, and well productivity has also improved. It's difficult to say how much more can be achieved in this area. If we were to use conventional "experience" curves, then unit costs might fall between 10% and 20% for a doubling of the cumulative wells drilled. That will likely take at least 4-5 years.

APLNG Capex		FY17	FY18	FY19	FY20	FY21
Upstream sustain		922	762	531	546	407
Upstream replace		138	105	122	83	45
Exploratation		80	65	102	88	40
Downstream		155	49	39		25
Non operated		79	189	262	205	149
Total		1374	1170	1056	922	665
Per unit of production	$/GJ	5.41	1.73	1.56	1.30	0.95

Figure 9. APLNG Capex. Source: Company

The reduction in upstream sustaining capex is particularly notable.

Even so we think it's reasonable to expect improvement to be incremental from here. Looking at it the same way as we look at solar, wind and batteries suggests that unit cost reductions might fall say 20% for a doubling of the cumulative number of wells drilled and ignoring the different characteristics of Bowen and Surat wells and that some capex is linked to processing plants.

Wells drilled		FY17	FY18	FY19	FY20
Operated wells drilled		226	290	251	260
Production	TJ/day	1364	1410	1429	1429
Well commissioned		413			267
Total wells		1921	2211	2462	2722
		13%	15%	11%	11%
Production per well	Tj/Yr	259	233	212	192

Figure 10. APLNG wells drilled. Source: Company

Origin's Beetaloo play

Public information regarding the Northern Territory Beetaloo basin states:

1. ORG booked a 6.6 TCF (6,500 PJ) 2C gas resource in 2017.The overall basin may contain as much as 200,000 PJ of gas some of which may be liquids rich. A commercial resource over the basin of say 20,000 PJ might exist.

2. ORG's Kyalla 117 well had a gas composition of 65% methane, 19% ethane and 11% propane, butane and no CO2, which is probably more liquids rich than the Cooper Basin was, but well fracture stimulation was unsuccessful due, the company says, to saline water flow back. The gas pressure pushes the liquids out.

3. The basin is about 500 km southeastof Darwin in the NT. It has a high regulatory burden, remoteness of play, lack of infrastructure, and a lengthy wet season that causes issues. To date there has been no commercial hydrocarbon extraction. All these difficulties can be overcome if the resource is good enough. Early wells are expensive - probably over $50 m per well by the time they are fracture stimulated. Costs will need to come down 80% for commercial outcomes.

4. There are 3 zones of hydrocarbon bearing shales at varying depths down to about 5000 metres.

5. It is certain that unless the quantity of gas is very large, it will end up as very expensive gas in Eastern markets due to the transport as well as extraction cost. To be commercial, other than in extremely large quantities, the gas needs to have a good liquid content. Assuming enough gas was found it could conceivably be sent to the Gladstone LNG projects. These will be running short of gas in another 15

years. It's hard for us to imagine that this will be competitively priced LNG without liquids providing most of the revenue. Since the QLD LNG projects run on dry gas, separate liquid processing facilities would need to be built.

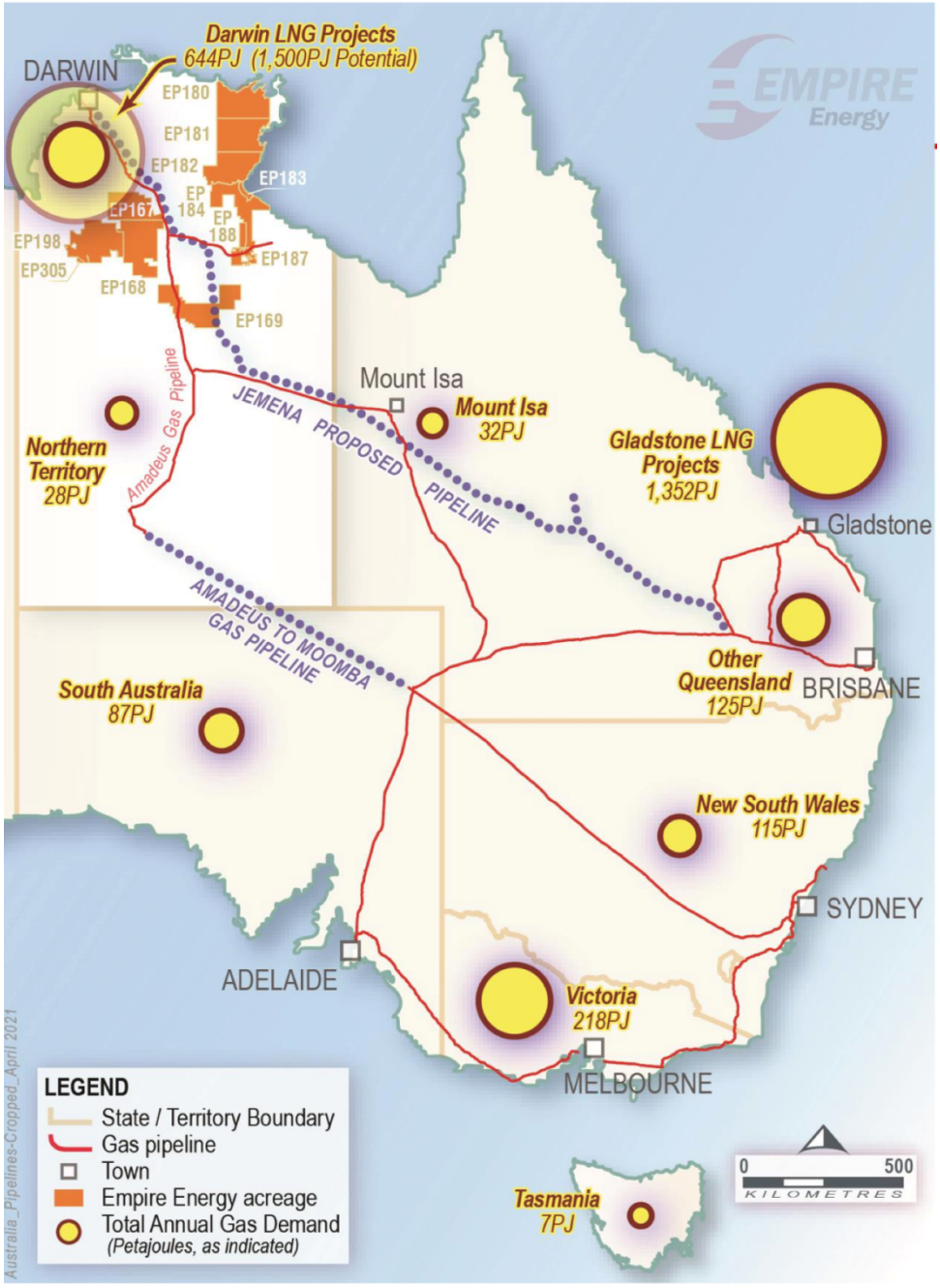


Figure 11. Eastern Australia gas reserves and transport. Source: Empire Energy

6. A couple of wells have flowed gas at average rates over the first 10 days without fracture stimulation of say 0.4 mcf/d and then higher rates after shut in.

7. There are some theoretical questions about the overall performance due to the age of the rocks. This may mean that repeated geological burial and exposure reduces the overall hydrocarbon content or accessibility of it.

8. Development of the field is likely to take, say, a decade. Every year that passes the decarbonization story for gas will get worse. Already this year we can see the "gas divide" coming into increasingly sharper focus.

9. In our view, the best commercial outcome would be the liquids justifying the field development and enough gas to build a pipeline to Gladstone to take advantage of the already existing spare train on Curtis Island. By the time any Beetaloo gas is available, Curtis Island trains may be looking for more supply. Although, this might also be available from the "Arrow" reserves in the Surat Basin.

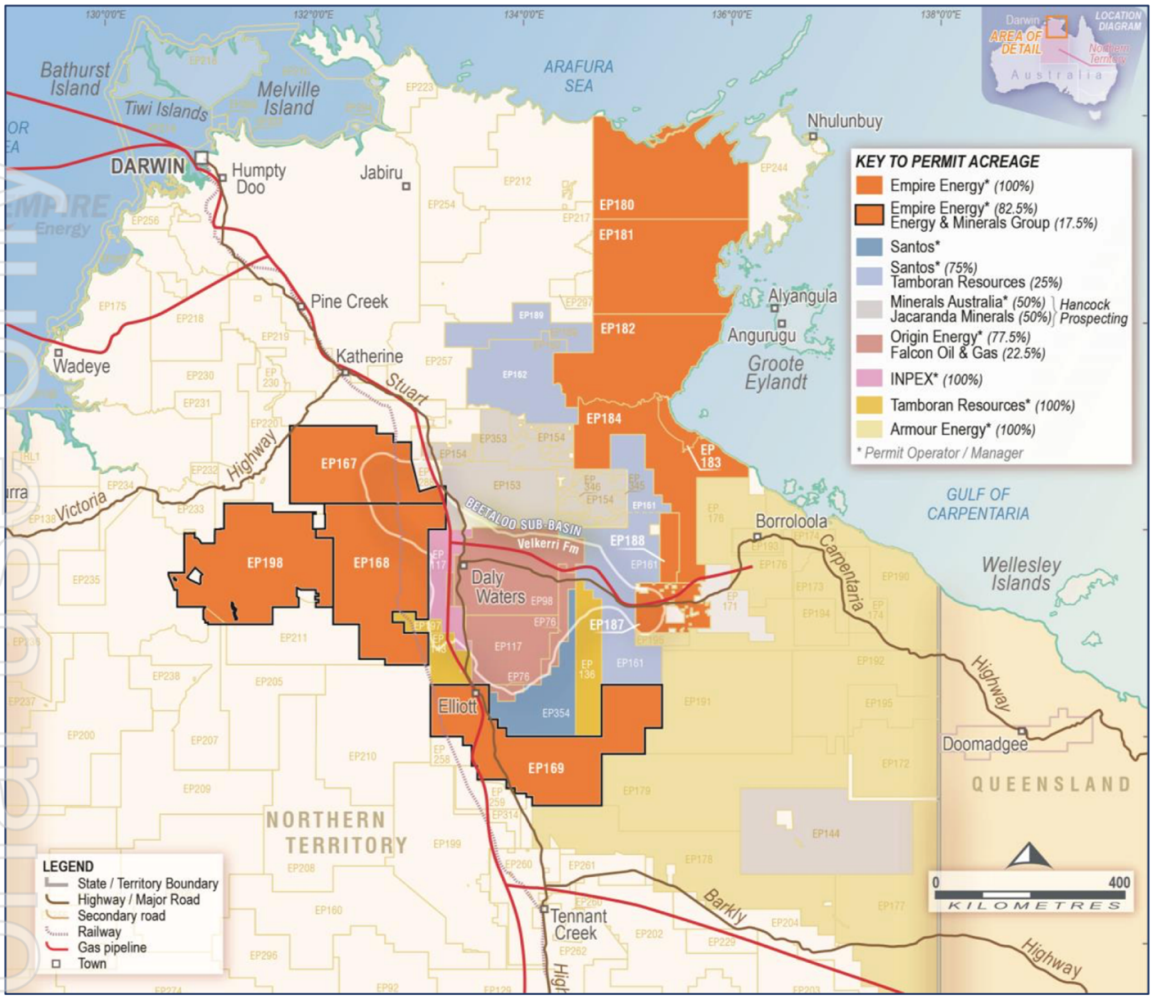


Figure 12. Beetaloo basin. Source: NT Govt

CURRENT DRILLING

- Santos (75%) and Tamboran (25%) are drilling two horizontal wells to a total depth of about 4,800 metres in the Tanumbirini play in EP161. These will be fracced and Tamobran says flow test results are expected in the December quarter.
- Empire energy will be doing vertical hydraulic stimulation and low testing of Carpentaria 1 and appraisal drilling and stimulation of EP 187 2D.
- Origin will be doing an extended production test of Kyalla 117 and vertically drilling Velkerri 76. Results from this program will be progressively available, some perhaps shortly. At the time of writing Falcon reported the well was paused.

A case for moving out of gas and into 100% renewable electricity

ORG in 2020 invested close to $550m for a 20% stake in a fast-growing but as yet unprofitable platform electricity retailer, Octopus Energy, with a marketing image based around being green.

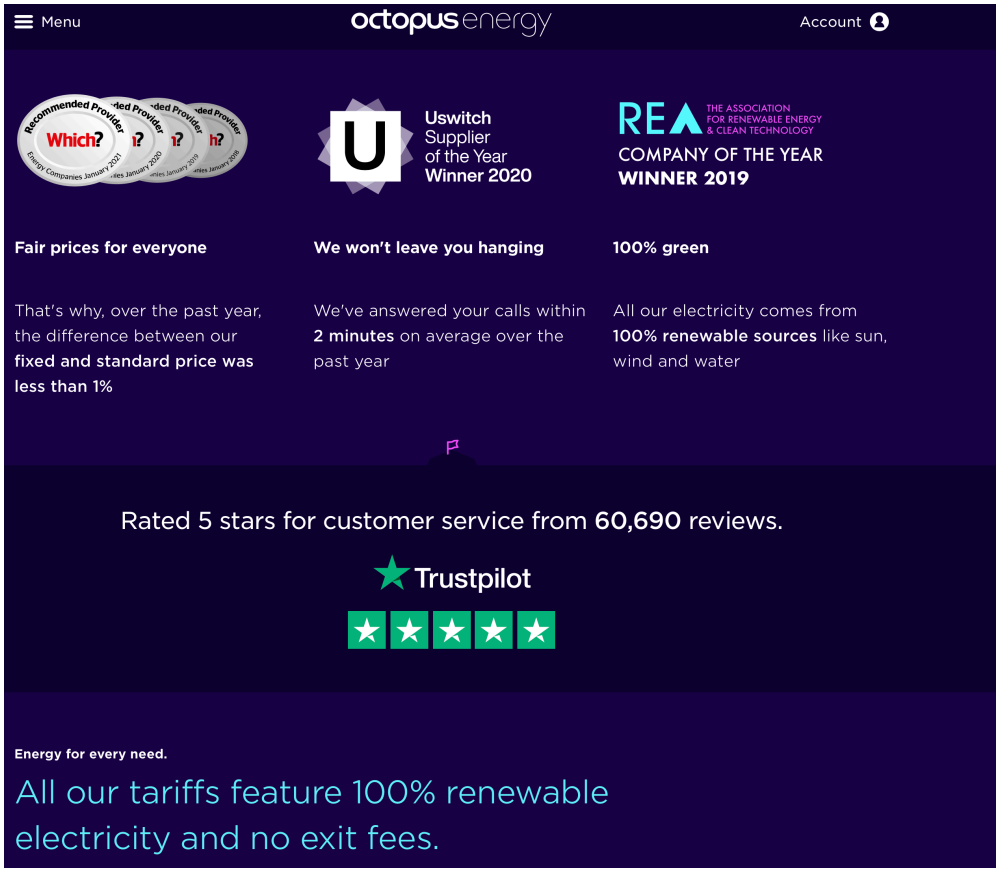


Figure 13. Octopus web page. Source: Company

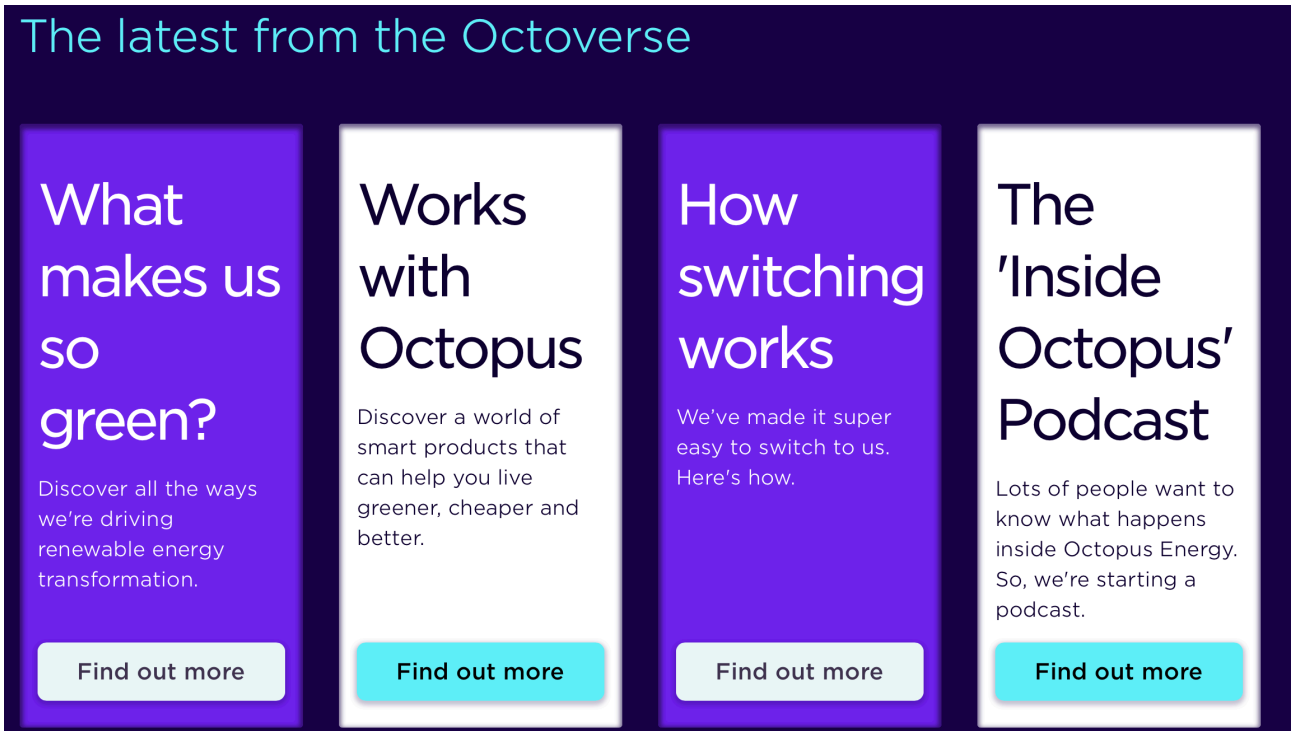


Figure 14. Octopus web page 2, Source: Company

Figure 15. Octopus web page 3, Source: Company

In fact, as detailed on the Octopus web pages, the company's green electricity is nothing particularly special by Australian standards (https://octopus.energy/blog/what-makes-us-green/) except that as a primarily retail-focused business, all of the company's 2 TWh of owned generation is renewable and it buys enough renewable certificates to cover the balance of sales. Or it did.

Octopus's position is totally and utterly incompatible with oil and gas production from just about every point of view imaginable. Octopus has been highly successful at getting customers with over 2 m on the platform as last published.

Culture, financial metrics, management style, and markets; there is almost no overlap. The other half of Octopus's business is utility software.

ORG will pay Octopus an additional $100 million for Octopus to convert ORG's sales and marketing computer software to Octopus' platform, Kraken. The implementation costs at time of announcement were to be spread over four financial years, with the bulk in FY22 and FY23. See Appendix 2 for some further details of Kraken and platform business.

At the time of the announcement in May 2020, eventual savings were targeted at, say, $125 million per year from FY2024. ITK has reservations about the transferability of utility software to a completely different environment, particularly one with as many different sub systems in different States as Australia has and one where the penetration of rooftop solar into the consumer market is completely different. Equally the wholesale market system is also quite different to the UK. Not even sure Octopus has a gas system whereas ORG has a lot of gas business all of which requires its own software. In short we won't be in the least surprised, and we doubt if the market will be either, should the Kraken installation in Australia be over budget and behind schedule. In fact we'd bet on it. Equally the valuation of a presently unprofitable but fast growing platform business like Kraken requires a much higher degree of familiarity with the actual uptodate numbers and the skill to see the future profits, than ITK possesses. Still the next update will soon be available with the FY21 profits.

ORG does do a great chart, so we have taken this from the 2020 investor presentation.

In ITK's opinion ORG has missed many an opportunity to get control of its generation future. It's been one misstep after another, little of the upside AGL gets from coal, and pretty much most of the carbon downside. Gas generation is not well regarded by green investors and although it occasionally gets good profits, the overall results are not great. Perhaps that will change.

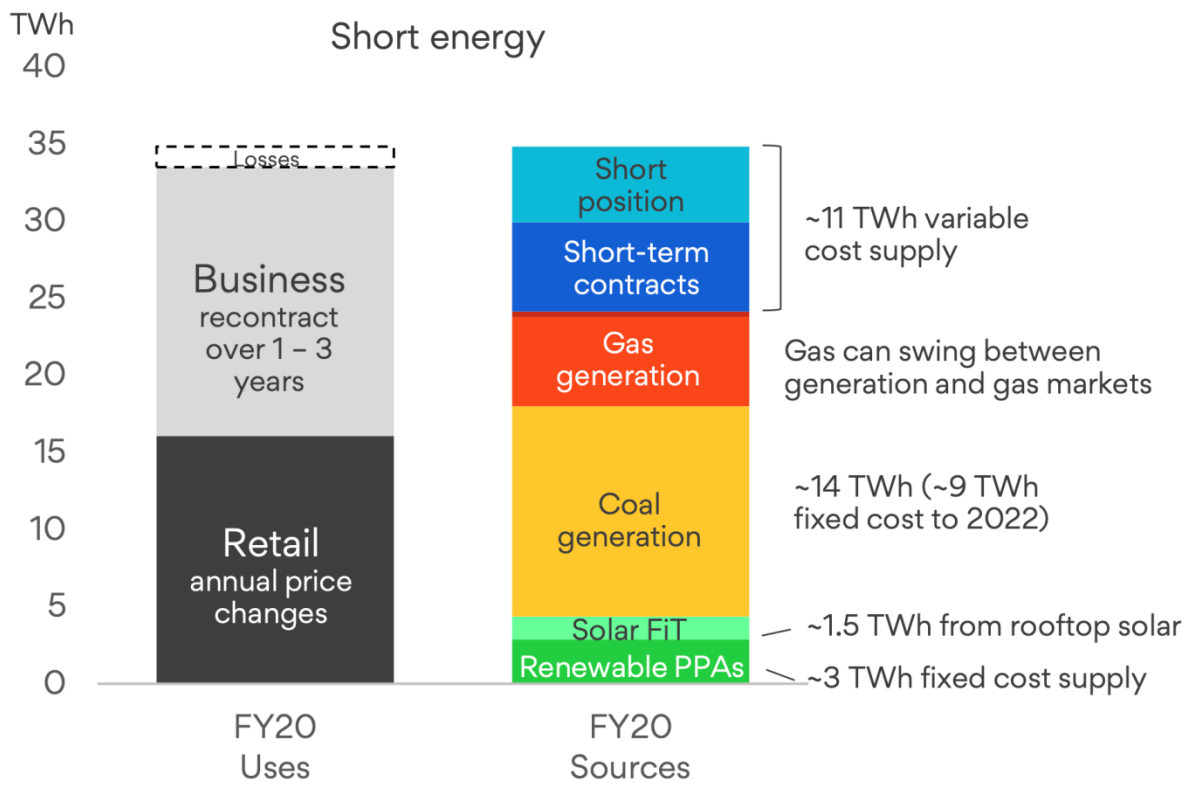


Figure 16. ORG electricity supply. Source: Company

What we do know though is that ORG's coal generation is going away. Eraring is due to close in 2032 when its ash dam is full and will likely move into a reserve role prior. This leaves ORG with the challenge of replacing its earnings. Eraring is profitable notwithstanding its coal contracts are short term and are no doubt linked to export parity in some fashion.

There can be no suggestion that more gas is going to provide 14 TWh of energy. The obvious answer is to invest in more wind and solar… but that is an approach that ORG has always resisted.

As a result, along with AGL and EnergyAustralia, it's in the process of ceding market share to the companies that are building a new breed of gentailers. ITK selected a group, out of a large number of suppliers, that we estimate have around 13% of NEM by energy already and we expect to continue to gain market share. The Group Neoen has already established a strong position in dispatchable power via its batteries. And we anticipate the rest of the group to follow along as they evolve towards the traditional gentailer model - but just using green assets instead of thermal. By and large we expect them to be supported by policy.

Emerging Green Generators				
MW	Solar	Wind	Total	Energy TWh
Neoen	760	762	1522	4
PowAR	155	1559	1714	6
Acciona		928	928	3
CWP Renewables		919	919	3
Iberadola	132	739	871	3
Sun Metals Corporation	125	400	525	2
Naturgy		813	813	3
Palisade Investment Partners	120	608	728	2
Total	1292	6727	8019	25
Share of total NEM				13%

Figure 17. Emerging renewable generators. Source: ITK

ORG's position is that the *customer* is the scarce resource. It's true that the number of customers is finite although the product range is not. However, the green gentailers will be selling the products the customers want, since 70% of the population is basically in favour of green energy.

We argue that ORG could stop being two-faced in its support of decarbonisation and actually demonstrate it means what it says by moving its generation assets away from thermal and towards green. If it gets on with it, there may still be time.

The question for us is how successful a large-scale single-fuel gentailer (i.e. electricity only, no gas) could be? Initially, getting out of gas retailing would certainly hurt profits although we would argue that right now the business still has as value. Energy Australia for instance, or even the new AGL Australia which has aims to be a multi-product retailer.

ORG'S GAS RETAILING BUSINESS HAS UNTIL RECENTLY PEFORMED WELL

Since about 2014 ORG has focused heavily on winning gas market share, initially based on upstream ownership of gas production together with the contract book that went with APLNG.

ORG went after not only the retail market but also taking a very significant share of AGL's industrial customer size loads, and selling significant quantities of gas into the LNG supply market, mostly to GLNG. Still, it also did quite well in the retail market:

Gas retailing	FY15	FY20	Change	FY21 (F)
Residential Volume (PJ)				
NSW	7.1	11	55%	
Victoria	26.1	25.2	-3%	
Queensland	2.8	3.1	11%	
South Australia	5.8	5.7	-2%	
Total volumes sold	**41.7**	**45**	**8%**	
Customers (000s)				
NSW	247	335	36%	
Victoria	479	479	0%	
Queensland	155	181	17%	
South Australia	202	239	18%	
Total gas customers	**1,083**	**1,234**	**14%**	
Business volume (PJ)	**105**	**159**	**51%**	
Gross profit $m				
Retail	978	1,163	19%	1140
Business	755	1,673	122%	1,520
Total revenue	1,733	2,836	64%	2,660
Network costs	(640)	(796)	24%	(830)
Energy procurement	(572)	(1,294)	126%	(1,330)
Gross profit	**521**	**746**	**43%**	**500**
$/GJ as reported				
Retail sales	23.5	25.8	10%	
Business sales	7.2	10.5	47%	
Network	4.4	3.9	-10%	
Energy Procurement	3.9	6.4	63%	
Business sales-procurement	3.3	4.2	27%	

Figure 18. ORG Gas retailing, Source: Company

If one of the other existing large gentailers was to buy ORG's gas business, there would be large economies on the cost side. The residential gas business might be worth in the order of $1500 per customer based on past transactions, or somewhere in the order of $2 bn. The business volumes will depend on the length of the contract book on both the sales and supply side. Essentially on the supply side, some contracts such as those with APLNG about 10 years to go. There is also a portfolio of transport contracts and so on. More information is needed to value the business part of the book but if ITK was forced to guess we might pencil in $250 -$500 m.

Gas retailing profits will be down very sharply in FY21, management forecast a full year $200-$250 m decline in gross margin at the half year due to roll off of legacy supply ($70

m), repricing of tariffs, lower business sales volumes and higher procurement costs. Quite the list really. Procurement costs rose a further $30 m in FY21 post the result due to arbitration outcomes on 13 PJ (FY21) of volume supplied by Beach Energy. That cost increase in $m terms will be larger when applied to all of FY22.

Selling the gas business would allow ORG to focus on selling carbon free electricity, align it with Octopus more closely, vastly simplify the customer care system, investment and transformation and with a clearer corporate goal ORG could use the funds raised to replace Eraring and develop a marketing strategy that was both aligned with what the public wants and was strongly differentiated from its main competitors.

It's the fact that the gas business is doing well which makes it saleable. In another 5 years' time it may be much harder. ITK expects that consumer attitudes towards gas consumption will take many years to change. Similarly, gas is quite hard to replace as a source of process heat to industry. Carbon free gas substitutes (green hydrogen and green ammonia) are nowhere near competitive as feedstocks for the plastics business as natural gas.

So, in ITK's opinion, gas retailing has relatively secure annuity business. Nevertheless, its growth outlook, contrary to consensus, is poor. That is the selling opportunity: the difference between consensus expectations backed up by Federal Govt rhetoric versus the imperative of climate science and the investment dollars that swing behind it.

ORIGIN'S ELECTRICITY RETAIL BUSINESS NEEDS SOME UNCONDITIONAL LOVE

ORG's electricity business has been an average to poor performer from about the time it bought its interests in the NSW electricity industry. The business has been hit from pillar to post by regulatory outcomes, a mis match between supply and demand in Queensland and to an extent in Victoria and cost performance has been far from stellar.

We have never understood what Origin's retail business proposition was. Is it meant to be the cheapest? The best customer service? The most forward-looking? Its proposition to customers is unclear. The same would go with the higher volume but much lower profit wholesale business. Anyhow, we don't propose to analyse the business in detail here. We're suggesting a scenario where it *did* sell its gas interests and *did* retool itself as Australia's

No. 1 green gentailer. Green and nothing but green. Lighting the path so to speak. In that scenario, the electricity business and its P&L would be profoundly different from what's been demonstrated so far.

ORG's electricity business				
	FY15	**FY20**	**Change**	**FY21 (F)**
Volumes (TWh)				
Retail				
NSW	8.9	7.8	-12%	
Victoria	3.2	2.9	-9%	
Queensland	5	4.1	-18%	
South Australia	0.8	1.3	63%	
Retail volumes sold	**17.9**	**16.1**	**-10%**	
Business volume	18.4	17.4	-5%	
Customers (000)s				
NSW	1288	1191	-8%	
Victoria	581	556	-4%	
Queensland	764	645	-16%	
South Australia	198	239	21%	
Total customers	**2801**	**2631**	**-6%**	
Gross margin account				
Retail sales $m	4902	4569	-7%	4406
Business sales	2238	2941	31%	2758
Revenue ($m)	7217	7510	4%	7164
Network costs	(3745)	(3142)	-16%	(3178)
Wholesale energy costs	(1906)	(3179)	67%	(3058)
Gross profit ($m)	1289	1189	-8%	928
Gross margin %	18%	16%		13%

Figure 19. ORG's electricity busines. Source: company, ITK

In actuality… this is a poor performance. Volumes are down and so are customer numbers. Gross profits are down 25% if we look to FY21 and probably more in FY22.

There are plenty of good reasons for these things, but in the end, management have been unable to do much about the external forces. We argue the ORG brand doesn't stand for anything that resonates with consumers. ORG does have a bunch of interesting products within electricity, a good example is its embedded network business, but these mostly seem like portfolio addons rather than a core strategy.

In any event if ORG is, as we think appropriate, to focus on electricity and nothing but electricity, as world class players such as Nextera and Orsted do, it will clearly need to improve these results.

And it could improve, the overall numbers show $7 bn of sales, a large gross margin, arguably one that should be round $1 bn or more, and about 9% of the Australian market by volume. That's a substantial starting point.

Origin's hydrogen initiatives:

- Origin and Kawasaki Heavy Industries are collaborating on a 300 MW, 36,5 KT green hydrogen production and export facility at Townsville. The project is advertised as likely to enter Front End Engineering [FEED] in calendar 2021 with a target production in the mid 2020s.
- Origin is doing a feasibility study on a 500 MW 420KT green ammonia plant based at Bell Bay. The feasibility study is targeted for completion by Dec 2021.
- Origin and Posco, a South Korean steel manufacturer, have signed an MOU to cooperate on supplying green power to Korea, via hydrogen. Right now, there is no project associated with the MOU. And indeed, historically, ITK does not value MOUs at all. But they are worth noting.

Hydrogen hubs and the role of gentailers:

The consensus plan to decarbonize the world at the moment is essentially:

1. Make electricity 100% carbon free;
2. Electrify as much of primary energy consumption as is feasible;
3. Deal with whatever's left over as the technology becomes available.

Over time, and in Australia undoubtedly it was Alan Finkel that lit the flame, it's become clear that there is a potential role for green hydrogen and hydrogen-rich chemicals to do part of the job.

ITK believes that green hydrogen is likely to be relatively advantaged when

- produced at scale;

- in regions of the world that have access to low cost renewable energy. This doesn't just mean lots of resource but also low cost of using the land, and low enough construction and operating costs;
- when surplus or short fall production from the VRE source can be managed as part of a larger portfolio, such as that owned by a large gentailer;
- when it is produced relatively close to the market where it will be used;
- when there are strong existing customer supplier relationships.

Considered against those criterion ORG is well placed on all fronts other than 'close to market'.

The emerging model of a decarbonised energy economy is one where most things are done by electricity. Those things that can't be done by electricity can often be done by green hydrogen. Green hydrogen is both a customer of the electricity industry, being manufactured by electrolysing water using wind and solar power, and also a supplier to it, by storing the energy and then having it used in a turbine to provide power.

Looking at the production costs of green hydrogen, or for that matter green ammonia there are two key drivers: the cost of the input power, wind and solar, and the unit cost of the electrolyser. That is the capital cost of the eletrolyser allocated to each kg of hydrogen produced. The electrolyser unit cost has itself two drivers, the cost of the equipment, and the denominator that is the volume that goes through it each year.

It turns out that the capacity utilization of the electrolyser is a big driver of the cost of hydrogen. This is a big problem because no matter how much wind and solar you throw at the electrolyser, you still can't get its natural capacity utilization over, say, 70%, even at ideal locations like North Queensland or the North West shelf. And even when you do get the electrolyser capacity up to 70%, you end up with lots of spilled energy as well as spare capacity.

So, the way to deal with the spilled energy is either to export it into the grid for other uses, or to use it to charge, say, a battery. Equally, the way to deal with the spare capacity is either to discharge the battery or import from the grid. Alas, importing from the grid only works if the grid itself is green.

Equally, to get capacity utilization up to 70% requires a large wind and solar resource operating as a portfolio. In short, it's a scale business.

ORG, as a gentailer, has the potential to sell the excess VRE production into the grid, or to store it and equally and take production from elsewhere in the portfolio, or even from a green grid when the hydrogen specific VRE production falls away.

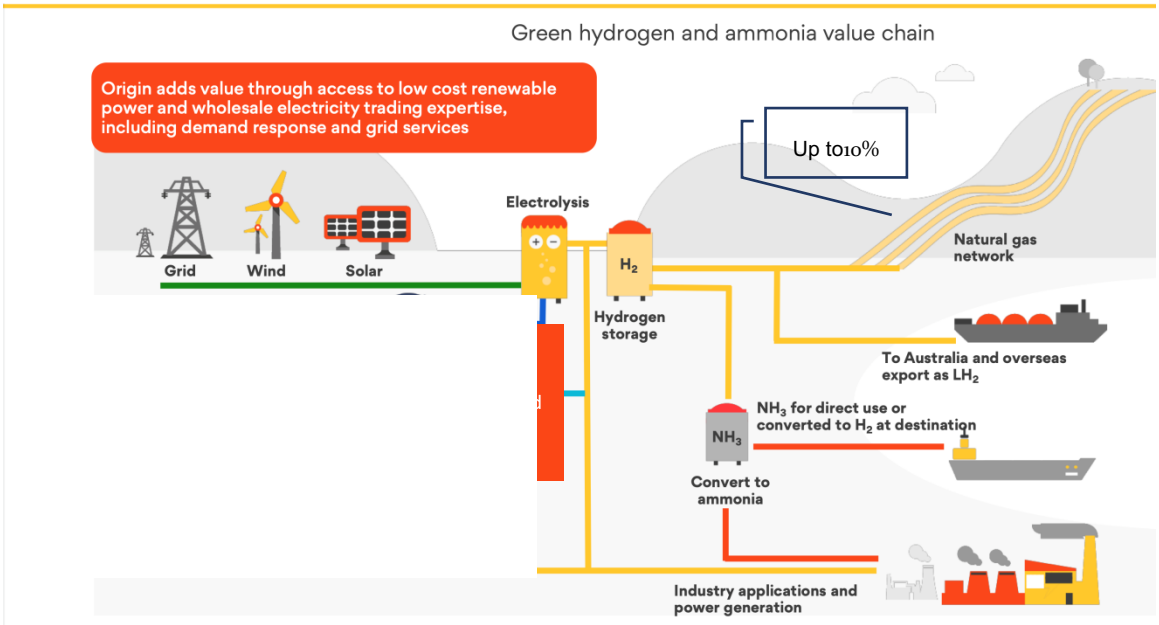


Figure 20. Hydrogen, generation and retailing.

5 mt of hydrogen to Japan by 2030?

For years, hydrogen has been studied as a conceptual solution to Japan's decarbonsiation effort. Along with nearly everything Japan has done in decarbonisation, the efforts have not been particularly successful. Onshore wind in Japan has 3x the LCOE in Europe, never mind Australia, and there is not the space for solar. ITK has argued that floating offshore wind could provide part of the answer and perhaps hydrogen can be another part.

Japan currently has a target of 10 mt of hydrogen by 2030 most of which is expected to be imported. This may be revised with Japan's next 5-year energy plan expected over the next few months. We estimate that 10 mt of hydrogen is broadly equivalent to 50 mt of thermal coal or going on for 40% of Japan's imports.

Australia might reasonably hope to supply half that market based on our existing trading relationship, likely competitive cost of hydrogen and allowing for part to be supplied as ammonia.

Japan may be one of the first countries to build a large ship powered either by ammonia or hydrogen but that won't be before 2028 at the earliest. Again, you can't easily bet on that as a reliable source of demand.

It's power demand where the obvious prize is. Japan's thermal coal consumption is 130 mt per year - equivalent to about 26 mt of hydrogen:

Using hydrogen to replace 40% of thermal coal	
GJ per ton coal	26
KG of hydrogen per GJ	7
KG of hydrogen per t coal equivalent	182
Japan thermal coal consumption (mt)	132
Equivalent mt of hydrogen for 100% replacement	24.0
Mt hydrogen for 40% replacement of coal by 2030	9.6

Figure 21. Replacing Japan's thermal coal with hydrogen.
Source: ITK

At the moment the immediate prospects are for ammonia to be used in coal generation in a ratio of say 20% hydrogen energy to 80% coal. This is on the cusp of being tested at two separate 1000 MW units of the Hekinan power complex. This would be about 160 – 200 KT of hydrogen. NOx emissions remain an issue, as do the overall safety issues of ammonia in general. Still, it would only need 4-5 projects of that size to justify a1 mtpa plant.

Sketching a 1 mtpa hydrogen plant…

A discussion of electrolysers is considered in an appendix. Right now, a 10 MW electrolyser can cost $1 m per MW or more, balance of plant costs including the site and compression could more than double that cost.

For a 1 mtpa plant, about 8000 MW of electrolyser is needed. We guess the electrolyser cost falls to A$333/MW and that the non-power balance of plant is 1.2 x that of the electrolyser. Let's assume that operating in a highly productive VRE area with an optimised portfolio of wind and solar, electrolyser capacity utilization is 70% but that nevertheless the wind and solar capacity is 20% oversized with an average capital cost of $1.6 m/MW.

About 6.5GW of wind and solar are needed. Total capex is thus about A$15.5 bn before contingencies etc and most of the capex is the very predictable wind and solar costs. And that it can be built at low risk in a reasonable time frame. Of course, one could contract out the power production… but why would you? Management of that is part of the core competency.

Assumptions for 1 mtpa LNG at 100% capacity use		
Electrolyser cost	A$$/KW	267
Size	MW	8000
VRE capital coast	$/MW	1.62
VRE capacity	GW	6.72
Electrolyser capex	A$m	2133
VRE capital cost	A$m	10886
Balance of plant	A$m	2560
Total capex	A$m	15580
Electrolyser cap use		70%
Non fuelopex	$/kg	0.2
Fuel opex	$/MWh	10

Figure 22. Hydrogen plant costs. Source: ITK

These numbers are entirely "guesstimates" and have a low range of confidence. Still, 2/3 of the capital cost is the VRE and we do have good data on that. Because 2/3 of the capex is VRE and because operating costs are relatively low and therefore don't impact value to a great extent, such a project might be able to sustain some debt. After all, even if hydrogen was a dud, the VRE could still be sold to the broader market. 40% debt funding might get you an equity IRR close to 15% at a price of US$2.5 kg or around US$18/gj.

The reality of any such project is likely to be far more complex. Our plant has a nameplate of 1 million tonnes per year but produces 687 kt in this scenario. No electricity modelling is done, all the surplus/short fall is assumed away. No tax modelling, no opex modelling, no balance of system modelling etc.

Hydrogen NPV jotter		1	2	3	4	5	6...	...20	24	25
Price	A$/kg	3	3	3	3	3	4	4	4	4
Volume	kt	687	687	687	687	687	687	687	687	687
Revenue	A$m	2,289	2,312	2,335	2,359	2,382	2,406	2,766	2,878	2,907
Opex	A$m	(137)	(140)	(142)	(143)	(144)	(146)	(168)	(174)	(176)
Fuel opex	A$m	(343)	(350)	(354)	(357)	(361)	(365)	(419)	(436)	(440)
Ebitda	A$m	1,809	1,822	1,840	1,858	1,877	1,896	2,179	2,268	2,290
Depreciation	A$m	(623)	(623)	(623)	(623)	(623)	(623)	(623)	(623)	(623)
Ebit	A$m	1,185	1,199	1,217	1,235	1,254	1,273	1,556	1,644	1,667
Cash flow										
Ebitda		1,809	1,822	1,840	1,858	1,877	1,896	2,179	2,268	2,290
Tax on ebit		(356)	(360)	(365)	(371)	(376)	(382)	(467)	(493)	(500)
Capex		(15,580)	0	0	0	0	0	0	0	0
Total cash flow		(14,127)	1,462	1,475	1,488	1,501	1,514	1,712	1,774	1,790
IRR	9.9%									
Debt 40% weightd cost	1.1%									
Implied equity return	14.6%									

Figure 23. Hydrogen concept NPV. Source: ITK

Appendix 1: Hydrogen markets

Forecasting the future demand for hydrogen is entirely speculative. Not only are there cost and technical issues but there are also competing technologies in virtually every application.

That said the basic law of more demand at lower price remains.

Secondly, it's become clear that there is global and above all Japanese and perhaps Chinese Governmental push to make hydrogen happen. As Japan and China are our two largest trading partners for energy this is super important. The idea of course is to replace coal and gas with hydrogen.

Australia: Selected commodity exports				
FY20 exports of	**LNG**	**Therm. Coal**	**Met. Coal**	**Iron Ore**
	MT	**MT**	**MT**	**MT**
Japan	30	74	32	57
China	29	52	50	711
South Korea	8	32	16	53
Taiwan	6	23	10	14
India	1	4	40	
All Others	5	29	29	23
Total	79	214	177	858
Share of total				
Japan	38%	35%	18%	7%
China	37%	24%	28%	83%
South Korea	10%	15%	9%	6%
Taiwan	8%	11%	6%	2%
India	1%	2%	23%	0%
All Others	6%	14%	16%	3%
Share of big 5	94%	86%	84%	97%
Share of Japan and China	75%	59%	46%	90%

Figure 24. Commodity exports. Source: Aus Govt.

Because of the interest and potential there are a range of forecasts of hydrogen demand. ITK chooses to focus on the publicly available estimates from BNEF. We regard BNEF as the preeminent energy demand and supply forecaster globally, particularly but not solely when it comes to low carbon. They are a focussed organisation with more than 250 global

analysts analysing mostly the global energy economy. By and large BNEF analysis is expensive and not publicly available. ITK draws extensively from:

Hydrogen economy Mar 2020 and just as extensively from Liebrich on Hydrogen demand 2020 - Noting that these references are already more than 12 months old.

Again, for the purposes of contemplating the merits of ORG betting the APLNG business on hydrogen, we focus on hydrogen demand.

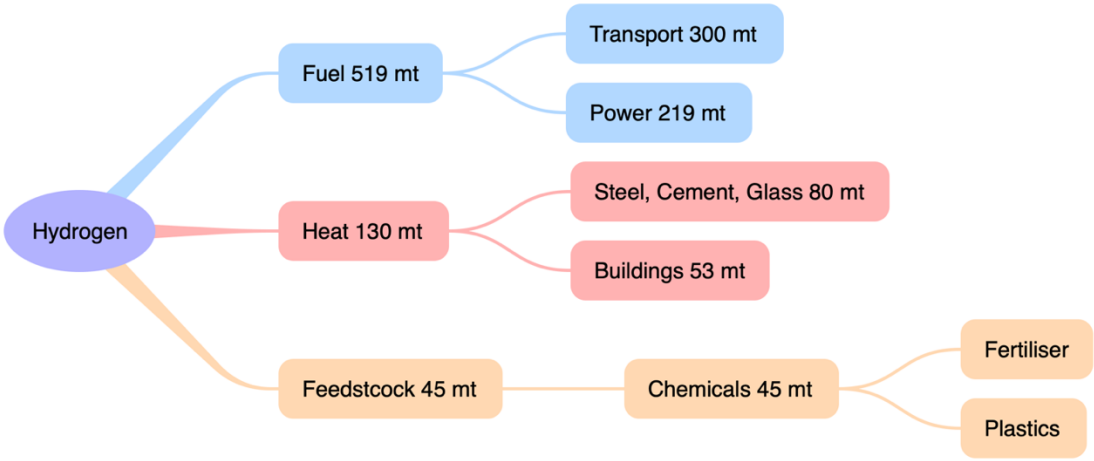


Figure 25. Global hydrogen market potential by function. Source: BNEF.

BNEF forecasts demand under three scenarios, Max, strong policy and weak policy and focus on the potential by sector in 2050.

2050 Hydrogen demand			
Mt	**Max**	**Strong Policy**	**Weak Policy**
Buildings	106	53	21
Power	439	219	6
Industry	515	123	37
Transport	524	301	123
Total	1584	696	187
EJ equivalent	195	99	27
Change on 2020 demand (70 mt)	2263%	994%	267%
Implied 30yr CAGR	11%	8%	3%
Buildings	7%	8%	11%
Power	28%	31%	3%
Industry	33%	18%	20%
Transport	33%	43%	66%

Figure 26. Global hydrogen demand scenarios. Source: BNEF.

The transport component of demand is mostly heavy trucks in each scenario and to a lesser extent shipping.

In ITK's opinion, there is still a good chance that electric trucks will end up beating hydrogen in the heavy trucking market.

In the industry segment the bulk of the expected demand is from steel and cement.

Note that hydrogen has a 50% round trip efficiency in energy storage, batteries are ~85% or better, fuel cells and turbines have a 60% efficiency rating, and electric motors have efficiencies of ~90%.

STEEL

Steel manufacture results in 1.8 mt CO_2/t and steel is responsible for around 8% of global emissions (McKinsey, World Steel Organisation). The main hydrogen steel method proposed and being tested is to reduce pelletised iron ore with hydrogen to form "DRI" [Direct Reduced Iron]. In step 2 the DRI is heated and liquified and mixed with steel scrap to produce raw steel. The heating process uses electricity.

According to BNEF if hydrogen was US$2/kg the steel cost is about US$650/t. Hot rolled steel prices have ranged from $440/t

An alternative to using hydrogen that is attracting interest, but so far only about $100 m of capital, is molten oxide electrolysis. BHP and Vale have put money into Boston Metal, the developer. The process heats iron oxide to 1600°C and then uses electrolysis to collect iron on the negative plate and oxygen on the positive, using perhaps chromium for the anode. This is a long shot, but one that seems to have progressed in the past two years.

Point being, it's still a bit early to put all the money on hydrogen for decarbonised steel.

CEMENT

Only some cement emissions can be eliminated. CO_2 emitted during the process will have to be captured. For the emissions generated by heating limestone, which in total are about

1/3 of cement manufacturing, electrification is a potential solution, along with burning hydrogen.

TRANSPORT

Despite many attempts, we think scepticism of fuel cell passenger vehicles is fully justified. The ones that are on the market can hardly be given away whereas electric cars sell quickly. As Michael Liebrich put it:

> *"There are three commercial hydrogen models on the market: the Toyota Mirai, the Hyundai Nexo and the Honda Clarity. They have no more range than comparable sized battery electric vehicles (BEVs). They are no lighter. They have less luggage space (those pressurized hydrogen tanks). They have half the acceleration and a lower top speed. And they have more moving parts, meaning higher maintenance costs. If none of that has not dissuaded you from buying one, there's the price: up to 20% higher than an equivalent BEV."*

And from the public policy perspective:

> *"Driving a small family car 100km, whether H2FC or BEV, uses 15kWh of motive energy at the wheels. For the BEV, taking into account losses on the grid and in the battery cycle and drive train, that translates into a need to generate 25kWh at the plant where the electricity is generated. The equivalent for the H2FC car, given losses in electrolysis, compression, transport, storage and reconversion of hydrogen, is at least 50kWh."*

The prospect for hydrogen in the shipping industry, in interstate transport and in long distance aviation, though, look quite promising.

POWER DEMAND

Hydrogen or ammonia (mostly hydrogen) have the incomparable advantage of being easily stored at low cost. As a result, they're an excellent way to provide the power for the last 10-20% of power generation. The further we electrify processes- which today primarily use oil, coal and gas - and the more variable renewable energy production grows, the greater

will the need be for large amounts of power to fill in the gaps between supply and demand when the batteries are empty. Hydrogen or ammonia generation is the most promising supply technology for doing that. Demand response may also play a part.

Appendix 2 HYDROGEN electrolysers

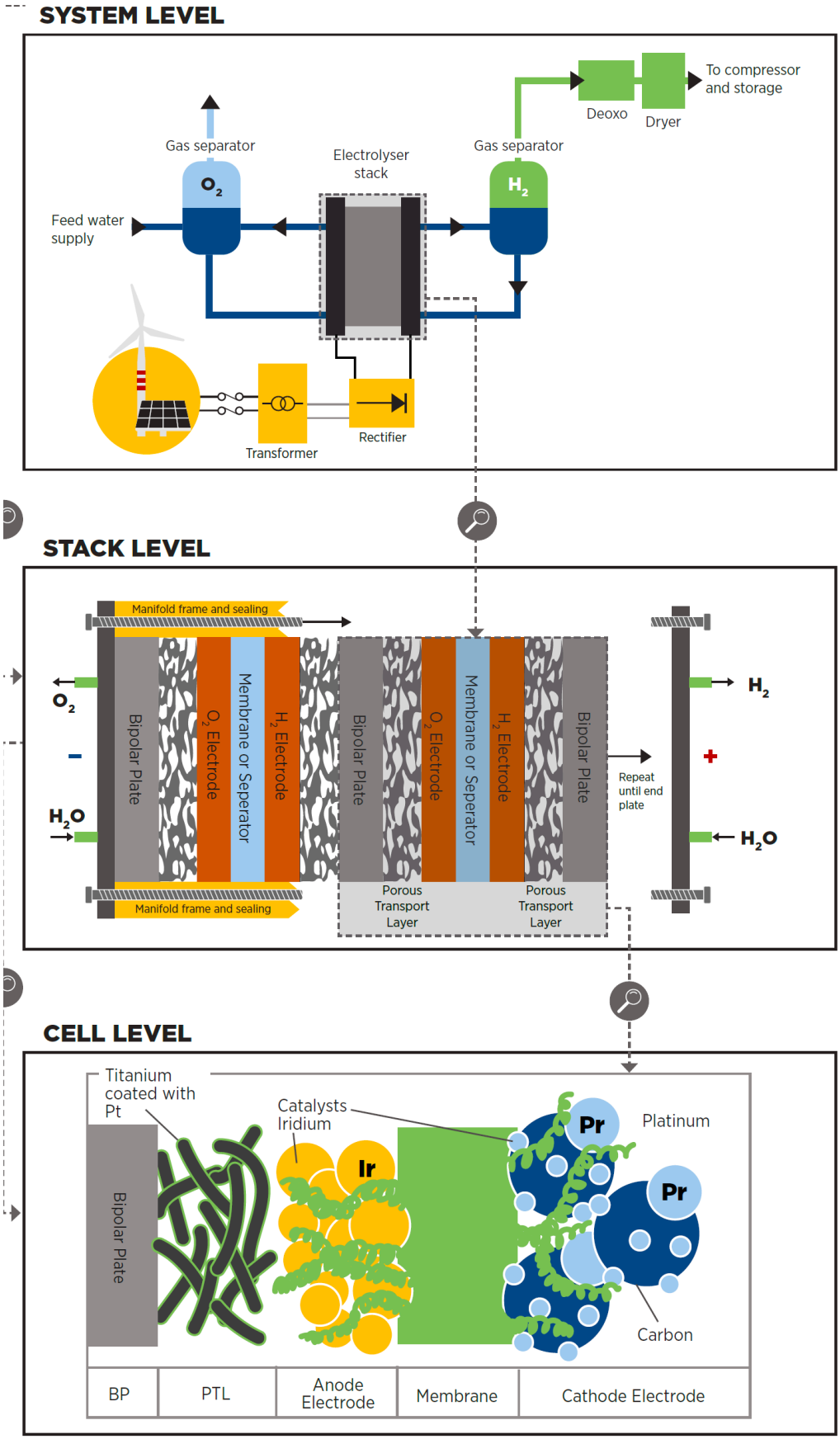


Figure 27. Hydrogen electrolyser, block diagram. Source: IRENA 2020.

5th generation (post-2020): *This period is expected to take electrolysis from niche to mainstream, from MW to GW scale, from potential to reality. The goals for this period include a lower (< USD 200/kW) cost, high durability (> 50 000 hours) and a high (approaching 80% LHV) efficiency. This will require economies of scale, a larger manufacturing capacity and technological breakthroughs through research.*

SCALE CHALLENGES

As of 2020 the largest electrolyser installed was 10MW facility at Fukushima Japan in single stack form. Commercial designs up to 20 MW are available.

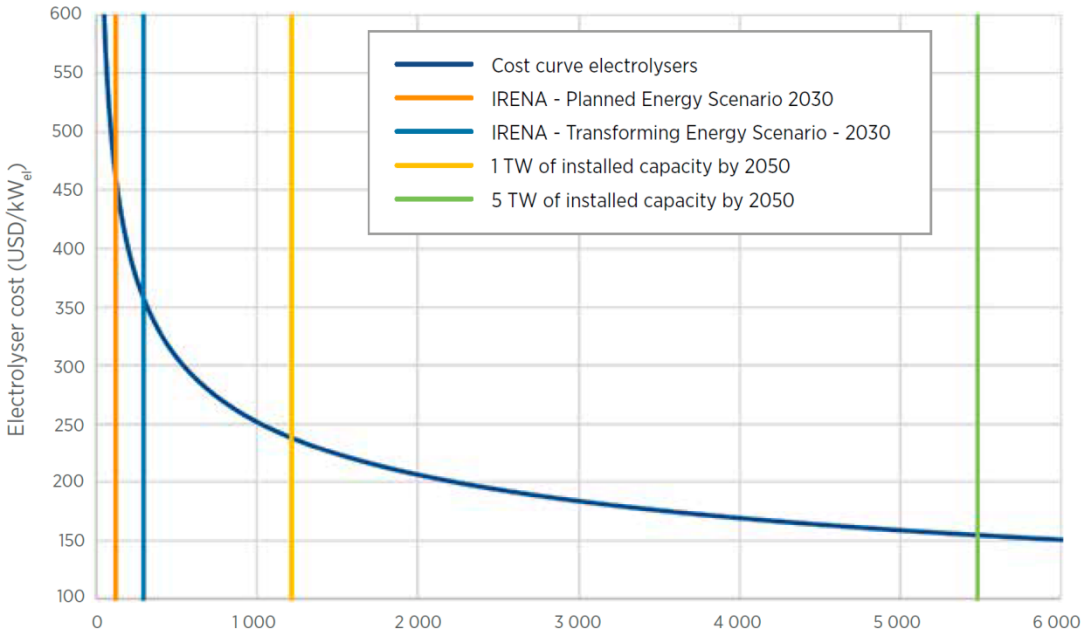
Economies of scale are said to exist both in the stack at up to say 100 MW and taking the balance of system cost into account at up to 1 GW.

Perhaps the most advanced scale project in the world is the 100 MW Gigastack project in the UK which includes partners Orsted, ITM Power and Phillips 66. FEED for this project concludes in July 2021, behind the original timetable. The 100 MW unit is made up of 5 x 20 MW units each of which seems to consist of 4 x 5MW PEM electrolysers.

In terms of the specifics of cost reduction, that at the electrolyser manufacturing factory going from 10 MW of production per year to 1000 MW gets the stack cost down by 70% to 80% to around US$70-80 KW (IRENA 2020). This is achieved largely by going from manual to semi-automated stack assembly including advanced coating process ("rolltoroll").

Electrolyser and fuel cells have a learning rate, to date, of about 18% and since we are at the very beginning of deployment the opportunity to get costs down quickly in the early years is large. Figure 21 is from an IRENA paper.

Figure 29. Potential cost decrease for electrolysers based on a learning rate and costs achieved by deployment in IRENA scenarios by 2030 and 2050.



Notes: 1 TW of installed capacity by 2050 is about 1.2 TW of cumulative capacity due to lifetime and replacement. Similarly, 5 TW by 2050 is equivalent to 5.48 TW of cumulative capacity deployed.

Based on IRENA analysis.

Figure 28. Electrolyser cost reduction from learning rate. Source: IRENA.

Appendix 3: Kraken and platform business outline.

What is Kraken? Kraken is a platform built on modern software buzzwords; Agile computing, Scrums, Django, Python. In my as-usual amateur opinion, the software is characterised by being open source and deployed rapidly. Please see glossary for a few concepts. As far as I can tell, it's a culture as much as a system. Historically, ORG and AGL have outsourced customer care systems and other retail software to consultants. For instance, AGL uses Accenture and I think Origin used Wipro.

What is a platform? Platform economics were new to me as a theory, even though I've watched them in action for many years and even though markets are platforms. So, I went out and read a textbook.

In my words, a platform company is a business that provides a way for groups of buyers and sellers, producers and consumers, to meet. PayPal which has a market cap more than

double the Commonwealth Bank and grew 30% in 2020 would be a typical example, alongside even more famous brethren Uber and Airbnb.

So, outsourcing customer care and other software means losing control of what should be the core competency of an energy retailer. It also means lots of sand in the gears in terms of responsibility, speed of change and all the other things that agile development as a culture is supposed to avoid.

Probably for ORG there will be more than 20 major packages involved with some of the functionality existing on servers and some of it in the cloud and some of it on devices.

Unlike the UK, the ability of customers to interact with the platform is very limited. That's because about 50% of ORG customers are in NSW, where communicating meter penetration other than for solar systems is only about 15%. And it's no different in Queensland.

And, of course, Australia is not just Australia; it's NSW, Victoria, Queensland, etc. Each of these regions have separate requirements. For example, Victoria has a different default tariff regime.

In one sense, all ORG is doing is changing from one outsource provider to another. The question is whether it's more than that.

Assuming the process goes well, we expect ORG management to gradually open up about what is involved and the benefits. So far, ORG appears to be operating in accordance with the current best practice paradigm of establishing a standalone business ('Retail X') to undertake a buildup of ORG's business model. In accordance with Agile philosophy it builds a "minimum viable product" (MVP). Presumably this standalone business already has been handed some customers. After that it scales, iterates and grows a life of its own.

If ORG's model is shown to have competitive advantages, the other gentailers will follow. Definitionally, Kraken is never finished and never complete. Almost certainly the packages on the platform will continue to evolve.

Multi-sided platform: A business that operates a physical or virtual place (a platform) to help two or more different groups find each other and interact.

Two-step strategy: An ignition strategy in which the platform secures significant participation by one group and then secures participation by the other group by offering them access to the first group.

Scrum: One of the agile methodologies designed to guide teams in the iterative and incremental delivery of a product. Often referred to as "an agile project management framework," its focus is on the use of an empirical process that allows teams to respond rapidly, efficiently, and effectively to change. Traditional project management methods fix requirements in an effort to control time and cost; Scrum, on the other hand, fixes time and cost in an effort to control requirements. This is done using time boxes, collaborative ceremonies, a prioritised product backlog, and frequent feedback cycles. The involvement of the business throughout the project is critical, as Scrum relies heavily on the collaboration between the team and the customer, or customer representative, to create the right product in a lean fashion. Scrum was developed as a concept in about 1995.

Agile: Agile is the ability to create and respond to change. It is a way of dealing with, and ultimately succeeding in, an uncertain and turbulent environment. From a 2001 conference came the "Agile Manifesto" with 12 principles. Agile appears to be a philosophy of continuous development with the higher priority being to satisfy the customer through early and continuous development of valuable software. Business people and developers work together daily and projects are built around motivated individuals. ITK foot note: Since my whole career (in broking research and now consulting) was built around similar concepts, it's hard for me to get excited, but I do recognise it's not how software was done historically.

Django: A free opensource high level Python Web framework built around the actually not-so novel idea of reusable modules. Python is a modern computer language now very widely used, deceptively easy to learn.

Appendix 4: Rough P&L with estimates

No reliance should be placed either on the accuracy of the historic numbers and still less on the estimates. They have not been subject to investment banking standards of due diligence or reviewed by knowledgeable people. The number of shares on issue is only approximate.

ORG P&L										
Full year										
		FY15	FY16	FY17	FY18	FY19	FY20	FY21F	FY22F	FY23F
Gas gross profit	$m	521	522	528	649	715	744	600	550	550
Electricity gross profit		1289	1289	1426	1544	1390	1187	801	700	700
Solar & services		42	55	-9	11	26	33	48	55	55
Future energy costs						-15	-15	-25	-25	-25
Octopus							-4	-4	-10	-10
LPG gross profit		198	208	88	91	68	83	80	80	80
Operating costs		-790	-744	-541	-629	-610	-570	-520	-500	-500
Energy markets		1260	1330	1492	1651	1574	1459	980	850	850
Integrated gas		498	386	1104	1251	1892	1741	1200	1740	1740
Corporate		-96	-81	-66	-115	-275	-134	-95	-110	-110
EBITDA		1662	1635	2530	2787	3232	3141	2085	2300	2300
Depreciation		-618	-604	-477	-381	-419	-509	-560	-500	-500
ITDA		-62	-296	-925	-1194	-1510	-1303	-1000	-1200	-1200
EBIT		982	735	1128	1212	1308	1329	525	600	600
Net interest		-78	-100	-296	-270	-154	-126	-125	-125	-125
Tax expense		-291	-275	-279	-213	-64	-93	-31	-37	-37
Minority interests		-10	-6	-3	-3	3	3	0		
NPAT		603	354	550	910	1028	1023	369	438	438
Shares on issue	m			1753	1770	1770	1770	1770	1770	1770
EPS	c.p.s.	54	23	31	51	58	58	21	25	25
DPS	c.p.s.	25	10	14	22		25	20	21	21

Figure 29. ORG P&L, Source: Company, ITK