Australia's aluminium sector is on life support. It can and should be saved

Simon Holmes à Court Thu 31 Oct 2019 The Guardian Simon Holmes à Court is senior adviser to the Climate and Energy College at Melbourne University

- ***Technology and leadership could save thousands of jobs and accelerate Australia's energy transition***

'[Aluminium producer] Alcoa recently announced plans to lift the share of clean energy powering its global operations from 70% to 85%, as well as closing 1.5m tonnes of smelting capacity – equivalent to four smelters the size of their Portland facility in western Victoria.'

The Australian aluminium smelting sector is crawling through a dark tunnel. Looking far behind, it can just make out the starting point – cheap hydroelectricity. A short distance back lies the remains of competitively priced power from what were once young, government-owned coal power stations. Today it's inching forward, choking on its own emissions and struggling under the weight of uncompetitive prices arising from a decade of politicised mismanagement.

The sector is faltering, threatening the livelihoods of thousands of workers and their families.

There's no turning back, but fortunately there's light ahead – cheap, clean power – if only the sector can get to the end of the tunnel before it's too late.

Aluminium smelting is famously energy intensive. Old engineers wryly describe the lightweight metal as "congealed electricity" – the electricity required to make a single kilogram of aluminium could power an average house for most of a day, and we produce around 1.5bn kilograms of the stuff each year.

Increasingly aluminium is also seen as congealed emissions. Not long ago the sector didn't give a hoot about carbon dioxide, but investors are increasingly factoring in carbon risk, and boards are feeling the pressure.

Alcoa recently announced plans to lift the share of clean energy powering its global operations from 70% to 85%, as well as closing 1.5m tonnes of smelting capacity – equivalent to four smelters the size of their Portland facility in western Victoria.

The vulnerability of Alcoa's 33-year-old facility cannot be overstated. Electricity prices spiked with the abrupt closure of Hazelwood two years ago and remain stubbornly high. Ironically, the brown coal power from the Latrobe Valley that lured Alcoa to Victoria has become an achilles heel – it's likely that no other smelter in the world is fed by higher emissions electricity.

Without a miracle – of the government intervention variety – the Portland smelter will close. Thousands of jobs and the lifeblood of an important regional town will fall victim to Australia's non-existent industry and energy policies.

And what a dreadful shame that would be, so close to the end of the tunnel. Fast -forward a decade from now and emissions from Victoria's grid will be half of what it was a decade ago. A portfolio of wind and solar storage coupled with flexible load will deliver power significantly cheaper than our current grid. Australia will once again be competitive.

But first we need to cross a chasm, requiring technology and leadership.

Aluminium smelters are made up of long arrays of refining "pots" and generally require steady power year-round. A "potline" can use as much power as a small city, and very occasionally, when power is in short supply, a smelter may switch a potline off briefly – very briefly, as after about an hour without power their contents "freeze". Alcoa Portland experienced such an event in December 2016 after a fault on a transmission line cut power. The bailout to get the plant back on its feet and secure operation through to 2021 reportedly cost taxpayers more than $200m.

The Portland smelter operates in a very narrow band below 470MW, occasionally dropping as much as 8%. This small amount of flexibility is a modest but valuable contributor to grid stability, but sometimes the smelter can play a much bigger role.

Late afternoon on 24 January, after a run of unexpected coal power outages, the fine balance between supply and demand became precarious. In order to shore up the grid, Alcoa Portland was directed to successively turn off each of its two potlines for an hour, helping avert blackouts. Alcoa participated in the scheme voluntarily and was paid handsomely for its service.

The next day, a steam leak forced the Loy Yang A coal power station to abruptly reduce power. This time, due to technical constraints, Portland couldn't help and the "involuntary load shedding" was instead spread across thousands of households. With more flexibility, Portland could have kept the lights on.

And here is where New Zealand company Energia Potior may hold the keys to the future of aluminium in Australia with a technology that allows smelters to operate with much greater flexibility.

By retrofitting pots with enhanced temperature regulation – an insulated, heat-exchanger jacket – whole potlines can operate indefinitely within a range 25% below to 25% above their normal operating point. Most of this demand "swing" can occur instantly, providing a highly valuable service to the grid, much like the Tesla megabattery in South Australia has been profitably providing for almost two years.

Energia Potior claims the enhanced temperature regulation delivers at least a 2.5% increase in energy productivity, but the real value comes from the grid services. The company's global head of strategy, Geoff Matthews, points to an International Energy Agency report claiming the technology has a 1.5-year payback period. Matthews claims that due to Australian market conditions, the payback here would be measured in "months, not years".

The technology, named EnPot, has been fitted to Trimet's 120-potline in Essen, Germany, where it has reportedly increased production efficiency by 7.8% and created a new grid services business for the family-owned metals company.

Matthews goes on to claim that "if you were building a large-scale renewable energy grid today, you'd want a flexible aluminium smelter as a cornerstone off-taker", and I have to say I agree.

I'm reminded of Rottnest Island off Perth, where a desalination plant was upgraded to allow multiple levels of power demand. The large, flexible load allows the island's microgrid to achieve 45% renewable energy without any storage, almost halving their diesel bill and carbon emissions. Similarly, smart money in Australia is looking at hydrogen electrolysers that earn extra revenue from helping to balance the grid.

Proponents often liken features of these large loads with batteries. Of course they don't store energy but they provide the same service of aligning supply and demand, the real challenge of running a grid with high levels of variable wind and solar. And they produce valuable products – aluminium, potable water and hydrogen – in the process.

So here's the pitch. Australia has four aluminium smelters. If we do nothing, they'll disappear as part of the ignoble de-industrialisaton of Australia. Thousands of jobs will be lost permanently, unlikely to ever return. And with them, a massively valuable grid stabiliser will slip through our fingers.

Instead, let's invest to make these smelters more flexible. Let's upgrade them so they add value to the grid just as they add value to the communities in which they operate. Let's use the proven capabilities of the Clean Energy Finance Corporation to put together a competitive energy supply portfolio that beats Alcoa's emissions targets. A one-time hand up, not a handout.

As the Beyond Zero Emissions thinktank demonstrated in their Renewable Energy Superpower report, Australia can be the preferred destination for energy-intensive manufacturing in the unfolding low-carbon global economy.

(Sceptics: pause for a second and consider that Sanjeev Gupta's Liberty Steel Group, owner of the Whyalla steelworks, announced on Tuesday a target for carbon neutrality by 2030. The company will be using electric arc furnaces and exploring hydrogen steelmaking to bypass the coking coal traditionally thought inseparable from steel-making.)

It's a tad ironic that EnPot's smelter flexibility technology was originally developed with funding assistance from Rio Tinto and tested on their Boyne smelter in Gladstone. Sadly the resources giant let the technology's development go offshore. But with new technologies, we can stop the smelting sector from following.

An energy-intensive 20th century industry is providing us with a limited time opportunity to address price, reliability and emissions while orienting our economy for the 21st century.

Keeping global heating to 1.5°C requires that every coal-fired potline in the world is either repowered or shut down well before 2050. With our unparalleled clean energy resources, technology and leadership, Australia and its smelter workers can emerge on top.

https://www.theguardian.com/commentisfree/2019/oct/31/australias-aluminium-sector-is-on-life-support-it-can-and-should-be-saved

Trimet Starts Trial Operation of its “Virtual Battery”

June 10, 2019

Trimet converted 120 electrolysis furnaces in its Essen aluminium smelter to trial operation as a virtual battery.

Trimet Aluminium SE began trial operation of its “virtual battery,” a technology aimed at making the energy intensive smelting process more flexible. The aluminum electrolysis process has traditionally required a constant supply of energy to remain stable, but this new approach allows for variations in energy input and more control over the smelting process.

“We have reinvented the electrolysis process for the production of aluminium. For the first time, we will be able to vary the energy supply during operation significantly. This will allow us to react to changes in the electricity supply, which will benefit the power supply to households in Essen,” says Philipp Schlüter, CEO of TRIMET. “As an aluminium producer, we are naturally an energy-intensive company. As such, however, we are also a valuable partner for the energy revolution.”

The €36m trial installation converted a total of 120 furnaces in hall one of its Essen plant, which will be able to consume either 25% more or 25% less energy for up to 48 hours. The energy requirement can also be reduced to zero for up to an hour, if necessary. This means up to 2,000 MWh of electricity can be stored for use in the energy revolution.

The “virtual battery” creates a huge power storage facility — with the capacity of medium-sized pumped electrical storage — which makes it easier to take advantage of peak power prices and to integrate inconsistent energy flows from renewable energy sources, such as wind and solar, into the power grid.

Trimet and Bergische Universität Wuppertal developed a controllable heat exchanger that keeps the temperature in the furnace constant despite an unsteady energy supply. The aluminum company also signed a license agreement with Energia Potior Limited for use of EnPot shell heat exchanger technology, which will be expanded to all four smelters following the trial phase.

https://www.lightmetalage.com/news/industry-news/smelting/trimet-starts-trial-operation-of-its-virtual-battery/

Background

The smelter in Germany has historically worked almost 100% with no real energy flexibility. This company has another 2 smelters in Germany and another in France.

Retrofitting an old smelter.

Testing a pilot scale for several years on individual reactors and more recently a whole pot-line (one of three). At the stage of using this buffering interacting with the grid now about the service they can provide, pilot has been funded by the State government.