

The role of aluminium smelters in decarbonising our future

Will our quest to decarbonise lead us to an energy-rich future, and what role can primary aluminium smelters play? **Geoff Matthews***, Future Aluminium Forum Advisory Board member, says there is significant commercial opportunity for smelters as we seek a low emissions future, but warns that flexibility is key.

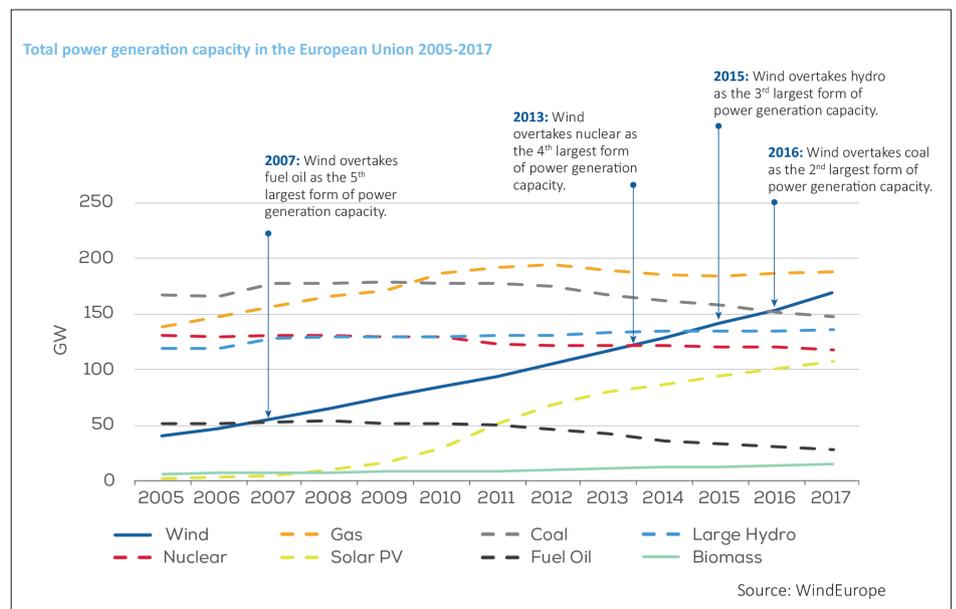
I recently visited a smelter where proudly displayed on the middle of the boardroom table was a very large piece of coal. The person escorting me in said, "that's there to show politicians what an aluminium smelter needs to run on."

The statement took me by surprise, and hours later I was still processing all of what it encapsulated. For such a simple statement it encompassed so much, and while it is wrong on several levels, the statement probably sums up where we sit as an industry today, and the problems we are facing.

I believe we are at a cross roads; with some wanting to stay in the past, some wanting to move forward, and others hoping things will remain the same. Given the decade we have had since 2007, and the changes going on around us, I think all three positions are somewhat understandable.

Just over 25% of our industry is blessed with being able to make low carbon emissions aluminium from geothermal and hydro generated electricity, and they are trying to distance themselves from the 75% who can't. You can't really blame them.

But it means we now have green, brown



and black aluminium.

While this is going on, the industry bodies are trying to distract the market away from the 75%, by focusing on the decarbonising effect that aluminium can play in the light-weighting of just about everything, its recyclability, and by

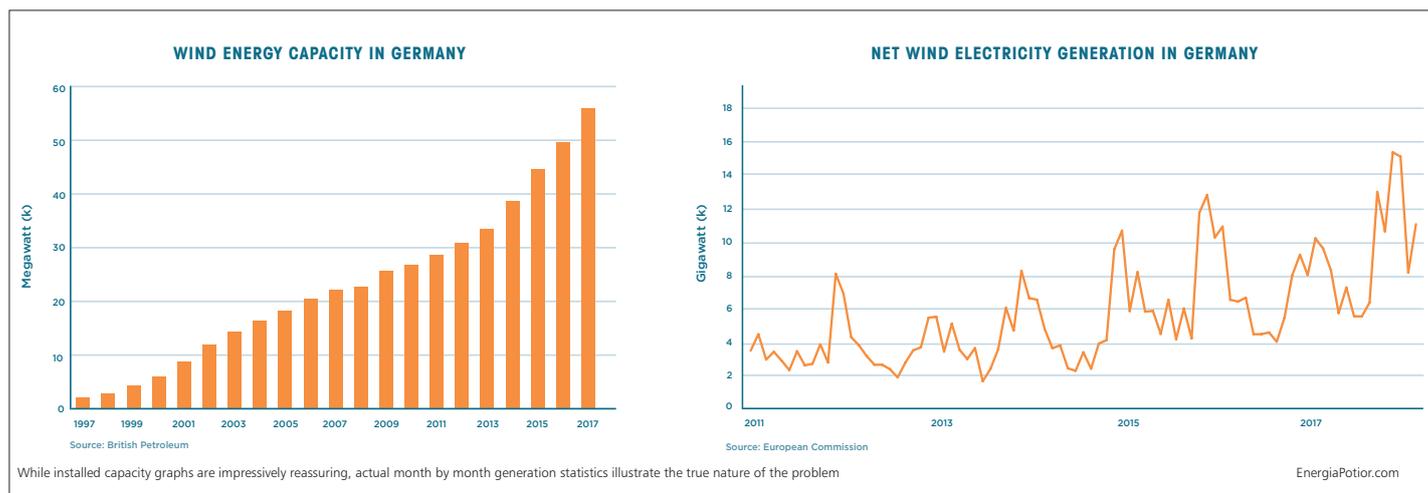
certifying good stewardship. And so they should, these are extremely important points.

But this begs the question; what are we doing about the 75% who are reliant on fossil fuels and nuclear for power generation?

According to the IEA, under the New Policies Scenario

- Electricity generation is the rising force among worldwide end-uses of energy, making up 40% of the rise in final consumption to 2040 – the same share of growth that oil took for the last twenty-five years and marks the end of the boom years for coal.
- Renewables capture two-thirds of global investment in power plants as they become, for many countries, the least-cost source of new generation
- Natural gas becomes the largest single fuel in the global mix in the Sustainable Development Scenario (providing action is taken to minimise leaks of methane)
- Improvements in efficiency play a huge role in taking the strain off the supply side: without them, the projected rise in final energy use would more than double.
- In the European Union, renewables account for 80% of new capacity and wind power becomes the leading source of electricity soon after 2030.

*Global Head of Strategy at Energia Potior Ltd



An Energy Rich Future? Some (strange) facts about the renewable energy around us.

- It has been estimated that if all the sunlight energy striking the Earth's surface in Texas alone could be converted to electricity, it would be up to 300 times the total output of all the power plants in the world.
- Studies of the available wind energy resource (using existing wind generation technology) puts the potential at between 10 and 20 times the world's total annual energy consumption.
- The energy potential of the ocean's waves and tidal flows is roughly three times the global electricity supply in 2008.
- The heat energy contained in the upper six miles of the earth's crust is estimated to be 50,000 times larger than the amount contained in all the world's oil and gas reserves combined.

After-all, as my colleague Dr. Mark Dorreen says, "someone needs to use the high CO₂ aluminium." As recent events have shown us, aluminium has a price corridor it needs to operate within to stay relevant as a material. It's the 75% that keeps the 25% within that corridor. Too much scarcity would drive the price to the point that the world would look to competing materials to fulfil the roles that aluminium plays today. This can be worse than oversupply in some ways, as once some applications change to other materials, there may be no coming back for aluminium.

Furthermore, I don't believe that the magnifying glass of public scrutiny has yet fallen on some of the claims of low CO₂ aluminium. There are a few who are exclusively using hydro, while forcing others on the same grid to burn coal. It won't take long before the public decide this is not a sustainable position.

There is a potential upside for smelters in this position however, and that is if a smelter in this situation were to modulate energy consumption, it would enable an increased percentage of renewables to be used in the rest of grid. In this case, it could be argued that the aluminium being produced is ultra-low CO₂ aluminium, as not only is the aluminium being made from renewable generation, the smelter is also

helping with the overall decarbonisation of the grid; 'double-green' so to speak.

Lastly, the statement I referred to in the opening paragraph also alludes to the historical purchasing and political power that comes with size. There is no doubt that aluminium smelters are huge generators of economic activity, and have been the

I have no doubt that grid-connected aluminium smelters, which can modulate energy consumption, can play a role in helping with decarbonisation.

A generational change

At the Future Aluminium Forum held in Milan earlier this year, I said the energy

It's possible that no one on the planet will be unaffected by the changes to our energy systems over the next 20 years

biggest users of electricity on the block, so to speak. But with decarbonisation, will the needs of a few override the wishes of the many?

As an industry we have flown under the radar for a very long time, but now some of the biggest brands on the planet, and some of our biggest customers, are starting to weave a sustainability story that involves us. Aluminium smelting cannot afford to ignore or be isolated from its consumer base when it comes to decarbonisation.

I believe the answers for aluminium smelting (indeed all large electricity users) will be to embrace the change going on around us, and look for the opportunity that lies in becoming an integral part of the energy transition.

use of primary aluminium production will have to change, because everyone and everything else around us will have, and our consumers will expect us to as well.

Electricity, the second largest cost input into making aluminium, is undergoing a rapid transition towards zero carbon emissions. Under all climate friendly future scenarios, including those of the International Energy Agency (IEA), electricity generation becomes largely CO₂ free by 2060 .

Only a short time ago the naysayers would shake their heads and say the capital cost for a transition to renewables was too high. This is no longer the case, and already in 2016 wind power became the 2nd largest form of power generation capacity in the EU.

However, the problem of intermittency of generation is still with us, and is not currently matched by the tools required to balance it out across the grid.

Wind power accounted for 18% of

Currently we are building capacity to compound a problem that we haven't yet got solutions to

installed electricity capacity in the EU in 2017, but only 11.6% of the annual generation.

We are currently 'technologically short' when it comes to technologies that can help with demand response. Or put another way; we are currently building capacity to compound a problem we haven't yet got solutions to.

When you consume power is fast becoming as important as how much you consume. Demand response will become king.

This is where modulating aluminium smelters can help with decarbonisation.

Whoever solves the problem wins

It is unthinkable to believe that the power pricing and contracts we enjoy today can remain intact. In fact, it may be detrimental for aluminium smelting to do so.

The electrification of industry that is predicted to go hand in hand with the increased use of renewables, also has the potential to challenge the privileged leverage-position aluminium smelting now enjoys as a large-user.

Other sizable players are predicted to come into the electricity market. Players who can use flexibility of consumption

as leverage, alongside their size. In fact, decarbonisation can't happen without it.

Historically, industry has used fossil fuels as a direct source of energy, as electricity generation from fossil fuels was inefficient and therefore too expensive for most industrial processes, especially for process heat, which accounts for the bulk of industry CO₂ emissions.

A staggering 75% of the total energy used in industry is for process heat, with over 50% of this being for medium to low grade requirements (under 400°C). Currently less than 10% of the total process heat requirements of industry is being met by electricity. Renewable power generation offers industry the prospect of electrification.

This means competition from other industries for each kilowatt-hour is set to increase, but it won't be for the most expensive kilowatt, or even competition for contracted kilowatts. It will be for zero or negatively priced kilowatts, as there will be times in a grid heavy with renewables (and plenty of them) when there is too much generation in the grid.

New players will be eyeing this over-generation and sensing opportunity like sharks sensing blood in the water.

Will aluminium smelting sit on its hands and let new players enter the market and absorb all the low-cost power? You would hope not, as bolt-on modulation technology exists today that would allow smelters to out-manoeuvre any new players before they even enter the market.

If I were designing a heavily renewables supplied grid from scratch today, I would have an aluminium smelter as a cornerstone partner. Not only does a smelter provide resilience and stability to the grid, it can also act as a virtual power plant to liberate energy back when there is under-generation, as well as soaking up the excess during over-generation.

This grid-balancing role is critical if we are to successfully decarbonise the energy grid, and in doing so, provide industry itself with a pathway to decarbonisation through electrification.

However, as I said at the Future Aluminium Forum; technology only enables the solution, it is people that ultimately solve the problem. ■