



A pioneer of electrification explains to Louise Davis why a sea change in mindset surrounding industrial processes is necessary if manufacturers are to continue providing the world with the products and materials it needs

An industrial **revolution**

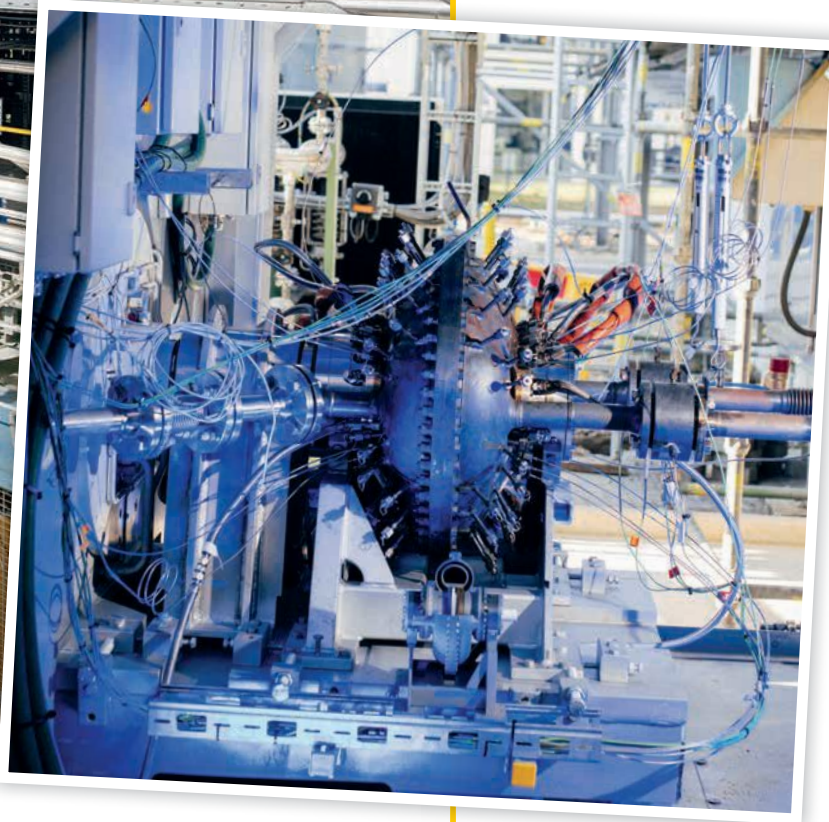
Given that he is not a politician, Joonas Rauramo, CEO of Coolbrook, spends a surprising amount of his time on lobbying activities. Rauramo is in no doubt that a revolution is needed; he just needs to encourage various parties to catch up with his way of thinking. The transformation Rauramo is calling for concerns industrial processes and he believes that electrification – which broadly refers to replacing CO₂-

emitting processes with alternatives that run on electricity alone – will prove to be the enabler here. “The need for a revolution in industrial processes stems from the urgent challenge of climate change and heavy industry’s contribution to global greenhouse gas emissions,” begins the green-tech expert. “Sectors such as steel, cement and petrochemicals are foundational to modern society but are also among the most carbon-intensive, responsible for

nearly a quarter of all global emissions. As global demand for these materials continues to rise, the traditional reliance on fossil fuels for heat generation becomes unsustainable.” For Rauramo, the solution is clear: “Electrification offers a transformative pathway to decarbonise these processes by shifting from fossil fuel-based energy sources to renewable electricity,” he states. “This transition not only reduces emissions but also enhances



Left: To develop its technology, Coolbrook is operating a RotoDynamic technology pilot plant at the Brightlands Chemelot Campus in Geleen, the Netherlands, in the heart of the petrochemical industry



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effectively a reverse turbine, where gas is heated to a supersonic velocity and then rapidly slowed in a diffuser to subsonic velocities. The initial product development began a few years ago and Rauramo reports that his team has considerable strides in advancing the commercialisation of these technologies.

“We have finalised the design of our first commercial RDH product, capable of reaching temperatures up to 1,000°C and a thermal power of 10MW,” he confirms. “We have completed large-scale pilot demonstrations at our facility, which confirmed the RDH’s ability to achieve these temperatures and powers with 95% energy efficiency. These results are a major milestone, validating the technology’s potential to cut global industrial CO₂ emissions by a third (two giga-tonnes).”

The company is now evaluating the technology’s integration into operational environments with its partners, including the likes of Shell, Sabic, Braskem, Ultratech Cement, CEMEX and JSW. “These collaborations are crucial as we move towards large-scale deployment at customer sites. Full commercial rollout is expected by 2025,

efficiency and scalability. Technologies such as our RotoDynamic Heater (RDH) can achieve the high temperatures required for industrial processes using renewable electricity instead of fossil fuels, with up to 95% energy efficiency. By electrifying these processes, we can maintain the production of critical materials while moving towards net-zero emissions, ensuring both environmental sustainability and economic viability.”

DYNAMIC DETAILS

As well as the abovementioned RDH product, Coolbrook has also developed the Roto Dynamic Reactor (RDR). These technologies work via what is

Above: In 2023, the pilot’s first phase successfully demonstrated RDH technology’s capabilities for industrial use in high-temperature process heating

Right: Joonas Rauramo, CEO, Coolbrook





marking a significant step towards widespread adoption of our technologies across multiple heavy industries," reveals Rauramo.

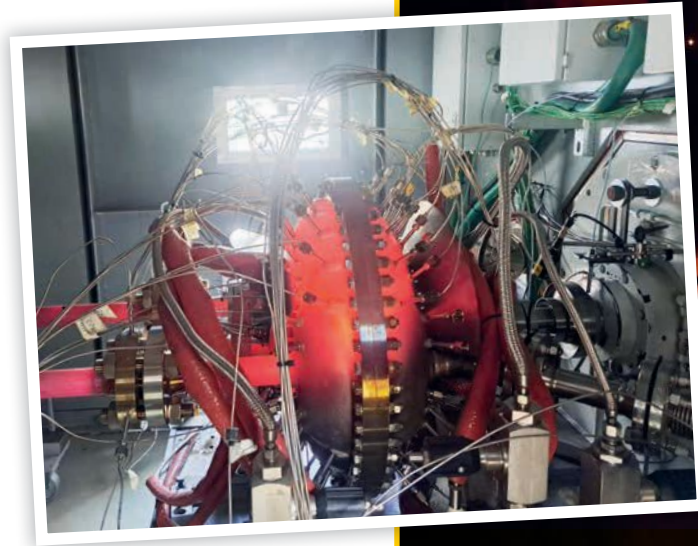
CONCRETE EXAMPLES

Coolbrook's cement-sector partners illustrate that this is one industry ripe for innovation and where Rauramo expects a good deal of business to come from. But what other industries also stand to gain by going electric? "Beyond the cement industry, the steel and petrochemical sectors are two prime examples where electrification can make an impact," Rauramo feels. "In the steel industry, RDH technology can be used across different production processes (eg. blast furnace, direct reduction of iron or recycled steel production). In blast-furnace based processes, preheating of combustion air and providing heat for coke production are traditionally reliant on fossil fuels and have enormous carbon footprints. With technologies such as the RDH, these processes can be electrified, achieving the necessary temperatures using renewable electricity. This shift drastically reduces the industry's reliance on fossil fuels and cuts down CO₂ emissions, while also improving process efficiency and stability."

In the petrochemical industry, the production of olefins such as ethylene and propylene requires high temperatures and is a major source of CO₂ emissions. According to Rauramo: "RDH can electrify this process, using electricity to achieve the same high temperatures needed for steam cracking without burning fossil fuels. This not only reduces emissions but also considerably improves product yields and reduces operational costs."

The benefits of electrification across many industries are clear if yet relatively unproven – and Rauramo acknowledges that achieving his desired revolution will require patience. "Our approach to electrification recognises the practical realities faced by industrial manufacturers," he reasons. "It's not feasible to shut down operations entirely to switch over to new technologies; rather, the transition needs to be gradual

Right: The steel industry is a prime example of a sector where electrification can lead to enormous benefits



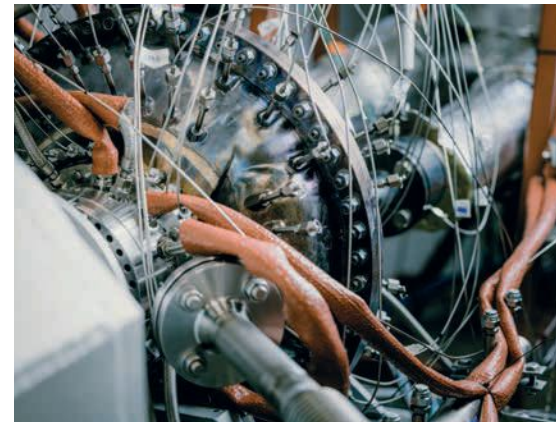
Above: The successful pilot means that the technology can move forward to industrial-scale projects at customer sites

Right: Coolbrook says that the RotoDynamic Heater (RDH) is the only technology in the world able to reach high-temperature heat, up to 1,700°C, powered by electricity and without burning fossil fuels



and strategic. This is where hybrid setups become incredibly valuable, allowing companies to integrate new electric technologies alongside existing systems, reducing emissions step by step while maintaining production continuity."

Rauramo says that both of Coolbrook's solutions – the RDH and the RDR – have been designed with this flexibility in mind. They can be retrofitted





Left: *The RotorDynamic Reactor (RDH) has been designed to enable a hybrid approach and can therefore be retrofitted into existing plants*



into existing plants, operating alongside traditional fossil fuel-based systems in a hybrid model. "For example, in steel manufacturing, the RDH can be used to preheat combustion air or scrap metal, which reduces the energy demand on fossil fuel burners," he explains. "Over time, as confidence in the technology grows and as more renewable electricity becomes available, these electric

systems can gradually take on a larger share of the energy load, moving the industry closer to full electrification."


A hybrid approach not only minimises disruption but also allows manufacturers to optimise the return on investment by progressively reducing fossil fuel dependency and lowering the cost of decarbonisation per tonne of material produced. "This strategy ensures that the transition to a net-zero global economy is both feasible and sustainable in the long term. Governments and industries need to set ambitious long-term targets and act upon them in a decisive manner and RotoDynamic technology is there to support the required change," emphasises Rauramo.

RISK VERSUS REWARD

Developing strong technology is one thing, but selling and marketing it to industries that are either completely against any form of downtime (i.e. most manufacturing operations) or are slow to adopt new technologies (e.g. cement, aggregates) is another. But Rauramo is confident that widespread adoption will soon follow the initial deployments. "Our technology is based on advanced turbomachinery concepts that have been refined over decades. Given the strong positive business cases we have identified in multiple industries, we see that our partners and customers are increasingly willing to take on additional risk to achieve these benefits." Elaborating on this, Rauramo adds: "Our

plan is to start from use cases where the downtime risk is either limited or can be effectively mitigated. In practice, this means using our technology outside of the continuous process, such as in drying of materials, or by retaining existing burners on the equipment to ensure continuous operation."

Could legislation be another enabling factor here? Rauramo feels it might: "Currently, there are areas in the world where electrification already offers a strong positive business case – such as low electricity price, significant cost for CO₂ emissions, and green electricity grid mix," he says. "In these areas, we believe electrification will take place regardless of regulatory changes. However, in areas where these conditions are not yet met, regulation will be crucial. For the world to reach the targets set in the Paris agreement, it is essential to pass legislation that lowers electricity costs, increases the share of CO₂-free power, and imposes meaningful costs on emissions."

In the meantime, Rauramo is happily observing that multiple industrial players – "leaders in their respective fields" – are now willing to become forerunners in decarbonisation efforts alongside Coolbrook. And with an eye on the longterm benefits, he also remarks that, "The early adopters share our view that being a leader in decarbonisation efforts, and taking a calculated risk, can also create competitive advantage and prove to be a clear market differentiator further down the line." 

WHAT'S NEXT?

When asked about the next stages of his electrification revolution, Joonas Rauramo begins by saying that Coolbrook is committed to starting a clean, new industrial era. "For us, this means achieving higher temperatures and greater thermal capacities. We are advancing the development of our next generation RDH, which can tackle the most demanding applications in our target industries. This product will be available soon. Simultaneously, we are continuing to develop RDR into a commercial product for the petrochemical industry".

And he reports positive signs coming from outside his own company, too. "Our partners, along with our broader target industries, have shown great interest in utilising our technology as a key enabler of their complete decarbonisation," he says. "We have completed tens of feasibility studies indicating the clear advantages our technology offers to our customers. The industry is eagerly awaiting the full commercial readiness of RotoDynamic technology. We are currently anticipating the first units to be operational in 2025."