FT Series **Climate control**

Climate change

Cleaning up steel is key to tackling climate change

Technology to make grey metal green will not be rolled out commercially until 2030s

The steel sector is the single largest industrial source of climate pollution

Michael Pooler in IJmuiden, the Netherlands JANUARY 1, 2019

Behind sand dunes on the Dutch North Sea coastline, clouds of smoke and steam billow from the mass of chimneys, pipes and cranes that form the imposing IJmuiden steelworks.

Deep inside this vast industrial complex, which for almost a century has churned out metal for cars, construction and food cans, an experimental project is under way — to make steel cleaner and cheaper.

The plant's owner, the Indian conglomerate Tata, calls its novel process a "game changer" capable of reducing both carbon dioxide emissions and energy consumption by one-fifth.

"There is a very big duty for us, as the steel industry, because we are one of the biggest CO2 producers," said Hans Fischer, the chief executive of Tata Steel Europe.

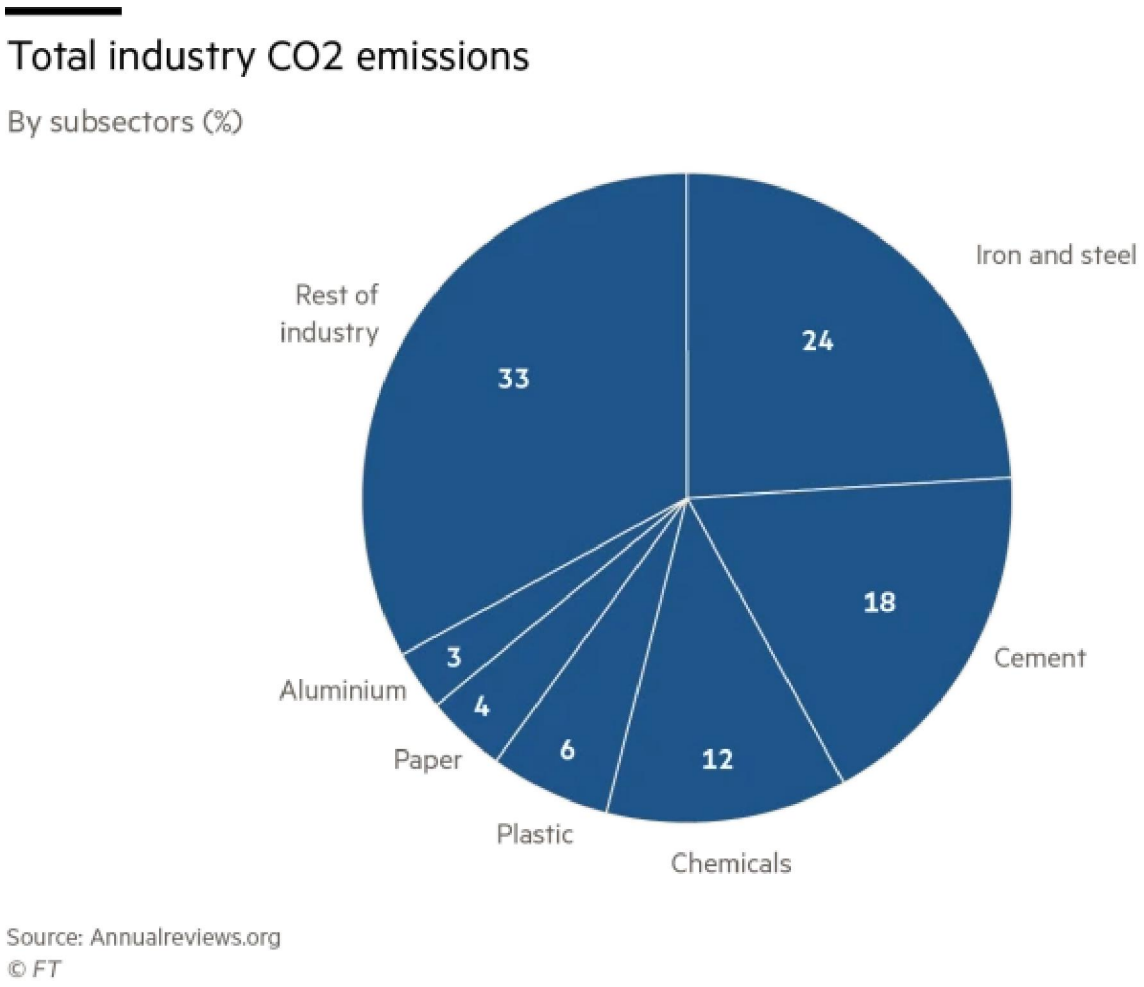
But despite more than a decade of gestation, this new steelmaking technology is unlikely to be rolled out on a commercial scale until at least the 2030s.

"It's not a financial reason, it is not an investment reason. In fact, it's for technical reasons that it takes that long," explained Mr Fischer.

At a time of renewed international efforts to avert environmental disaster, the slow pace of progress illustrates the huge task to overhaul a monolithic sector that is the single largest industrial source of climate pollution.

Globally, steel is responsible for 7 per cent to 9 per cent of all direct emissions from fossil fuels, with each tonne produced resulting in an average 1.83 tonnes of CO_2, according to the World Steel Association.

And as the world's population grows, demand is only predicted to increase.



"It's very clear that if we want to reach [emissions reduction targets] and keep global warming to 2C, steel would also need to become more or less emissions-neutral," said Nicole Voigt of Boston Consulting Group.

The goal of policymakers, who negotiated the UN Paris agreement on climate change in 2015, is to ensure global temperatures do not rise more than 2C above pre-industrial levels.

Yet even as producers of the grey metal develop a spectrum of new technologies, from dealing with waste gases to rethinking core metallurgical equations, experts say a large-scale decarbonisation of the industry remains decades away.

As a basic material central to the modern economy, which is also the most traded commodity after oil, perhaps the greatest challenge is to deliver so-called green steel at a competitive price.

"In principle there are technology routes to lower emissions from steelmaking," said David Clarke, head of strategy and chief technology officer at ArcelorMittal, the world's largest producer by

tonnage. The catch, he added, was that "society would have to accept higher costs of steel production".

The traditional method for making iron and its tougher alloy steel, smelting raw materials at extremely high temperatures, has not fundamentally changed since the grey metal became widespread more than 150 years ago. Large blast furnaces rely on coke, a carbon-rich fuel made from coal, to reduce iron ore into liquid metal, which is refined into steel.

A large-scale decarbonisation of the industry remains decades away © PA

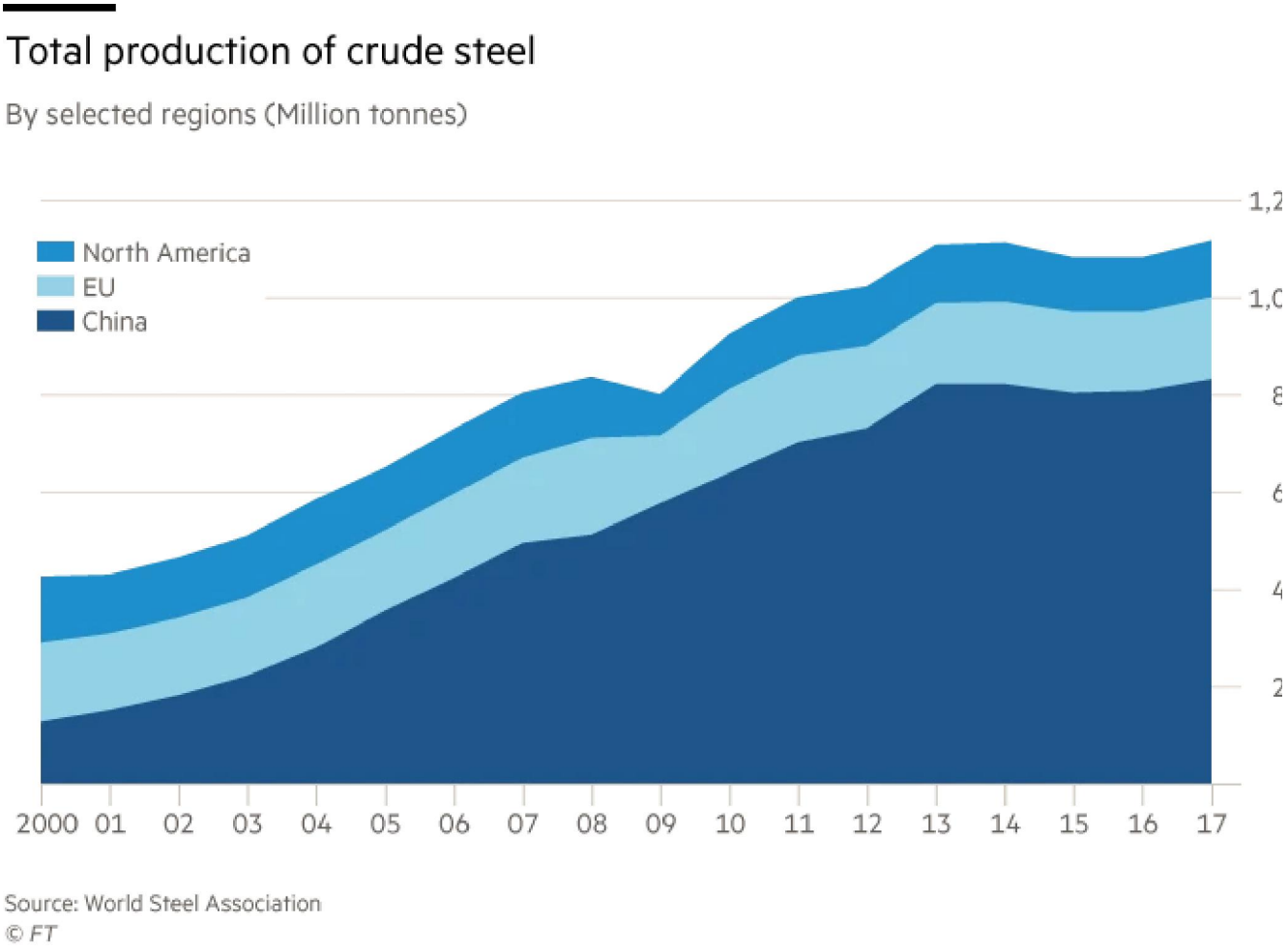
Despite substantial efficiency improvements over the years, the laws of chemistry mean that carbon dioxide is an unavoidable output of this reaction.

"There are two ways you could reduce the carbon footprint," said Ms Voigt. "One is you avoid CO2 in the steel production, so you try to use either scrap, or something other than carbon as a reductant agent.

"Or, you use end-of-pipe technology, which is carbon storage or usage. The question is which way to go — it's still debated, though you could argue [the latter] is more feasible."

A well-established alternative to blast furnaces are electric arc furnaces (EAFs) that melt down scrap, instead of using raw materials. EAFs are smaller, less expensive and, because they do not consume coke, pump out less CO2 than blast furnaces. They already account for about one-quarter of global steel output.

However, renewable energy sources alone cannot meet their enormous electricity demands — enough to power a town of 100,000 people. Another limitation is the supply of scrap, while the grades produced in EAFs are often not the right quality for certain applications, like automotive.



For many in the steel industry, the holy grail lies in finding a less polluting way of extracting iron from its ore.

“This is the real challenge for steelmakers. It’s not just about being more efficient,” said Chris McDonald, chief executive of the UK-based Materials Processing Institute, a research organisation.

“There’s a chemical reaction happening and so you need the carbon, but hopefully one day you could get hydrogen to do that job.”

With its potential to eliminate virtually all carbon emissions from the ironmaking stage, some companies are trying to make hydrogen-based steel economically viable.

Swedish steel group SSAB is building a €150m pilot facility, scheduled for 2020, that would make the Nordic country the first to manufacture the metal without fossil fuels.

Hydrogen produced by electrolysis from Sweden’s abundant renewable energy resources will be used to reduce ore into a product called sponge iron, which can be converted into steel through arc furnaces.

But clean hydrogen production is expensive and would require a huge expansion of renewable energy generation capacity. South Korea’s Posco and Voestalpine of Austria are pursuing similar projects, although the latter said it could take two decades to become reality.

Until then, steelmakers are taking intermediary steps. Tata's system removes several stages of pre-processing raw materials and, if combined with the capture and storage of waste gases, the company said it could lower CO_2 emissions by 80 per cent.

ArcelorMittal is backing a €150m project that deploys microbes to convert waste carbon monoxide gas into bioethanol, which could be used as transport fuel or in plastics. Another initiative aims to substitute coke in blast furnaces with biocoal made from waste wood.

While several projects in Europe have received public funding, industry figures point out the amounts are dwarfed by subsidies for renewable energy.

Sceptics also say that as long as some countries do not incentivise steelmakers to change tack, there is the risk that cheaper — and dirtier — material floods regions, such as the EU, where companies are charged for emissions, undermining their ability to invest in clean technologies.

"This makes steel one of the largest dilemmas from an international CO_2 reduction perspective, because it is one of the few industries where . . . you need equal effort around the world, otherwise you get significant trade imbalances," said Jens Burchardt of Boston Consulting Group.