Climate Change and the Production of Iron and Steel: an Industry View

Åsa Ekdahl | Head, Environment and Climate Change

World Steel Association (worldsteel)

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Disclaimer

worldsteel – who we are

The World Steel Association (worldsteel) is a non-profit organisation.

It has headquarters in Brussels, Belgium. A second office in Beijing, China, opened in April 2006.

worldsteel represents steel producers, national and regional steel industry associations, and steel research institutes.

Members represent around 85% of global steel production.

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Today’s speaker

Åsa Ekdahl, Head, Environment and Climate Change.

Ms Ekdahl has been with worldsteel for 13 years, with previous experience at EUROFER, the European Steel Producers’ Association and Jernkontoret, the Swedish Steel Producers’ Association.

Ms Ekdahl holds a degree in Environmental Science from the Gothenburg University, Sweden.

Presentation outline

- State of play
- Part of the solution
- worldsteel's 3-step approach
- A portfolio of technology options
- Partnerships and enabling framework

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State of play

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The Paris Agreement

- The Paris Agreement is a legally binding international treaty on climate change.
- It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016.
- Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

The debate has moved on

- **Focus almost completely shifted to 1.5 degrees**
- **Spreading commitment to net zero by second half of the century**
  - 2050 – EU, USA, South Korea, Japan, UK, Canada
  - 2060 – China, Brazil
  - 75% of 2021 global steelmaking capacity is in countries with net zero targets for 2050 or 2060
- **“Decarbonisation of hard to abate sectors” in focus**
  - After energy and transport
  - Steel, Cement, Chemicals, Aluminium, Heavy Transport

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A call for industrial transformation

Decarbonizing industry will take time and money—but here's how to get a head start

The Hard-to-Abate sectors need innovation solutions to reach Net-Zero Co2 Emissions

Decarbonising hard to abate sectors for the net-zero energy transition

How far off is the steel industry from decarbonising?

What is the best pathway to decarbonise the steel industry?

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Steel companies' commitments

SUSTAINABLE BUSINESS JANUARY 21, 2021 / 5:42 AM / UPDATED A MONTH AGO

China's top steelmaker Baowu Group vows to achieve carbon neutrality by 2050

United States Steel Corporation Announces Goal to Achieve Carbon Neutrality by 2050

Auto News / Latest Auto News / Auto Components

Tata Steel says edging towards carbon neutral goal in UK

Tata Steel has claimed to be taking various initiatives to make its European business carbon neutral by 2050.

PTI • May 02, 2020, 09:30 IST

Press Room > Press Release

POSCO Pledges to Achieve Carbon Neutrality by 2050 And Lead Low Carbon Society

2020/12/16

Nippon Steel, Number Three Steelmaker Globally, Officially Commits to Carbon Neutrality

DECEMBER 11, 2020 | CLEAN ENERGY, STEEL, JAPAN

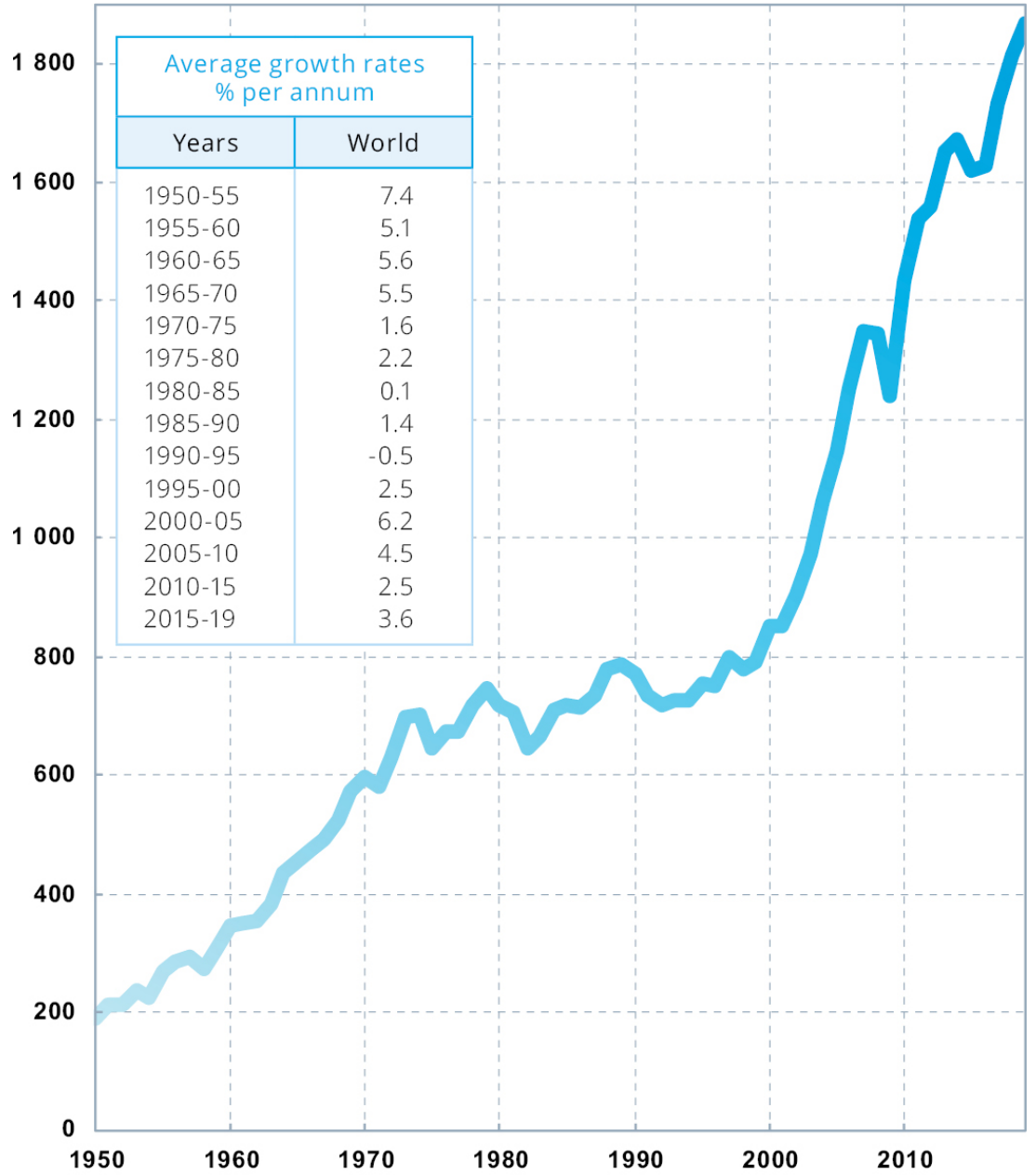
The JFE Group's Medium- to Long-term Vision

Aiming to Reduce CO_2 Emissions by 20% or More by FY2030 and To Be Carbon Neutral After 2050

The scale of the challenge

In 2020, on average, every tonne of steel produced led to the emission of 1.85 tonnes of CO_2.

In 2020, the total direct emissions were of the order of 2.6 billion tonnes, representing between 7% and 9% of global anthropogenic CO_2 emissions.



Part of the solution

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Part of the solution

Promoting material efficiency and the circular economy

Reducing our own impact

Developing advanced steel products to enable societal transformation

worldsteel's 3-step approach

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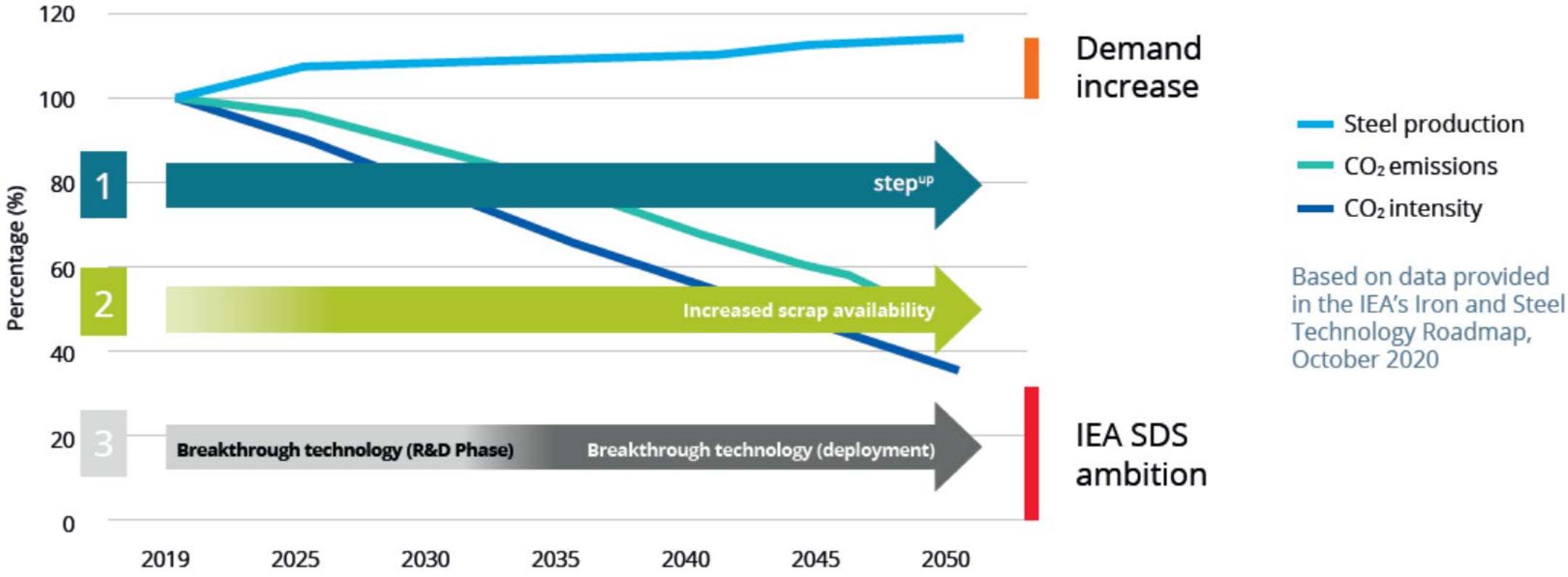
IEA scenario and our approach

Steel production, total CO_2 emissions and CO_2 intensity, 2019 - 2050 under the International Energy Agency (IEA) Sustainable Development Scenario (SDS)



Based on data provided in the IEA's Iron and Steel Technology Roadmap, October 2020

1. step up

Industry programme that supports improvements in mill operations to efficiency levels in line with the steel industry's top performers

- Optimal raw materials selection and use
- Increasing energy efficiency and minimising waste
- Improving yield
- Improving process reliability

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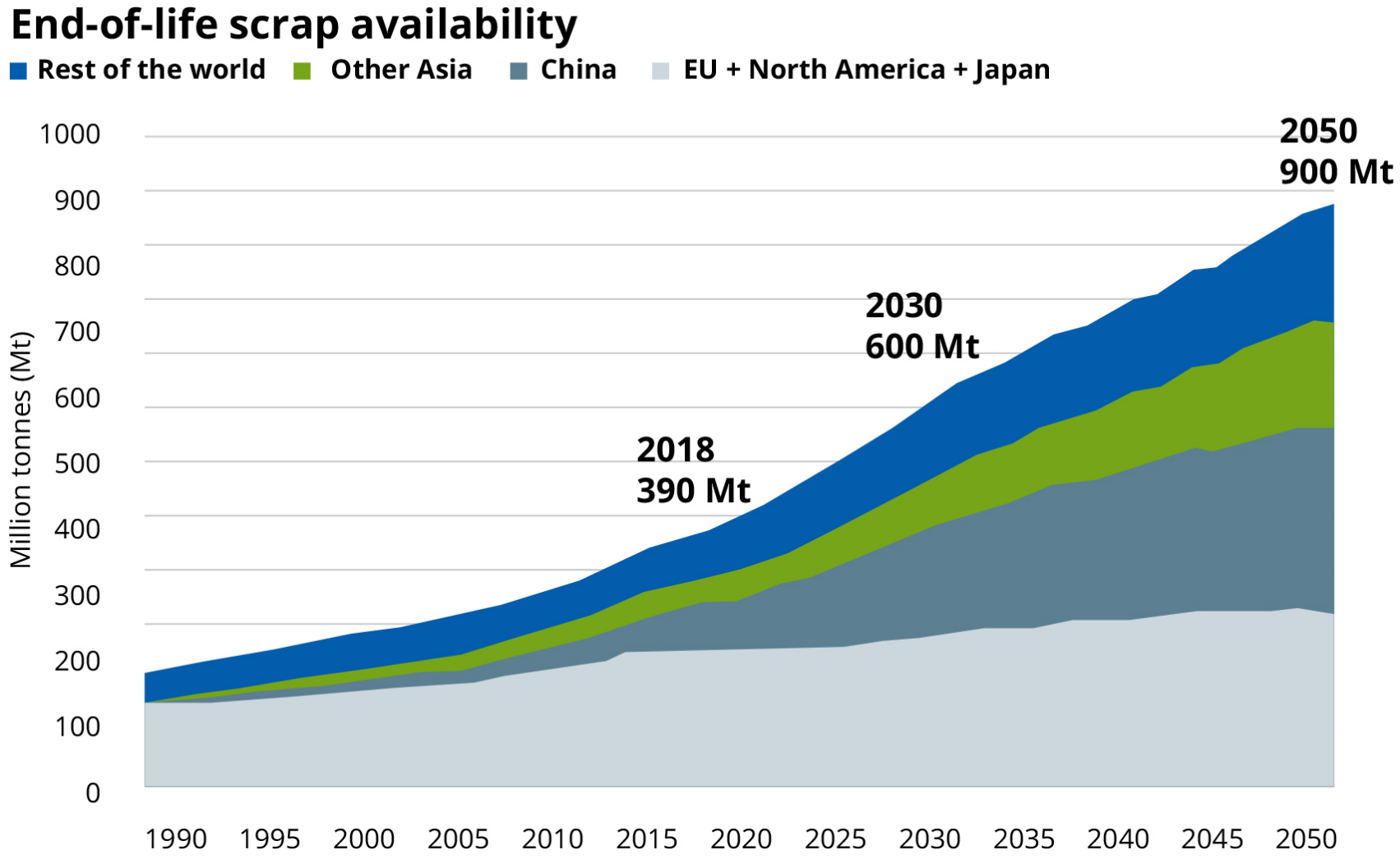
2. Maximise scrap use



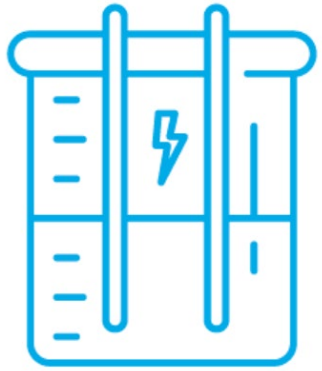
3. Breakthrough technology

There are several promising approaches that could be taken to reduce iron ore at industrial scale without the release of CO_2.

These fall into three broad categories:

Using carbon as a reductant while preventing the emission of fossil CO_2, e.g. using CCUS and/or sustainable biomass.

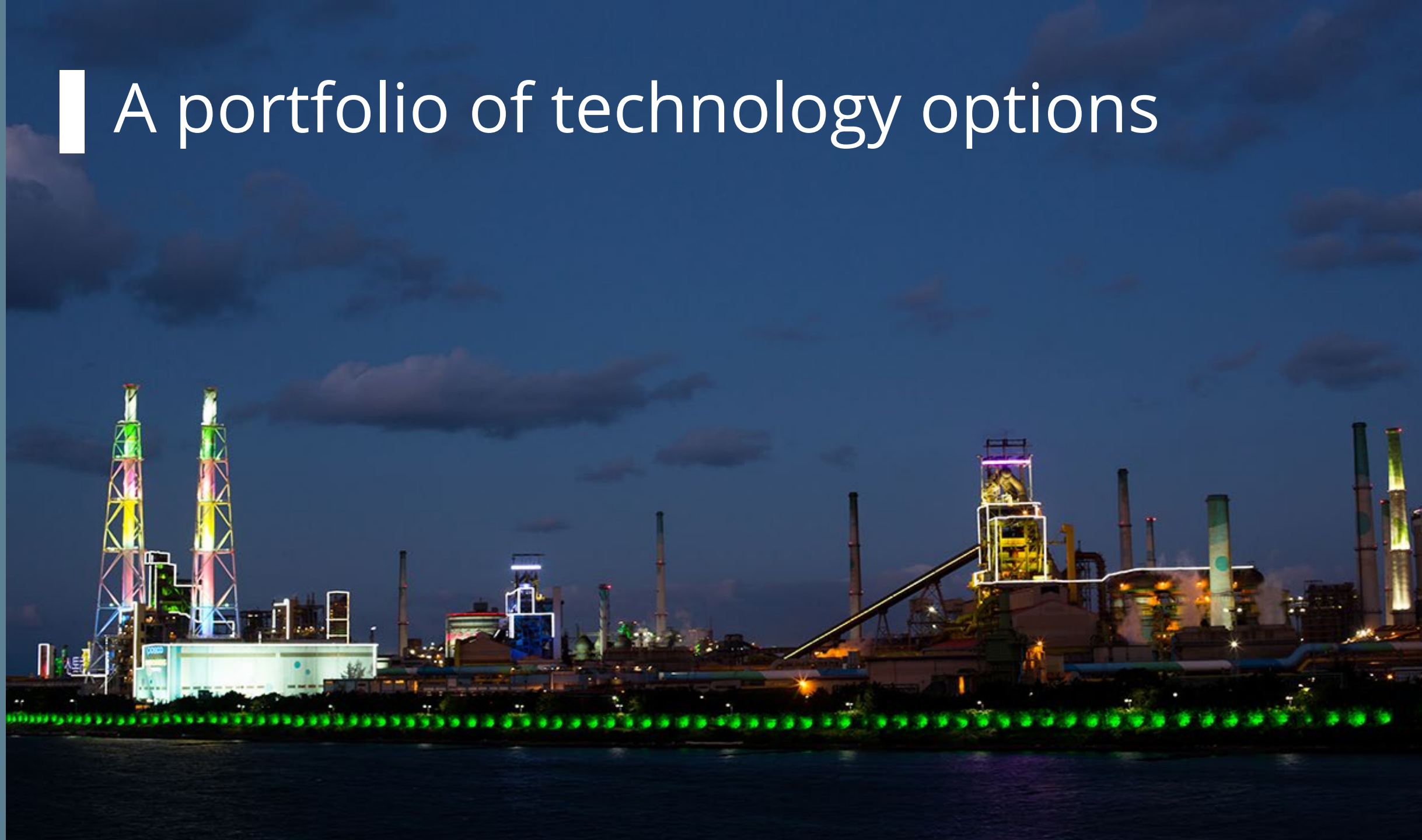
Substituting hydrogen for carbon as a reductant, generating H_2O (water) rather than CO_2.



Using electrical energy through an electrolysis-based process.

Which breakthrough solution to deploy will be determined by availability of resources and policy support.

A portfolio of technology options



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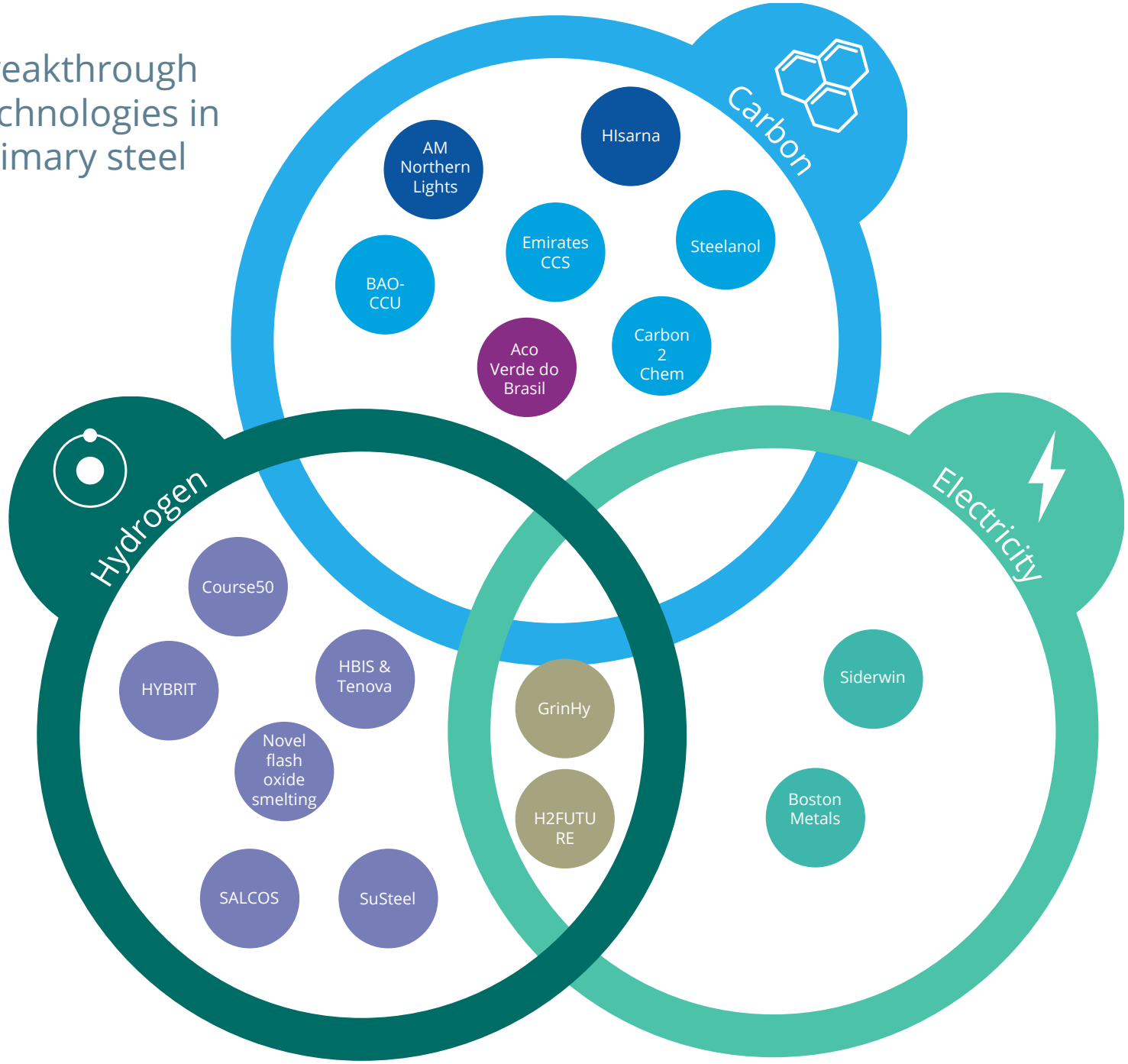
Breakthrough technologies in primary steel



Technology type:

- Biomass
- CCS
- CCU/ CCUS
- Hydrogen reduction
- Hydrogen production
- Electricity

Breakthrough technology is becoming real

CCUS

Shougang operate a large-scale facility to convert steel plant process gases to ethanol.

ArcelorMittal are building a similar commercial facility in Belgium.

Hydrogen

HBIS is building a 1.2Mt capacity hydrogen metallurgy DRI demonstration project.

voestalpine's SuSteel project is looking to apply hydrogen plasma reduction to ironmaking.

CCS

At Emirates Steel up to 800kt of CO_2 per year is captured from the CO_2-rich gas stream from the ironmaking plant and stored.

ArcelorMittal are part of the Norwegian "Northern Lights" CCS project.

Renewable energy

Evraz's Rocky Mountain Steel in Colorado, USA, is transitioning from coal to solar.

Biomass

Aço Verde do Brasil is exclusively using sustainably grown biomass for their steel production.

Electricity

The Siderwin project (currently at TRL4), being led by ArcelorMittal, is looking at using low temperature electrolysis using a water-based electrolyte.

Cost implications

IEA estimates the additional cost of production to be between 10% and 50% compared to today, a cost increase significantly exceeding production margins.

This will create a first mover disadvantage and policy support will therefore be needed.

It is clear that low-CO_2 steel production is going to be more expensive than steel production today.

Steel produced using low-carbon technologies will be competing with conventionally produced steel in the same market for a while.

Partnerships and enabling frameworks

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Partnerships are fundamental

Governments, the steel industry and other stakeholders will all need to collaborate to overcome the challenges involved in transforming our industry.

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The steel industry's role

The steel industry will:

Mitigate our own emissions	Create partnerships for transformation	Be transparent
Efficiency, scrap and breakthrough technology	Engage with governments	Continue to measure and report our emissions

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Governments to create frameworks that:

- Do not pick winners and losers among technologies
- Ensure availability and affordability of low carbon resources
- Enable access to finance for the transition
- Reduce first mover disadvantage by increasing the demand for low-carbon materials and create a market for low-carbon steel
- Take an innovative approach to the regulation of low-carbon processes and products
- Take a life cycle approach and support the circular economy
- Support collection and sorting of end-of-life steel products

Customers should:

Consider the entire life cycle and design of steel-containing products suitable for remanufacturing, reuse and recycling

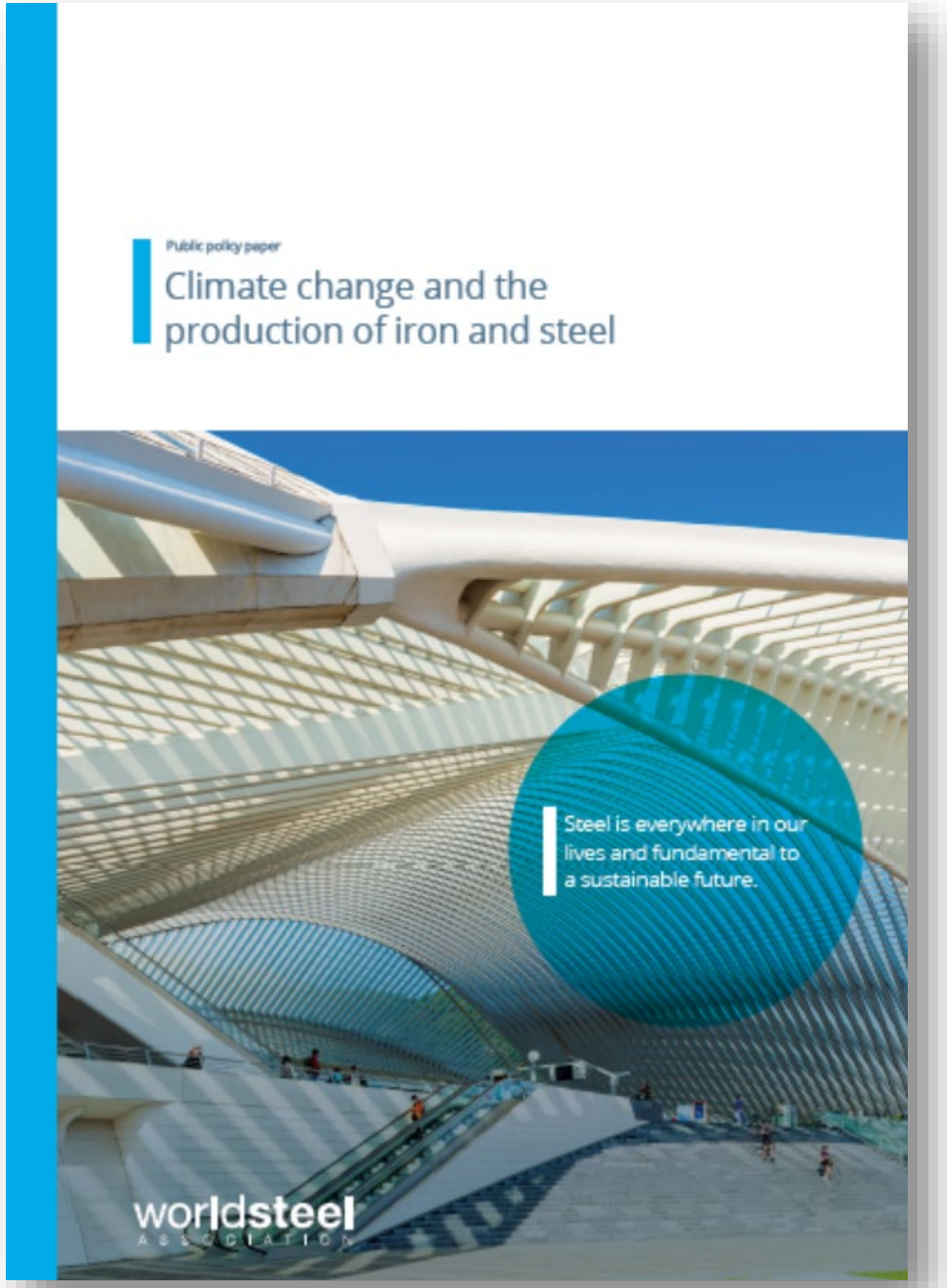
Demand low-carbon steel and understand that this will come at an additional cost

Support collection and sorting of end-of-life steel products

New policy paper

Restructured and expanded public website content in the new Climate Action section includes the policy paper and:

- Fact sheets detailing the suite of low-carbon breakthrough technologies currently under development.
- Examples of member initiatives in related areas, including new business practices encouraging low-carbon market development
- Work being carried out by other international organisations including the IEA and ResponsibleSteel



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