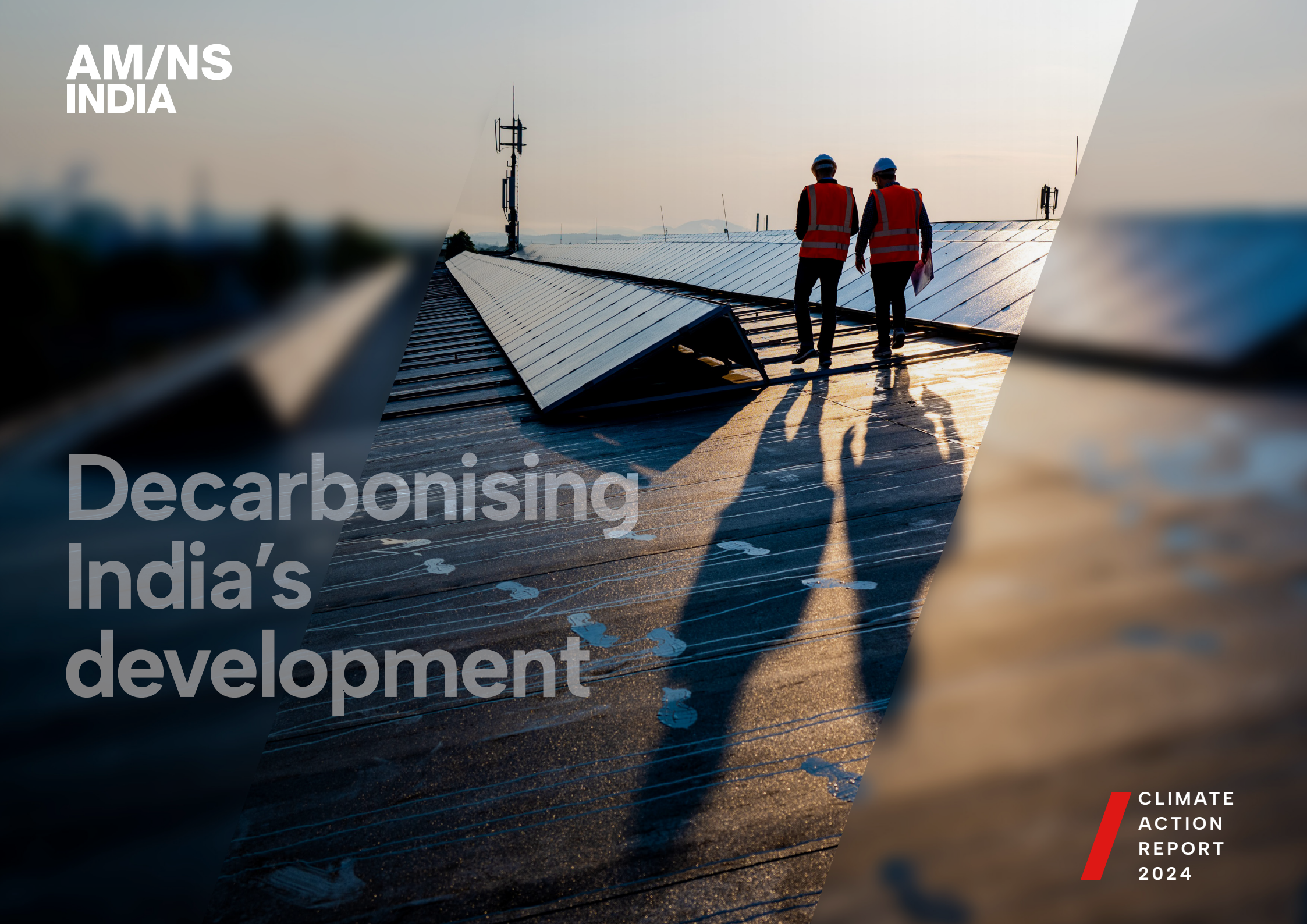
AM/NS INDIA



Decarbonising India's development

CLIMATE ACTION REPORT 2024

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Aditya Mittal
Chairman AM/NS India

An Opportunity and an Imperative: Decarbonising India's Development

Welcome to the first Climate Action Report from ArcelorMittal Nippon Steel India (AM/NS India). In this report we lay out an immediate plan to decarbonise our business and set it up to succeed in a world that can and must achieve net-zero emissions.

In the more than four years since AM/NS India began operating at Hazira, the company has taken great strides to support India's long-term growth and help build an economy that is more self-reliant and resilient. In the coming years we will redouble our efforts: increasing our annual production to 15 million tonnes, before growing further in the future.

Yet as our company and country grow, we also push ourselves to confront a parallel challenge: decoupling development from emissions. This challenge is not unique to India, but it is certainly more pronounced for one of the largest, fastest growing economies in the world. As this report makes clear, the magnitude of the challenge is matched by the opportunities of overcoming it.

By 2026-27, India aims to be a $5 trillion economy and the third largest in the world.[1] That growth will create millions of jobs, raise living standards for tens of millions of people, and fuel a wave of small and medium sized enterprises, the lifeblood of Indian society.

Steelmaking will be integral – the backbone of the houses and highways, bridges and buildings that will define a more competitive manufacturing economy. To build this exciting future, our country's steel capacity will need to double by 2030, and increase more than threefold by the middle of the century.[2] Yet without an economy-wide transformation in the way steel is powered, procured and produced, research warns us that meeting that rising demand for steel could drive up associated sector emissions by as much 200% by 2050.[3]

India's recent experience of punishing heat waves and devastating floods makes it clear this is a future which we can and must avoid. Every effort to reach net-zero is needed. As a rising economy and a reservoir of talent, India's contribution of innovation and actions will be significant, and we know our commitment will be critical.

The challenges are great, but we start from a position of strength. Investing in lower carbon gas-based production processes and maintaining a relentless focus on operational efficiency has seen the emissions intensity of our steel production fall by about a third since 2015, making it one of the lowest of any steel producer in India today.

In this first Climate Action Report, we set out an immediate ambition and roadmap to reduce AM/NS India's emission intensity by a further 20% by 2030 (from 2021 levels). We'll strive hard towards this by driving operational efficiency through technology investments; significantly scaling up renewable energy to meet 100% of our grid electrical energy needs; and maximising our use of scrap steel, an under-used resource due to a lack of collection and processing infrastructure across India.

We also outline important actions we are taking across the value chain that will lay the foundations for us to reach net zero over the longer term. We are working hard to make green hydrogen viable for steel by forming strategic partnerships; we are studying Indian geology to improve the feasibility of carbon capture, utilisation and storage (CCUS); and extending the ArcelorMittal climate fund to sponsor and mentor the next wave of breakthrough decarbonisation projects in India.

1 The Economic Times: India to become US$5 trillion economy, third-largest by 2027: RBI DG Patra (2023)
2 Ministry of Steel: India Focussing on 300 Million Ton Annual Steel Production by 2030 (2023); Climate Policy Initiative: Taking Stock of Steel: India's Domestic Production Outlook and Global Investments in Green Steel Production (2023)
3 Rocky Mountain Institute: Decarbonising the Indian Steel Industry: Roadmap towards a Green Steel Economy (2023)

FOREWORD

Chairman's letter

> "At its core, the task is making promising solutions both technically and economically viable at scale."

We also are looking at how we can harness technologies ArcelorMittal is pioneering elsewhere, such as 'smart carbon', which uses alternate sources of circular carbon from agricultural waste or waste plastic to both replace reliance on coal in steelmaking and allow for carbon-rich waste gases to be turned into products like bio-ethanol and bio-plastics.

Realising the potential of net zero steel will not be easy. It requires multi-stakeholder collaboration on enabling policies, incentives, investment, and strong customer demand signals for green steel. At its core, the task is making promising solutions both technically and economically viable at scale.

AM/NS India is confident that two key breakthrough technologies, CCUS and Hydrogen, if suited to the Indian context, could help make net-zero steelmaking in the country a reality – and we're actively involved in helping to develop both. Of course, these breakthroughs will require active policy and financial support from stakeholders.

As a business with a global perspective, we know that each region must follow a decarbonisation pathway that reflects their physical geography and infrastructure, as well as the development status of their economy.

In India, the economic challenge is particularly stark. Today, the cost to produce a ton of steel through lower carbon gas-based route is significantly more expensive in India than existing technology. Meanwhile, zero carbon fuels such as green hydrogen are still more expensive, and indeed, simply not available at the scale needed today.

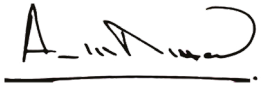
The pathway to net zero has to be economically viable and the industry must remain competitive. We know that today's choices and investments not only shape tomorrow's outcomes – they also shape tomorrow's possibilities. That's why, alongside the actions outlined above, despite the stark difference in fuel prices in India we will retain our significant gas based Electric Arc Furnace capacity. And while today's economics make new blast furnaces the only viable way to meet India's massive demand for new steel in the short term, we are designing the next phase of steel plants so they have the space and capacity to quickly build lower carbon processes, such as hydrogen-based steelmaking, when they become available, ensuring we are not locked into a particular production process.

We believe transformational steps by the industry, with support and leadership from government, can close the gap to net zero steel and we are committed to making that happen.

One of our hopes in sharing this report is to encourage others – customers, government, peers – to work even more closely together to accelerate the pace of change. That's why we are transparent about the uncertainties and constraints ahead. And why we set out the enabling policies that we believe can accelerate progress, if delivered in partnership with the international community who have a key role to play.

For more than 100 years, since the first Indian steel plant was set up, steel has helped build some of India's most remarkable and enduring projects. Now once again, an opportunity presents for our company, and our industry – the opportunity for our most defining act yet: producing net-zero steel to support a net-zero economy.

Aditya Mittal Chairman AM/NS India



This Climate Action Report outlines the significant immediate actions we are taking and intend to take to be part of the solution to decarbonising steel in India. It is made up of three sections:

1. **Pathways for decarbonising steel**: This section provides a brief overview of the steel production process, and the five main pathways available for decarbonising steel. It draws on and pulls together insights from our team as well as a wide range of expert bodies.
2. **Our strategy**: This section sets out our climate action strategy – a roadmap of actions across the entire value chain of steel production. This includes strong near-term commitments, plans and partnerships that aim to reduce our emissions intensity by 20% by 2030 while laying the foundations for a successful transition to net zero.
3. **Policy to accelerate progress**: This section outlines clear areas where we believe government can play a critical role in accelerating progress with ambitious policy and regulation.

A pivotal moment for Indian steel

A DECISIVE DECADE:

2x

growth in steel production capacity this decade, to drive India's development

2nd

largest steel producer in the world

THE CHALLENGE:

12%

of India's carbon emissions come from the steel sector, compared to 7% global average

200%

potential growth in associated sector emissions by 2050 if demand forecasts are met with BAU steel production

50%

Approximate extra cost of producing a tonne of steel with gas compared to coal in India today[4]

4 For further details see page 8.

SECTION 1:
Pathways for decarbonising steel

Making steel

Steel is produced from two basic sources:

- The 'primary source' path, where virgin steel is created by smelting iron ore and converting it into steel.
- The 'secondary source' path, which uses scrap – or recycled – steel.

Understanding these two paths and the differences between them offers a window into the steel industry, as well as the technical and economic hurdles of decarbonising steel.

Primary source

Most steel in the world (70%) is produced using blast furnaces to create virgin steel.[5]

The process starts with iron ore, which is smelted in a blast furnace (BF), usually using coke. This produces pig iron, which is then converted into steel using a basic oxygen furnace (BOF) – a process that involves blowing oxygen into the molten pig iron to oxidise impurities until it becomes steel. This production route is called BF-BOF.

There is another route known as DRI-EAF. This process also begins with iron ore, which is first processed into pellets or lumps and then reduced (i.e. the oxygen is removed) using a reducing gas made up of hydrogen and carbon monoxide (either through natural gas or coal).

This results in what is known as direct reduced iron (DRI), which can then be melted in an electric arc furnace (EAF) to produce steel. Some two-thirds of AM/NS India's production capacity today is via the gas-based DRI-EAF route, compared to a global average of around 7%, and an Indian average of 26%, which comprises both coal and gas-based DRI.

Because it uses gas rather than coal, the gas-based DRI-EAF route has lower direct greenhouse gas emissions than BF-BOF on average.[6] Promisingly, those emissions could be even further reduced towards zero if the DRI-EAF route uses green hydrogen – hydrogen generated by renewable energy (a topic we explore further on page 14).

If DRI is more efficient and produces fewer emissions, why isn't all of India's steel – or the world's steel – made using DRI? Because it requires higher quality iron ore, which is in short supply; and further, there is a significant price discrepancy between natural gas and coking coal in many countries such as India, which do not have sufficient domestic natural gas supply (See page 8). Changes in demand, supply and policy interventions in support of lower carbon steel are required to promote emissions reduction through the gas-based DRI route.

5 World Steel Association Fact Sheet | Steel and Raw Materials (2023)

6 IEA: Iron and Steel Technology Roadmap (2020)

SECTION 1:
Pathways for decarbonising steel

Secondary source

Producing steel from secondary source emits much less CO_2 than average primary source production processes. Rather than extracting iron from iron ore – an energy-intensive step – secondary source starts by putting scrap steel into an electric arc furnace with small amounts of virgin steel. It then melts them down and remoulds the products into new forms of steel. This process uses around one eighth of the energy required for producing steel from iron ore, according to the IEA.[7]

Between 20-25% of steel today is produced via the secondary source path.[8] That global figure varies widely by country and tends to be far lower in developing economies, given they have significantly smaller steel inventories to draw on and little by way of collection and processing infrastructure. The challenge is particularly acute in India, given that its steel demand is growing at a much faster pace than domestic scrap availability.

Despite these challenges, on pages 12 and 13, we highlight how AM/NS India is working toward a multifold increase in the use of scrap in our steelmaking to accelerate decarbonisation this decade.

Decarbonising steel

Steelmakers are increasingly appreciating that decarbonisation is the key to future commercial success, helping them meet the growing demand for low carbon steel, and become more efficient in the process.

A growing body of research[9] suggests there is a broad agreement on the pathways to decarbonise steel globally and in India, and mounting confidence in the viability of those pathways. Five major pathways in particular stand out:

1. Operational efficiency
2. Circular economy for steel
3. Scaling up low carbon fuel sources
4. Greener grid
5. Net-zero technology innovations: hydrogen and CCUS

The first four entail scaling conventional technologies to progressively reduce emissions. These improvements can take us a long way in the coming decades. Estimates from the IEA suggest around half of cumulative emission reductions for steel production from 2020 to 2050, could come from improvements like these.

The fifth and final lever focuses on new technology innovations that, if scaled, could deliver the final remaining emissions reductions needed to reach net zero. Indeed, all studies are clear: reaching net-zero steel will not be possible without scaling new technologies that are at demonstration or prototype stages today.

1. Operational efficiency

From sourcing iron ore to shipping a finished product, there are a wide range of different steps involved in the steelmaking process. As the sector enters a period of significant expansion, there is an opportunity to establish a series of operational improvements across many of those steps.

In the near term, those improvements would include using less material per unit of output, reusing waste gases, and optimising processes to reduce energy demand. Longer term, it will entail implementing advanced technologies like heat recovery systems and improved furnace designs.

Digitisation, digital analytics, and AI could help further optimise every part of the steelmaking process. That's encouraging news for India, given its high technology adoption rate and rapidly growing workforce.

2. Circular economy for steel

Steel is a metal made for the circular economy – it is incredibly durable and 100% recyclable. Despite limited scrap availability and high utilisation to date, there is room to take better advantage of those capabilities.

On the durability front, improving material efficiency will help steel stay longer in use and also require fewer virgin materials to make it.

An even more important step – particularly for India – will be raising our ability to reuse scrap steel to produce new steel, which is much less energy and emissions intensive than producing virgin steel. One challenge in India is that the supply of scrap is limited – the country is a net importer of scrap. At the same time, so is the infrastructure to collect, sort and process it. Strengthening that infrastructure, especially improving processing capabilities, could increase the yield and density of scrap material. Those, in turn, could help improve furnace productivity and, as with other optimisations, also lower costs.

There are new opportunities for cross-sector partnerships between the producers and users of steel to increase the availability of scrap in India – for instance, between the transportation industries and the steel industry.

7 IEA: Iron and Steel Technology Roadmap (2020)

8 "Cement and steel — nine steps to net zero" by Paul Fennell, Justin Driver, Christopher Bataille and Steven J. Davis. Nature (2022)

9 Energy Transitions Commission: Making Net Zero Steel Possible (2022)
SteelZero: India Net Zero Steel Demand Outlook Report (2023)
McKinsey Quarterly: Transition to Net Zero | Steel (2022)

SECTION 1:
Pathways for decarbonising steel

3. Scaling up lower carbon fuel sources

A range of alternative fuel sources exists, with varying limitations:

- Gas: Natural gas is seen as an ideal transition fuel for steel; when burned, it is almost half the carbon intensity of coal, yet this option is limited for India.
  - India has the DRI capacity to leverage natural gas, but lacks a strong supply of domestic natural gas. Since India depends on imports to meet 50% of its current natural gas demand, it's not an economically viable option, currently.
- Biomass: Carbon-neutral bioenergy derived from sustainably sourced biomass or even plastic waste can replace coal in steelmaking.

Currently, biomass is used extensively for heating and cooking in rural households, power generation and, to a lesser extent, for producing biofuel for blending with petrol/diesel in the transport sector. However, bioenergy in the form of bio-coal and charcoal is a great source of high-temperature heat, making it ideal for steelmaking.

Although sustainable biomass is a limited resource, ample scope exists for scaling it up and directing its use in the steel industry.

Over time, there is potential that the carbon in the off-gases released in the process can be captured and converted into recyclable products like bio-ethanol, bio-plastics and chemicals. This way the carbon removed from the biosphere and held in biomass waste, can be kept locked in downstream products like chemicals made from off-gases, creating the potential for a 'circular carbon' system.

4. Greener grid

Underpinning progress in all areas is the critical push to green the Indian energy grid.

Indirect emissions account for around 25% of the total emissions in the steel sector[10], so integrating renewable energy sources such as wind and solar across every stage of the production process can make a significant impact.

India, naturally endowed with abundant renewable energy sources, has chalked out an ambitious agenda of achieving 50% of power demand from renewable energy by 2030 (forecast to increase tenfold during the next two decades), with one of the lowest levelised costs of electricity globally.

The Indian government is spearheading this transition through foundational initiatives such as the National Green Hydrogen Mission, National Solar Mission and production-linked incentive schemes, which all envisage a strong leadership role for private enterprises, as well as new laws to accelerate renewables and the emergence of a domestic carbon market. Allocations of about US$4 billion have been made for priority capital investments towards India's energy transition to meet net zero by 2070.[11]

5. Net-zero technology innovations – hydrogen and CCUS

Over the coming decades, important incremental improvements across each of those four levers can get steelmaking a significant portion of the way there in terms of emissions reductions. But getting the rest of the way to net zero will take a series of technological breakthroughs.

The consensus is that two pathways are particularly promising: (1) green hydrogen, which could unlock a net-zero carbon production process for gas-based DRI; and (2) carbon capture, utilisation and storage (CCUS), which has the potential to abate the vast majority of emissions from other production processes including BF-BOF and DRI-EAF. Today, the storylines for both are similar: the technology appears to work, but the economics and infrastructure aren't there yet. A third very promising pathway also exists – direct electrolysis – but here the technology is at a much earlier stage of development.

Green hydrogen

Hydrogen is a carbon-free, energy-intensive fuel that emits zero greenhouse gases on combustion – and it is called 'green hydrogen' when it is produced using clean energy such as wind or solar power.

Hydrogen can partially replace coal in the BF-BOF route and substitute significant amounts of natural gas in the DRI route – in other words, a near-zero-emissions steel production process is possible.

To make the most of green hydrogen's potential and drive towards net zero, new technology and infrastructure would have to be introduced around the world at a truly blistering pace, according to the IEA. Since two thirds of AM/NS India's present production capacity is already made up of gas-based DRI, this means we are very well placed to quickly switch to hydrogen when supply becomes available.

The challenge is that while the technology has been proven to work, the pathway is simply not yet economically viable in India – largely because of low technical efficiency and limited renewable energy supply, driving up its price. Indeed, it is worth underlying that significant amounts of renewable energy are required to produce green hydrogen. Over the long term, India is well positioned, with its natural geography providing great potential for generating renewable energy. The key to progress will be developing the required infrastructure at pace.

The government is partnering with major industrial groups with proven expertise on execution at scale to deliver its hydrogen ambitions– which would make a significant step on the journey to net-zero steel.

10 IEA: Iron and Steel Technology Roadmap (2020)
11 Government of India Union Budget 2023-2024 (February 2023)

SECTION 1:
Pathways for decarbonising steel

The economic challenge: the price of coal, gas and green hydrogen

The relative costs of steel produced by the BF-BOF route versus the gas or hydrogen-based DRI-EAF routes are largely affected by the price and availability of coking coal, natural gas and renewable energy.

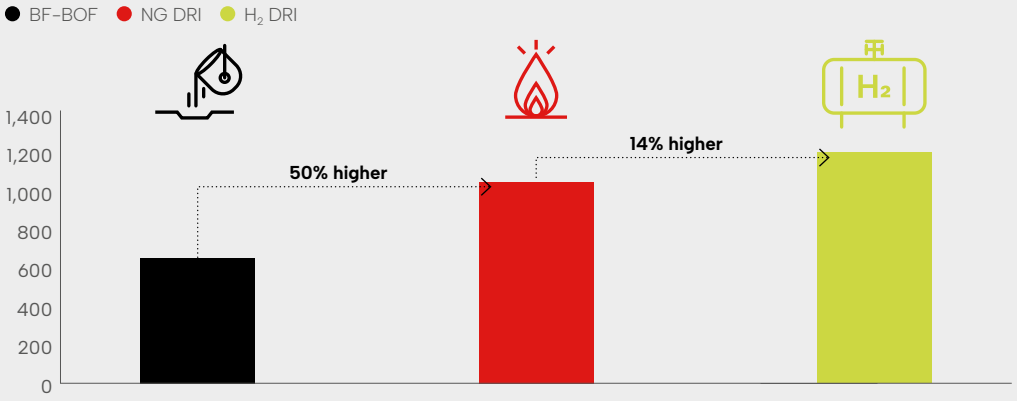
As per the graph below from Indian Steel Association, there is as much as 50% difference in energy-related operating cost per tonne of steel produced by gas-based DRI-EAF compared to a tonne of steel produced through the BF-BOF route. This is primarily because India does not have enough domestic supply of natural gas, and therefore must import gas from the global markets. Recent global events such as the war in Ukraine have also placed significant upward pressure on gas prices and make the price inherently volatile. There are also other important competing demands for the use of gas in India, for instance in agriculture, adding further pressure on price.

We know this well, having built AM/NS India from the acquisition of a business that ran into difficulties when supportive gas policies were diverted from steel. Though the conditions remain the same, we are developing strategic partnerships to secure consistent price and supply of natural gas, so that we can continue to operate existing gas-based DRI-EAF processes. This also puts AM/NS India in the best placed position to switch to lower carbon production processes including hydrogen-based steelmaking.

Currently, zero carbon fuels such as green hydrogen are even more expensive and, indeed, simply not available in India at the scale needed given a lack of renewable energy infrastructure.

We hope by sharing these constraints transparently we can support progress by providing clarity on the key challenges for industry, government and civil society actors to focus on. See page 14 for our work to accelerate progress on green hydrogen, and page 17 for details on the strategic partnerships we are developing to secure consistent price and supply of natural gas.

HYDROGEN-BASED DRI IS ~2X MORE EXPENSIVE THAN BF-BOF-BASED STEEL (2021)[12]



Note: Units are US$ per tonne of crude steel (US$/tcs)
Source: Indian Steel Association, drawn from Industry, Civil research estimates

12 Indian Steel Association: Pathway to Low Carbon Emission Steel, p29 (2022)

SECTION 1:
Pathways for decarbonising steel

CCUS

Coal-powered blast furnaces dominate global steelmaking, and will play a key role in the expansion under way in the Indian steel sector to meet rising demand for steel. If India is to reach net zero – and if the world is to meet its climate ambitions – those furnaces must be able to harness carbon capture, utilisation and storage (CCUS) at scale.

Indeed, the IEA's net-zero emissions scenario recognises that CCUS will have to be scaled up to around 7.2 GT of CO_2 annually by 2050 (180 times the current level in less than 30 years)[13], while their report on decarbonising steel highlights that CCUS-equipped blast furnaces will play a key role in periods where there are fewer lower carbon alternatives available.

The good news is that pilot projects have shown that CCUS in steel plants can safely capture and store the CO_2 emissions arising from the BF-BOF production process – CO_2 that can be used in other processes, or stored underground. Also, recent research by Niti Aayog[14] suggests that India could be well-placed to scale up CCUS technology, as the geology in key areas has anticipated potential to store carbon.

But we have a long way to go. Although the technology is proven, CCUS has not yet been shown to be fully viable at scale, giving rise to valid concerns from a range of stakeholders. Currently, CCUS deployment globally is sequestering only 40 MT of CO_2 annually[15] (roughly 0.1% of current global emissions), and of the existing CCUS facilities, only a few cater to steelmaking.

A critical early step will be establishing storage potential in key areas, and developing an infrastructure to incentivise investment, while also ensuring next generation blast furnaces are designed to be compatible with the technology.

Direct electrolysis

Direct electrolysis, or molten oxide electrolysis, has the potential to revolutionise steel production by enabling the direct conversion of iron ore into steel using electricity. Though it remains in the early stages of research and development, several pilot projects, including one led by ArcelorMittal, have delivered promising results, suggesting it could become a key part of the mix in later years.

Each of these levers presents its own distinct promises and challenges. Some rely on nascent technologies that have yet to be scaled. Others leverage resources and energy that are not equally available across the world, making them economically unviable for many. As countries and companies decarbonise steel, the relative weighting between each of these levers will depend significantly on local context.

But one thing is clear – the steel sector cannot rely on one technology or pathway alone to decarbonise steel, it must progress on many fronts at once, and remain agile to quickly respond to setbacks and successes as it progresses.

13 IEA: Global Energy and Climate Model Documentation (2022)
14 Report on Carbon Capture, Utilisation, and Storage (CCUS) Policy Framework and its Deployment Mechanism in India, Niti Aayog (2022)
15 IEA: Energy Technology Perspectives (2020)

SECTION 2:
Our strategy

Dilip Oommen
CEO AM/NS India

> “We see a clear pathway to net zero and are committed to leading our industry there – that is why both our parent companies, ArcelorMittal and Nippon Steel, have set targets to become net zero by 2050, and are investing heavily in global partnerships to decarbonise.”

We know there is no one-size-fits-all solution for decarbonising steel. The path to reducing steel emissions in India will look different than the paths in other markets. India does not currently have access to the supplies of competitive gas and renewables other countries do, just as other countries do not boast India’s vibrant economy or tech workforce.

We believe that the best strategy is both market-specific and informed by global best practices, and our company structure makes us very well positioned to pursue this approach.

As our Chairman says in his foreword, we are also clear that today’s choices and investments not only determine tomorrow’s outcomes – they also determine tomorrow’s possibilities. It takes time to implement new technologies and build new facilities. Where we are today is the product of years of improvements and decisions:

- AM/NS India has the largest Gas-based DRI-EAF capacity in India today, representing nearly two-thirds of our current production capacity.
- Across production processes, we have increased capacity utilisation to over 80% and are recovering waste heat from gases.

By 2021 we had reduced our carbon emissions intensity by nearly 33% to 2.23 tonnes of CO_2 per tonne of crude steel (tCO_2/tcs), compared to 2015.[16]

16 Worldsteel CO_2 methodology. Boundary: Pellets to finished steel at integrated facilities in Hazira and Odisha. Scope: Scope 1, Scope 2 and limited Scope 3 (As per WSA). Emission factor for grid electricity considered as WSA Global average.

> “We begin by targeting a reduction in our emissions intensity of 20% by 2030 (from 2021 level) while setting out a clear roadmap to get there, that anticipates our announced growth.”

These efforts mean we have one of the lowest emissions intensities of integrated steel producers in India today.

As we look to deliver on the next phase of growth – doubling our production capacity, from 8.6 million tonnes of crude steel per annum to 15 million tonnes in the near term and more beyond that, this is an important moment to push on significantly further with our decarbonisation efforts.

We begin by targeting a reduction in our emissions intensity of 20% by 2030 (from 2021 level) while setting out a clear roadmap to get there. Here we outline our strategy with a number of concrete commitments and actions over multiple levers and timeframes – what we are doing today to drive further emissions reductions this decade, while laying the groundwork and planning for deeper decarbonisation to reach net zero.

Dilip Oommen CEO AM/NS India

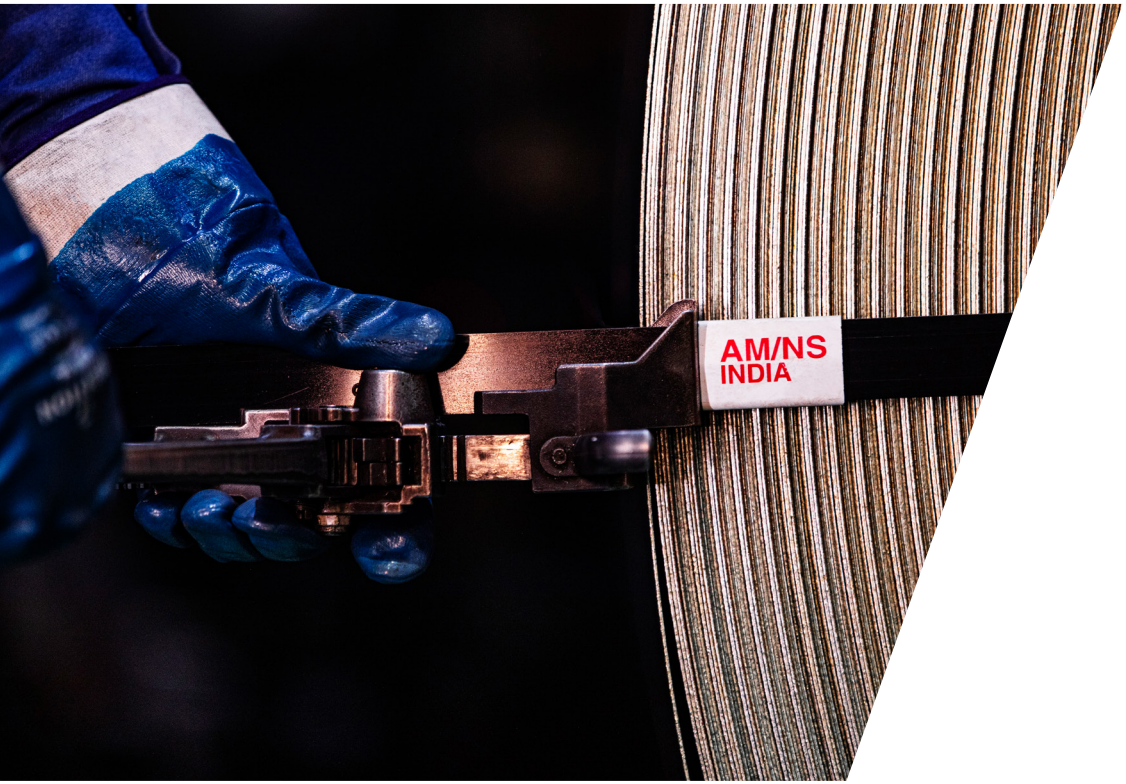
SECTION 2:
Our strategy

Targeting 20% emissions intensity reduction this decade

To support India's growth and meet its rising steel demand, we're expanding our operations and production over the coming decade. As we develop this additional capacity, we also aim to reduce emissions intensity of 20% by 2030.

Three areas are particularly important for us to reach that goal:

1. **Operational improvements**
2. **Clean electricity**
3. **Increased scrap use**



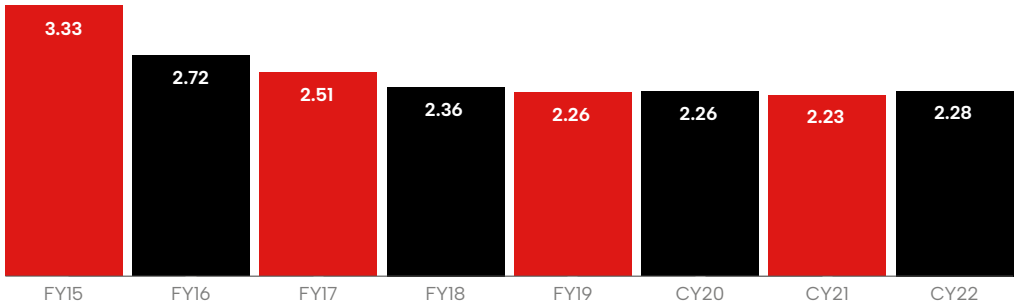
1. Operational improvements

As part of our ongoing capacity expansion project, we will deploy technologies to ensure the process is as energy efficient as possible, driving operational efficiencies that aim to deliver a 1–2% reduction in emission intensity. These steps include:

- Increasing capacity utilisation even further by focusing on debottlenecking processes where possible, including ongoing investments to ramp up efficient production capacity at Hazira to 8.6Mt by end of 2024; with estimated capex of US$0.8 billion.
- Using best available BF–BOF processes and technologies, including the use of higher-grade iron ore and coking coal, and deploying energy recuperation wherever possible.
- Scaling successful tests which we have undertaken to inject gases, which are cleaner than coal, into the production process.
- Integrating new equipment with advanced digitalisation technologies that will ensure maximum fuel and material efficiency through improved data analytics.
- Fitting our blast furnaces so that they are ready for adopting new technologies that unlock significant improvements in the energy use.

Throughout this process we will also be actively drawing on the experiences and mature R&D capacity of our two parent companies as they also undertake significant efforts to improve their operational efficiencies.

THE JOURNEY SO FAR: REDUCED EMISSIONS INTENSITY BY A THIRD SINCE 2015



SECTION 2:
Our strategy

2. Clean electricity

AM/NS India plans to reduce scope 2 emissions by transitioning to clean electricity – specifically solar and wind power. During this decade, we aim to reduce emissions intensity of our production process by 11-12% through this lever, making it the most significant component of our overall 2030 decarbonisation roadmap.

We have taken the first step to this by developing a 975 MW hybrid renewable energy project at Alamuru Village of Panyam Mandal of Nandyala District and other villages in Kurnool District of Andhra Pradesh.

We are developing a 661 MW (925 MWp) solar power capacity and a 314 MW Wind power capacity, which shall be integrated with a pumped hydro storage facility owned by Greenko, to overcome the intermittent nature of wind and solar power generation ensuring round-the-clock power.

The project is wholly owned by AM Green Energy Private Limited (AMGEPL). It represents a major investment of around US$0.7 billion, with solar and wind sites spanning ~3,500 acres of dedicated land.

The project, forecast to be completed by mid-2024, will result in more than 20% of Hazira's plant's electricity needs coming from renewable sources and is set to reduce AM/NS India's carbon emissions by 1.5 million tonnes per annum.

For transmission of power to Hazira, the solar and wind sites will be connected to the interstate transmission system (ISTS) through 400 kv transmission lines.

The power from this project will be scheduled or injected into the ISTS at Kurnool and the scheduled power will be drawn by AM/NS India Hazira facility connected to the ISTS substation in Gujarat. This will also contribute to adding to India's total green grid capacity.

Our plan is to continue momentum beyond this project with the aim of delivering 100% of our grid electrical energy requirements through renewables by 2030.

The availability of suitable land and transmission infrastructure will be two key factors effecting success in this area.

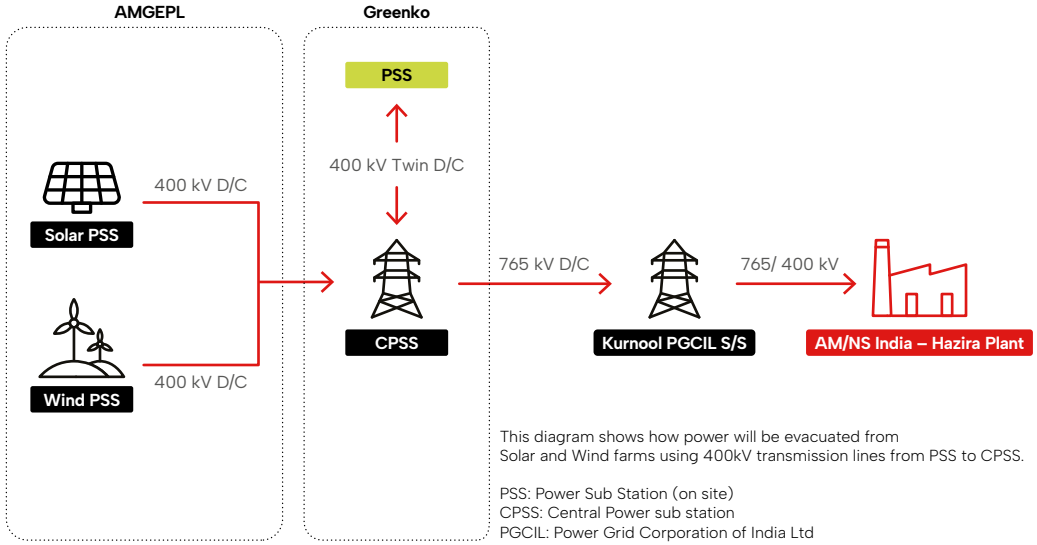
3. Increased scrap use

AM/NS India is determined to accelerate its decarbonisation through enhanced scrap utilisation in steelmaking to ramp up secondary source production.

As noted, there is already a shortfall of scrap supply in India – and that gap is set to widen even further by 2030 as demand grows.[17] A key challenge that needs to be overcome in India is a lack of collection and processing infrastructure. In addition, the quality of the raw materials that are used as inputs is critical to driving greater efficiency, fewer emissions and enabling greater use of scrap in steelmaking.

Despite these limitations, we believe much more can be done to increase India's capacity to collect and process scrap. At AM/NS India we will therefore work proactively to increase scrap utilisation with a comprehensive three phase roadmap focused on improving collection and processing capacity of scrap.

17 Material Recycling Association of India (MRAI); National Steel Policy, 2017: scrap supply estimates of 70MTPA Steelmint production estimates FY22 and FY30 (e)



This diagram shows how power will be evacuated from Solar and Wind farms using 400kV transmission lines from PSS to CPSS.

PSS: Power Sub Station (on site)
CPSS: Central Power sub station
PGCIL: Power Grid Corporation of India Ltd

SECTION 2:
Our strategy

Currently, AM/NS India has a scrap mix of 3–5% of its total steelmaking capacity. We aim to significantly increase this proportion in the coming years, targeting a scrap mix of over 10% by 2030.

To work towards this ambitious goal, we plan three key steps:

– Phase 1: Upgrade existing facilities and establishing a brand new scrap yard and processing unit in one of our major plants. This will significantly increase scrap producing and storage capacity. The processing unit will leverage cutting edge practices to dramatically accelerate productivity.

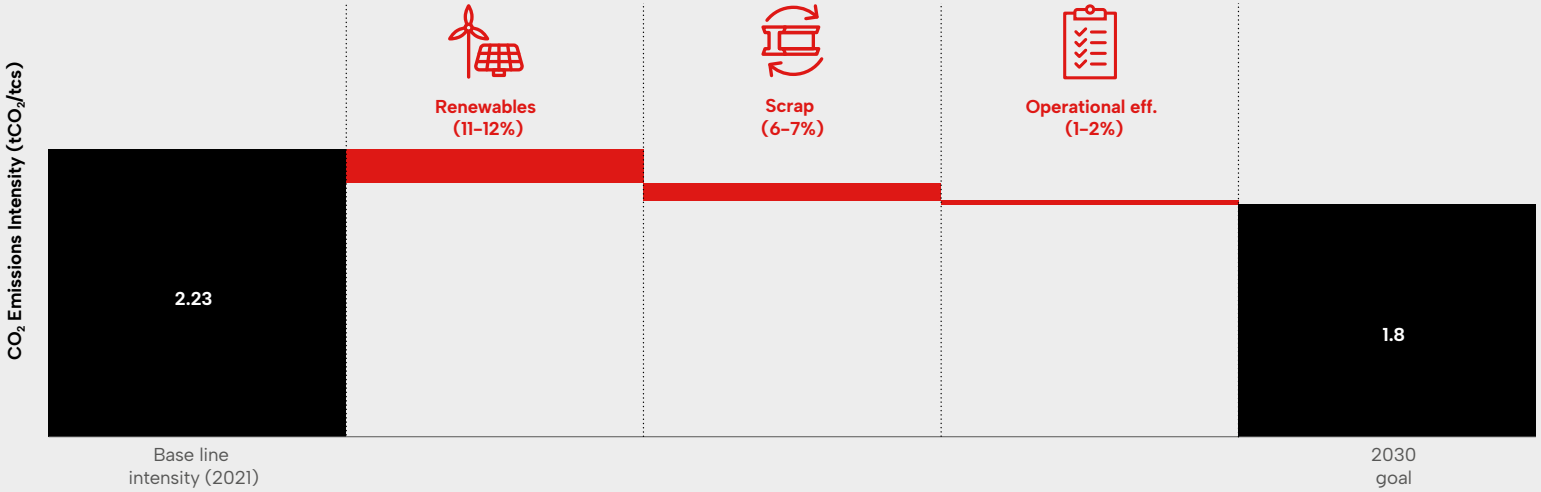
– Phase 2: Set up a further series of new industrial scrap processing centres across multiple locations, strategically placed in the vicinity of industrial scrap generation and automotive clusters to simplify and expand collection.

– Phase 3: Proactively working beyond the business to increase sourcing of available household scrap while embedding capacity to scale. We are also developing plans to collaborate with our customers directly to build a circular economy for steel.

Today, India is already a net importer of scrap – last year we imported approximately 8 million tonnes, and as countries and companies around the world seek to increase scrap use to decarbonise steelmaking, this will put further pressure on global supply and make it even harder for India to import scrap at a viable price. On pages 19 and 20, we therefore outline key policies the government could introduce to try and improve domestic scrap creation by focusing on major sectors such as shipbuilding.

Delivering simultaneously across these three levers will allow us to lower our total emission intensity, with the aim of reaching 1.8 tCO_2/tcs by 2030, a reduction of 20%.

OUR ROADMAP TO 2030



As highlighted in the steps above, achieving these goals will be dependent on key external factors, such as access to land for renewables and availability of affordable scrap in India. Alongside accelerating our own efforts, it's clear success requires multi-stakeholder collaboration on enabling policies, incentives and investment.

To support these efforts, in section three we outline clear areas where we believe government can play a critical role in accelerating progress with ambitious policy and regulation.

SECTION 2:
Our strategy

Investing in breakthroughs

AM/NS India is confident that two key breakthrough technologies, suited to the Indian context, could help make net-zero steelmaking in the country a reality – and we're actively involved in helping to develop both. Of course, these breakthroughs will require active policy and financial support from stakeholders.

Green hydrogen

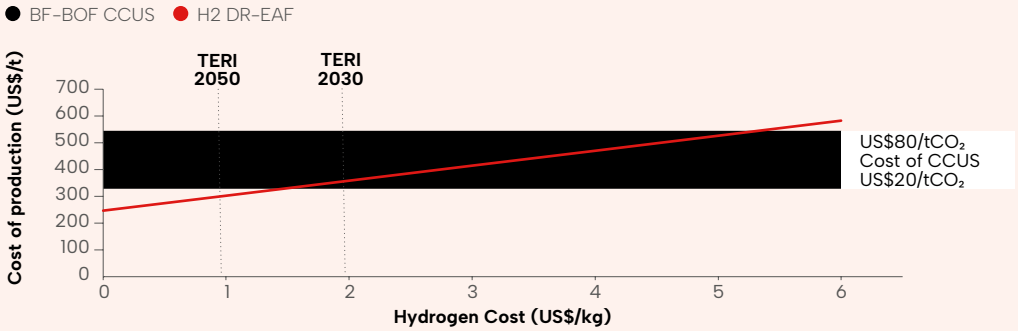
Why does it matter

Hydrogen can partially replace coal in the BF-BOF route and substitute for a significant amount of natural gas in the DRI route. Out of all technology routes available today, the green hydrogen-based DRI-EAF route is the lowest emitting for primary steelmaking; but given limited renewable energy supplies and the many competing demands on those renewables, supply of green hydrogen is extremely limited in India. It is therefore not yet available, scalable or commercially viable.

What needs to happen

- The government has laid out a clear agenda to accelerate the adoption of green hydrogen through initiatives such as the Green Hydrogen Policy and the National Green Hydrogen Mission. With this push, the demand for green hydrogen from India's steel sector is forecast to increase multi-fold over the next three decades, and companies in the sector are starting to explore pilot activity using hydrogen.
- Further support in facilitating a few large-scale H_2 infrastructure projects and the development of hydrogen corridors along with R&D will be instrumental in accelerating the adoption of green hydrogen by the Indian steel industry. Some of the initiatives that can be explored are:
  - Public-private partnership (PPP): Partial funding of H_2 trial projects in existing gas-based DRI plants.
  - Financial assistance through SPVs to build large-scale hydrogen projects focusing on the entire value chain from components of renewables and electrolysers to the transport of hydrogen through pipelines. This will automatically bring down the costs of hydrogen and jumpstart the hydrogen industry in India.
  - Funding of R&D projects: Low-cost manufacturing of electrolyser components like stacks, cheaper alternatives to rare and expensive catalysts used in electrolysis like platinum and iridium.
  - Financial assistance: Rebate on duties and GST applied on capex and output of hydrogen.
- These developments would help drive up the supply of green hydrogen in India and, crucially, reduce its price. Estimates from The Energy Resources Institute (TERI) suggest that green hydrogen-based steel production would become cost competitive at a price of around US$1-US$1.2 per kilogram of hydrogen.[18]
- Notably, around 70% of the costs of green hydrogen are from the costs of renewable energy.[19] Therefore, there is a significant opportunity for costs to fall as investment into renewable energy infrastructure continues to rise, creating a double benefit.

MAKING THE HYDROGEN ROUTE VIABLE: US$1 PER KILOGRAM



Source: Energy Transition Commission and The Energy Resources Institute (TERI).
Note: tCO_2 refers to the cost of carbon capture and storage, not to carbon price.

18 The Energy Resources Institute (TERI): Green Steel through Hydrogen Direct Reduction | A Study on the Role of Hydrogen in the Indian Iron and Steel Sector (2021)

19 McKinsey & Co.: Green Hydrogen – An opportunity to create sustainable wealth in Brazil and the world (2022)

SECTION 2:
Our strategy

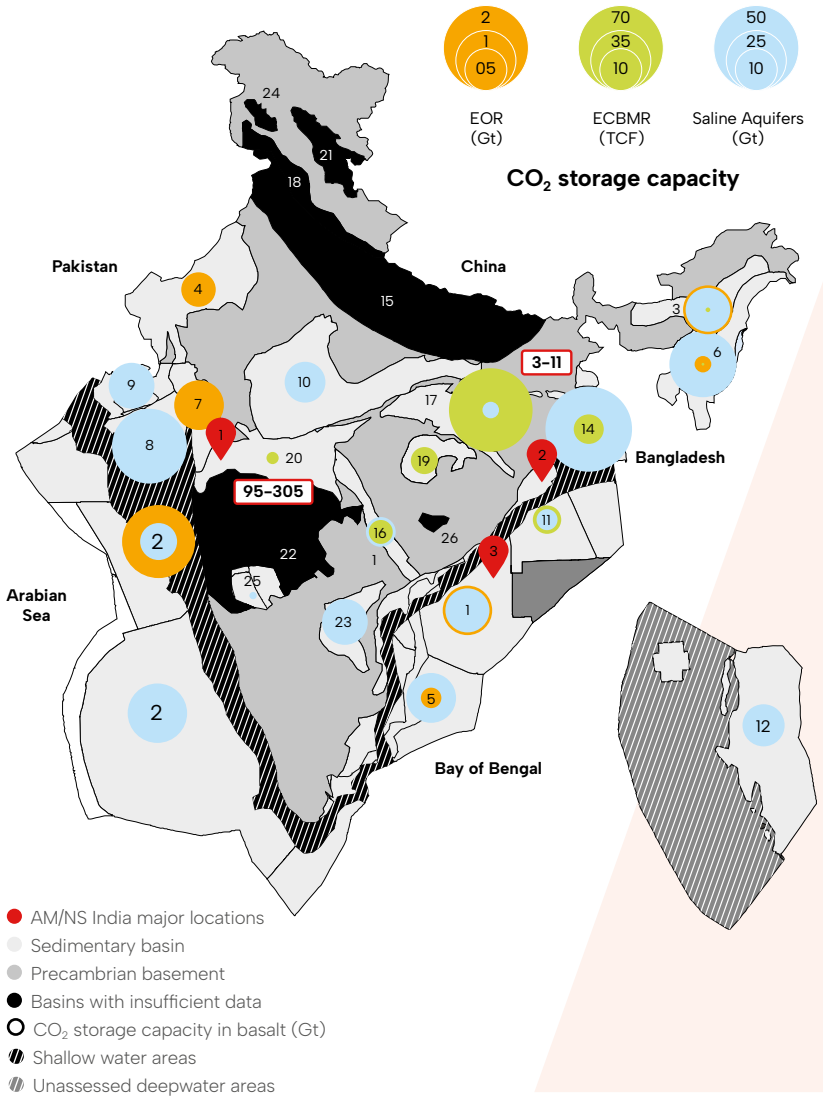
Our focus

While the development of a green hydrogen economy is very nascent globally and in India, we believe that the economics could improve as hydrogen supplies increase (and its costs decrease) – just as they have with solar panels and electric vehicles. Its low-carbon emissions make it a powerful solution, and we want to be an active partner in making it happen. We are:

1. Learning from **innovative activities across our parent companies**. For example, ArcelorMittal is developing a new project at its Hamburg site in Germany aimed at the first large-scale production and use of DRI made with 100% hydrogen as the reductant, with an annual production of 100,000 tonnes of steel. In Asia, Nippon Steel is exploring the opportunity of injecting hydrogen to substitute carbon in blast furnaces.
2. Beginning to **experiment with hydrogen utilisation** in our Indian facilities. Today, we generate hydrogen for use in our downstream mills, and will explore injection of these gases into our furnaces, to learn in practice about the opportunities and challenges.
3. Exploring **long-term strategic collaborations** with the world's leading energy companies to explore generation of round-the-clock power through renewable sources; to secure lower carbon gas supply and at the same time, assess and develop hydrogen. For more details see page 17.

SECTION 2:
Our strategy

MAJOR SEDIMENTARY BASINS IN INDIA, SHOWING CO_2 STORAGE POTENTIAL



CCUS

Why does it matter

A critical part of the long-term solution is making the upcoming steel capacities in India future-ready to deploy CCUS technologies that can capture CO_2 gases, and either reuse or store them safely at identified sequestration sites.

What needs to happen

- Pilots and prototypes – we need to prove that CCUS technology can work effectively and economically.
- Plan – to make CCUS viable in the Indian context, concerted efforts will be needed to accelerate its deployment. For example, the Indian government has already taken some steps in that direction, identifying CCUS as a priority area in its Second Biennial Update Report for the United Nations Framework Convention on Climate Change.
- Scale – ultimately, we need to finance a stable external economic environment to deploy CCUS at scale.

Our focus

AM/NS India is embarking on a programme of activity to help unlock this breakthrough. We are:

- Developing **prototype CCUS activity** across ArcelorMittal and Nippon Steel, which are already demonstrating the pathways to decarbonise the BF-BOF route by using the Smart Carbon route, participating in Japan's COURSE50 programme, and implementing CCUS.
- Embarking on a **large-scale research project** into the feasibility of CCUS at scale in India. We are working with the Indian Institute of Technology Bombay, to study the geology surrounding our facilities to implement CCUS at scale. Early indications are that India's geology, and the location of our plants, makes this a viable option, and this research will help us develop a pathway for development and deployment.
- Actively exploring **place-based partnerships in the Hazira Industrial belt** where we can collaborate with research institutions and other industrial companies across a range of sectors to create local clusters to achieve greater efficiency, speed and scale in the deployment of CCUS.

Note on graph: Major sedimentary basins in India, showing CO_2 storage potential through CO_2 EOR, ECBMR, in saline aquifers, and in basalt. The area of the circles represents the relative capacities of the basins, and the storage capacity range in basalts have been marked in a red box. The basins corresponding to the numbers (1–26) are mentioned in the legend. The basins marked in grey have been omitted from this study due to availability of limited data.

Source: 'A systematic capacity assessment and classification of geologic CO_2 storage systems in India', Indian Institute of Technology Bombay, 2021.

The red pins represent the locations of AM/NS India's major plants: 1 Hazira, 2 Paradip, 3 Vizag.

SECTION 2:
Our strategy

Partnering across the system

Given the systemic nature of the challenge, partnership across every lever will be key to success. That's why AM/NS India is working proactively to forge partnerships with a wide range of actors – academic institutions, government and businesses across many sectors and countries – to accelerate progress in key areas.

Some recent highlights include:

1. XCarb India Accelerator Programme

- Innovation will be key to decarbonising the steel sector and, in July, our parent company ArcelorMittal announced that its XCarb™ Innovation Fund launched XCarb India Accelerator Programme to fund and support the next wave of breakthrough ideas on decarbonisation emerging from India.
- The project is being driven by ArcelorMittal and AM/NS India and delivered in partnership with the Indian Institute of Technology Madras, whose pedigree in nurturing ideas and mentoring will be applied to support start-ups or early-stage companies selected, enabling them to scale their technologies and business models from lab to the market.
- The India Accelerator Programme commenced with a three-day workshop at IIT Madras to introduce start-ups to the faculty, followed by a comprehensive 8-10 week mentorship programme to prepare finalists for their pitch to the XCarb™ Innovation Fund Investment Committee, chaired by Aditya Mittal, CEO of ArcelorMittal. Finalists can seek an equity investment or a potential research collaboration.
- This builds on the success of ArcelorMittal's inaugural accelerator programme, launched globally in 2022, which reviewed over 90 start-ups from five different continents and awarded CHAR Technologies, which is developing a high temperature pyrolysis technology that transforms organic waste streams into valuable energy outputs, a US$5 million investment.

2. Renewable energy partnership with Greenko for round-the-clock power

- Integrating AM Green Energy Pvt. Ltd's (ArcelorMittal subsidiary) 975 MW hybrid renewable energy project with Greenko's pumped hydro storage facility to overcome the intermittent nature of wind and solar power. AM/NS India will receive 250 MW of uninterrupted renewable power annually.
- The project, forecast to be completed by mid-2024, is set to reduce AM/NS India's carbon emissions by 1.5 million tonnes per annum, while contributing to India's total green grid capacity.

3. CCUS research partnership with the Indian Institute of Technology Bombay

- AM/NS India has partnered with the Indian Institute of Technology Bombay, one of the leading research institutions focused on engineering and technology in India and indeed the world. Together, and in collaboration with other heavy industry sectors, we will study the geology surrounding our facilities to determine the potential for CCUS in the landscapes around our major sites.
- This partnership builds on previous research from IIT Bombay which highlights Indian geology may be particularly well placed for long-term carbon sequestration, and will help us develop a pathway for development and deployment of CCUS at scale.

4. Low carbon energy supply collaboration

- AM/NS India have recently developed a partnership with a globally renowned energy player to develop:

  Renewable power solutions: As part of the collaboration, AM/NS India will explore the generation of round-the-clock power through renewable sources.

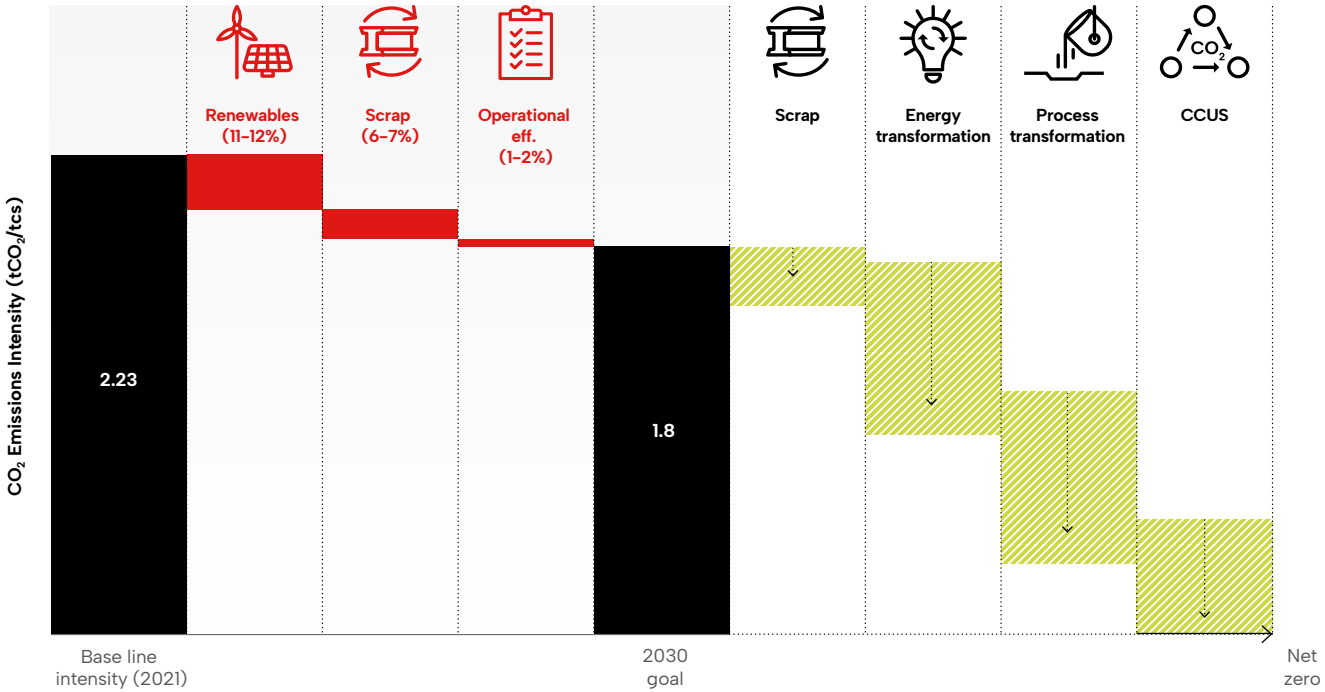
  Green H_2 supply: AM/NS India will also work with the partner to assess using green H_2 in DRI production process and explore a joint pilot.

  Natural gas portfolio: The partnership will also help develop a comprehensive natural gas portfolio management strategy.
- To achieve these goals, the collaboration will create joint working groups across workstreams.

SECTION 2:
Our strategy

THE JOURNEY TO NET ZERO

These important actions across the value chain will help lay the foundations for AM/NS India to reach carbon neutrality over the longer term



Up to 2030, the waterfall chart shows a breakdown of the 20% reduction in CO_2 emissions intensity we are targeting, taking into account the announced projects and initiatives outlined in this report. The waterfall chart beyond 2030 is for illustrative purposes only, and shows estimates of the emissions reductions potential of key levers based on best available data and the latest thinking outlined in major reports from expert bodies.

The bars correspond to the key breakthrough levers that have been outlined above, and our ambition is that the actions, partnerships and research we are undertaking in those areas will lay the foundations for the emissions reduction potential estimated in the levers post 2030.

SECTION 3:
Policy to accelerate progress

> “Given the complexity and scale of the task at hand, and the speed at which it must happen, ambitious policy and regulation will be key to creating the enabling conditions for progress.”

Indian government and business alike are clear about the opportunities of low carbon steelmaking, which could provide the backbone of a more resilient, self-reliant, competitive economy that by some estimates could create 50 million new high-skilled jobs in India by 2070.[20]

At this time, the right policy frameworks are still being determined. Our role is to play an active part in the Mission Green Steel framework being developed, and we are actively involved in all of the 13 taskforces established to deliver a concrete plan.

Having consulted across our business we see seven key areas where policy can help accelerate decarbonisation. We will be bringing these to our discussions as part of that taskforce, and are committed to supporting the government to develop effective policy in these areas:

1. Demand signals: The government is one of the biggest buyers of steel in India. A clear commitment to increase procurement of low carbon steel over time will allow producers to plan for the future, and scale lower carbon production with confidence. These efforts should be underpinned by the development of robust procurement standards, which provide clarity on what counts as low carbon steel over time.
2. Carbon market: The development of efficient carbon markets that promote decarbonisation investments will act as a critical enabler for decarbonisation. Although the government has laid out the building blocks for CCTS (Carbon Credit Trading Scheme), they are at a very nascent stage in India and should be a key point of focus in coming years.
3. Infrastructure:
   - Green grid: The drive to a renewable powered national energy grid is a very important foundation for decarbonising our sector and the economy. India has developed an ambitious agenda of supplying 50% of power from renewable energy by 2030[21], with one of the lowest levelised costs of electricity globally.[22]

20 World Economic Forum, Kearney: Mission 2070: A Green New Deal for a Net Zero India (2021)

21 GoI – Ministry of New and Renewable Energy | Renewable Energy in India (2022)

22 IEA: Projected Costs of Generating Electricity (2020)

SECTION 3:
Policy to accelerate progress

The Indian government is spearheading this transition through initiatives such as the National Solar Mission, Green Energy Corridor and production-linked incentive schemes. We fully support the government's efforts to scale India's renewable capacity.

- CCUS pipelines: to ensure permanent sequestration of carbon is viable and, crucially, scalable, a network of CO_2 pipelines will be needed in key regions. New incentive structures to make the technologies economically viable could also unlock progress in the future.

4. **Tax incentives:** A supportive tax environment can be a significant unlocker for progress toward decarbonisation. This is exemplified by the IRA in the US – encouraging greener manufacturing across the US. Similarly, tax incentives can help ramp up the production of low carbon steel, across key levers in India. Key steps could be to:
   - Support the development of India's renewable energy infrastructure by waiving duties on the import of solar panels.
   - Align national taxes with international regimes including CBAM, such that nationally paid GST and Compensation Cess are recognised by the EU as taxes paid in the country of origin.
5. **Foreign direct investment:** Decarbonising the steel sector will be highly capital-intensive, but there is also an opportunity to attract flows of capital to India to support progress, as investors around the world seek to transition to net zero too. Clear and consistent statements of intent on low carbon steel from the Indian government could be very helpful in attracting the foreign direct investment needed.
6. **Hydrogen:** Hydrogen could be a key unlocker for decarbonising our sector, yet is not economically viable at scale. We therefore strongly support the government's National Hydrogen Mission, and will work proactively with government to help achieve its goals. R&D alongside funding for demonstration and pilot projects will be particularly critical here, and the government can give a much-needed boost to these efforts.
7. **Scrap:** Increasing scrap availability in India would contribute significantly to decarbonisation efforts. As it becomes harder to import scrap to India given increasing global demand, the government could be key to unlocking progress by supporting key sectors to increase domestic scrap production.
   - India has a large coastline which makes it an ideal hub for international ship breaking. Building on strong foundations, there is further opportunity to generate approximately 3-4 million tons scrap annually if the government can work with industry to invest in facilities and attract international ship-breaking to India.
   - The domestic car market could also be key. The government has taken great strides to introduce an End of Life Vehicle (ELV) policy to incentivise consumers to take their used cars to be recycled. We commend the policy and call for accelerated implementation to unlock more scrap steel.

Also, just as the Indian government will be key to decarbonising Indian steel, so too will governments around the world. In particular, developed economies who have benefited significantly from a rapid growth in steel production in the past, using up much of our shared carbon budget, have a critical role to play.

The rapid expected rise in demand requires an urgent shift towards low carbon steel production. International finance institutions, including multilateral development banks and private finance, can play a pivotal role in ensuring that India can grow into an active leadership role in this transition and act as a lighthouse for green industrialisation. We therefore call on developed economies to deliver on their green financing pledges, while also stepping up proactive engagement to foster international collaboration focused on driving breakthroughs in key sectors such as steel. This includes supporting roadmaps for hydrogen, de-risking and financing first-movers, backing demand for low carbon steel through country and corporate procurement strategies.

Note: This report is intended as our decarbonisation roadmap and any forward looking statement in the report is subject to various external factors including macroeconomic outlook and evolving regulatory framework. The non-proprietary information in this report is sourced from publicly available data and records.

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CLIMATE ACTION REPORT 2024