Climateworks CENTRE

Decarbonising Indonesia's high-value industrial sites through place-based action

SUMMARY REPORT

DECEMBER 2025

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge and pay respect to the Traditional Custodians and Elders – past and present – of the lands and waters of the people of the Kulin nation on which the Climateworks Centre office is located, and all of the Elders of lands across which Climateworks operates nationally. We acknowledge that sovereignty was never ceded and that this was and always will be Aboriginal land. More information.

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ABOUT US

Climateworks Centre bridges the gap between research and climate action. We are climate transition specialists, working in Australia, Southeast Asia and the Pacific with decision-makers who have the power to reduce emissions at scale. Climateworks Centre develops evidence-based solutions to accelerate emissions reduction in line with the global 1.5°C temperature goal and shared climate safety.

Co-founded by philanthropy and Monash University, Climateworks Centre is an independent not-for-profit working within the Monash Sustainable Development Institute.

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Introduction

Indonesia is expanding quickly – its population, economy, energy use and emissions are all on the rise. Achieving the country's dual goals of rapid economic growth and emissions reduction will depend, in no small part, on how its industrial and manufacturing sectors navigate the government's greenlight for growth and changing global dynamics that incentivise low-carbon production.

Since 2020, Climateworks Centre has analysed high-value industrial sectors across Australia and Southeast Asia as catalysts in net zero transitions capable of preserving livelihoods, economic growth and international competitiveness. We have found that collective action – collaboration between multiple industrial actors and between industry and government – is key to accelerating emissions reduction, saving valuable time and resources while creating better outcomes for business and surrounding communities.

The Indonesian Government has taken steps to support decarbonisation of its industrial sector, including top-down initiatives to map the sector, create a mechanism to value industrial carbon emissions, implement emissions reduction policies, strengthen circular economy practices and develop 'green' industry standards. This type of overarching direction and agenda-setting for the sector is critical for its decarbonisation. But so too is more localised action, which is where Climateworks Centre's place-based approach to industrial decarbonisation fits in.

Importance of industrial decarbonisation in the global push towards a net zero economy

Heavy industry and manufacturing – production of iron and steel, cement, textiles, chemicals and many other commodities – is one of the world's largest sources of greenhouse gas emissions.

Sources estimate that the sector's emissions account for between a quarter and 40 per cent of total global emissions (Stanford University 2024). And they are growing. In the past two decades, industrial emissions have increased by 70 per cent (IEA 2023a).

As the world pursues net zero emissions by 2050, it is forming a global economy that trades and competes in low-carbon products. A decarbonised industrial sector is a prerequisite for limiting global temperature rise and maintaining continued economic competitiveness in many countries.

That task is significant, and a net zero economy will demand more, not less, from the industrial sector. Beyond decarbonising existing supply chains, demand for new low-carbon products, such as green steel, green hydrogen and improved batteries, is expected to rise this decade and in the future.

Industrial transitions will look different from industry to industry and from country to country. However, for all, low-carbon industry can be an economic opportunity, a climate solution and a chance for industrial facilities to find a better balance with surrounding communities and ecosystems.

Economic opportunity

Low-carbon industries – predominantly renewable power generation and electric vehicle (EV) supply chains – are estimated to be worth 5 per cent of global GDP by 2050 (Lambert 2022). To accommodate the technology needed to reach net zero by 2050, mineral demand is expected to increase two to three times between 2024 and 2030, and the combined market value of energy transition minerals is projected to double (IEA 2024). Countries like Australia and Indonesia, rich with transition mineral reserves, could have a strong foothold in global markets.

There are increasing commitments from large multinational companies to produce low-carbon products despite higher costs, indicating that a green market is emerging. For example, the World Economic Forum's First Movers Coalition has committed key consumers across seven sectors, including aluminium and iron and steel, to produce or procure a target percentage of low-carbon products, despite premium costs (World Economic Forum n.d.).

Climate solution

Efforts to limit global temperature rise depend on swift emissions reductions in the world's most emissions-intensive sectors. Global industrial emissions, which have increased over the past two decades, must decrease by 60 per cent by 2040 to achieve net zero emissions by 2050 (IEA 2023b).

The reductions are possible, underpinned by increases in material and energy efficiencies, low-carbon high-heat technologies, and renewable energy generation, storage and transmission (Bashmakov et al. 2022). These solutions already exist. Available technology allows industrial and manufacturing facilities to achieve near-zero emissions from industrial heat and other industrial processes, with more technologies in active development.

Improved social outcomes

Industrial sectors are core economic drivers in countries worldwide. A transformation to low-carbon and net zero production can expand their purpose to be vectors for sustainable development goals and equitable growth (International Labour Organization 2016). A just industrial transition places workers and communities at its heart, ensuring that no one is left behind in the shift to a low-carbon future. This means proactively reskilling and upskilling the existing workforce, designing social protection measures for those in legacy sectors and creating new, high-quality jobs in emerging low-carbon industries.

Decarbonisation is also an opportunity to rebalance industry–community dynamics, centring economic opportunities, jobs, equitable regional development and reduced environmental harm (WRI 2019). Done well, decarbonisation will be undertaken in collaboration with public, private and community actors to co-design an industrial transition that works for all.

Industrial growth and extractive industries in Indonesia

Indonesia is one of the fastest-growing economies and populations, and growth on both fronts is anticipated to accelerate in the coming decades.

Policies like its National Long-Term Development Plan *(Rencana Pembangunan Jangka Panjang Nasional)*, which sets out development goals to 2045, aim for 7 per cent annual GDP growth and for per capita income to reach US$30,000 in that time (Karyza 2023; ANTARA May 2023). By 2045, the Indonesian population is expected to reach 324 million (Wiradji 2023).

Indonesia's plans to meet its economic growth targets are primarily underpinned by industrialisation, especially in its downstream sectors, which focus on adding value to raw materials through processing and manufacturing. Demand for Indonesia's critical minerals, such as nickel, bauxite, tin and copper, is forecasted to increase in the coming decades. These are vital to producing clean energy technologies such as EVs and lithium-ion batteries. Policies encouraging domestic processing, refining and manufacturing capacity for these commodities aim to attract up to US$545.3 billion in investments by 2040, underpinning ambitions for future economic growth (Reuters Plus n.d.).

Indonesia's energy sector is also vital to its economic growth goals. Indonesia's energy demand is projected to grow 4.5 times by 2050 compared to 2022 levels, underpinning ambitions to quadruple the economy and become the fourth-largest economy by 2050 (Grant et al. 2024; DFAT 2023). Rapid decarbonisation of emissions-intensive high-growth sectors, particularly the energy and industrial sectors, is essential if this growth is to align with domestic and international net zero targets.

However, Indonesia continues to expand domestic fossil fuel capacity to power the growth of the industrial sector and achieve energy self-sufficiency (ANTARA 2024). Total energy sector emissions have outpaced energy demand, having more than doubled over the last two decades (IEA 2022; IESR 2023). The renewable energy rollout in Indonesia has been slow, generating only 13 per cent of the energy mix, falling short of the pledged 23 per cent by 2025 (IESR 2024). Instead, fossil fuels generate more than 80 per cent of Indonesia's energy, and there is a growing reliance on coal for industrial growth.

Indonesia's industrial decarbonisation goals

Indonesia's government is making concerted efforts to pursue sustainable growth in its industrial sector, one of the country's most emissions-intensive sectors.

Industrial emissions are estimated at 460 megatonnes of carbon dioxide equivalent ($MtCO_2e$), accounting for nearly 23 per cent of the country's direct emissions (IESR 2024; Climate Transparency 2022). The Ministry of Industry has announced its intention for the industrial sector to reach net zero emissions by 2050 (WRI Indonesia 2025).

The government is taking steps to ensure that its industrial sector re-orients towards low-carbon production. Two of its primary initiatives are a decarbonisation roadmap for the sector and policies and regulations for 'eco-industrial parks'.

Decarbonisation roadmap

The Ministry of Industry, in collaboration with the World Resources Institute (WRI) Indonesia and the Institute for Essential Services Reform (IESR), has developed an industrial decarbonisation roadmap to translate mitigation targets outlined in the country's nationally determined contribution – 43.2 per cent emissions reduction by 2030 and net zero by 2060. The roadmap focuses on nine priority industrial subsectors – cement, ammonia, iron and steel, pulp and paper, textile, chemicals, ceramic and glass, food and beverages, and automotive – and highlights strategies such as energy efficiency measures, the adoption of clean and renewable energy and the implementation of circular economy principles. The roadmap outlines a trajectory that the sector could follow to reach net zero by 2050 (WRI Indonesia 2025).

Energy transitions are key strategies in industries' decarbonisation trajectories outlined in the roadmap. It is also a focus for some of the government's most high-profile international decarbonisation partnerships. At the 2024 G20 summit, the government announced an earlier target date for transitioning the country away from coal power (Milko 2024). This would mean dramatically expanding renewable energy generation and substituting coal with cleaner energy sources to maintain energy security for industries. The government is relying on international partners involved in its Just Energy Transition Partnership and the Energy Transition Partnership to help the country transition to cleaner energy sources and away from a fleet of more than 250 coal power plants (JETP Indonesia n.d.; Energy Transition Partnership and UNOPS 2024).

To expand renewable energy capacity, the Ministry of Energy and Mineral Resources' regulation No. 2/2024 promotes the installation of rooftop solar power systems by eliminating previous capacity limits, including a 15 per cent restriction, and implementing a quota-based approach for renewable energy adoption in industries (Karyza 2024). The Ministry expects this modification to promote broader adoption of rooftop solar energy by facilitating larger installations that meet the energy requirements of industrial and commercial sectors.

Eco-industrial parks

The government aims to transition all industrial estates[1] to 'eco-industrial parks', an effort being undertaken through updated regulation and in partnership with the United Nations Industrial Development Organisation (UNIDO) Global Eco-Industrial Parks Programme (GEIPP) (GEIPP n.d.; ANTARA November 2023). GEIPP uses UNIDO's international framework for eco-industrial parks and implements principles like energy efficiency, circular economy and waste management at the parks.

Additionally, the government has introduced a series of updated policies aimed at enhancing the planning, management and development of industrial zones.[2] The most prominent regulation in this regard is Government Regulation (PP) No. 20 of 2024 about Industrial Spatial Planning *(Perwilayahan Industri)*, which forms the core of the updated framework for industrial zone development in the country. PP No. 20/2024 establishes the foundation for the future development of industrial zones, with an emphasis on environmental sustainability. Support for eco-industrial parks is among the critical updates found in the regulation:

1. Environmental awareness in industrial zones: A shift towards the establishment of eco-industrial parks (*Kawasan Industri Berwawasan Lingkungan*), ensuring that industrial zones contribute positively to the environment. This approach aligns with Indonesia's broader environmental and climate goals, promoting green technologies and sustainable practices within industrial zones.
2. Strengthened central government role: The regulation affirms the central government's oversight in spatial planning, particularly in cases where regional authorities have failed to meet deadlines for establishing zoning plans. This centralisation aims to streamline the development process and ensure consistency in industrial zoning nationwide.
3. Strategic national projects: PP No. 20 permits the implementation of industrial projects deemed nationally strategic, even if they are not yet reflected in the regional spatial plans. This flexibility enables the government to advance national priorities without being hindered by local zoning delays.

[1] Industrial estates are legally designated industrial areas that are developed and managed by a central company (private or state-owned), see Figure 2.

[2] 'Industrial zone' is a zoning designation used in regional planning and are areas where industrial estates or sole industrial actors may operate, see Figure 2.

Despite existing policy frameworks and intervention from international organisations and non-governmental organisations (NGOs), decarbonising Indonesia's industry sector is not without challenges. Multiple analyses find Indonesia's industrial decarbonisation could be hindered by high investment costs, limited technical capacity and policy or regulatory gaps (Lawrence Berkeley National Laboratory and IESR 2024; Clean Energy Investment Accelerator 2023; WRI Indonesia 2024).

In addition, industrial decarbonisation is a complex undertaking that varies from country to country and from one supply chain to the next, which is why some of these industries have been branded 'late to abate'. Complicating factors include the high cost of low-carbon infrastructure, high-temperature processes requiring combustion, the long lifetimes of industrial assets, regulatory barriers, the maturity of existing commodity markets and the dependence on renewable energy rollouts.

The complex systems challenge of industrial transition requires stakeholder coordination across industry, governments, finance, communities and the energy sector. Simultaneous shifts will underpin the transition, including changes to infrastructure and the energy system, regulation and policy, workforce and skills, corporate strategy, technology solutions, new demand and markets, and finance and investment.

Through our industrial programs in Australia and Southeast Asia, Climateworks Centre has found that these transitions are often too cumbersome for a single facility, company or even industrial estate to undertake alone; instead, collective action can provide the leverage and momentum needed to set change in motion.

Collective action through net zero industrial precincts can decarbonise industry

Climateworks Centre (n.d.) has developed a place-based approach to industrial decarbonisation – a model for collective action, investment and renewal that we use in Australia, Vietnam and Indonesia, called net zero industrial precincts (NZIPs).

Place-based industrial decarbonisation is an approach that can be applied to industrial 'precincts' where co-located, emissions-intensive industries collectively decarbonise through securing firmed renewable energy, leveraging shared infrastructure, building enabling infrastructure, sharing risks, knowledge, costs and resources, and implementing circular economy systems, energy efficiency and low-carbon technologies. NZIPs aim to produce competitive low-carbon goods and stimulate new green exports through decarbonising existing production and attracting new industries.

Comparing NZIPs with existing place-based initiatives in Indonesia

Place-based approaches are widely accepted as important economic and policy approaches to accelerate net zero transitions (World Economic Forum 2024; Agarwal et al. 2024; Beyond Zero Emissions and WWF-Australia 2020). A few place-based programs are already underway in Indonesia, including the World Economic Forum's Industrial Clusters Program and UNIDO's GEIPP.

There are two sites participating in the World Economic Forum program in Indonesia: a greenfield site in development for EV battery supply chain operations, the Indo-Pacific Net Zero Battery Consortium, and an existing estate, Jababeka Industrial Estate, which hosts small- to medium-sized businesses in downstream manufacturing industries (World Economic Forum n.d.). This program is being implemented at the industrial estate level.

UNIDO's GEIPP is also working with existing industrial estates – five participating sites to date – aiming to improve resource and energy efficiency, circular economy, waste management and other practices in line with the global Eco-Industrial Park (EIP) framework (UNIDO and GEIPP n.d.).

However, by only working within the boundaries of industrial estates, these programs miss out on a significant portion of Indonesia's industrial output and emissions, which are produced at older upstream manufacturing facilities not located in existing hubs. Climateworks Centre's proposed NZIPs approach casts a wider net to ensure Indonesian industrial sites of economic and global supply chain importance, which are also significant emitters and energy consumers, are targeted for place-based decarbonisation.

NZIPs fill a gap for industrial action in Indonesia, using a complementary approach to both macro and micro initiatives and bringing together multiple stakeholders to create impact. By including industrial actors beyond, but close to, individual industrial estates, NZIPs can spread costs further, accelerate energy transitions and build valuable leverage for government and investor support. By keeping action contained within NZIPs, stakeholders can more precisely plan a decarbonisation pathway that suits the unique dynamics of industries located there and work with local government and community groups to adopt approaches that work for all.

NZIPs support dual decarbonisation and growth goals

Low-carbon, socially and environmentally conscious production is becoming a critical factor for maintaining access to global markets.

Globally, regulatory pressure is increasing in the form of more stringent environmental, social and governance (ESG) reporting mandates, consistency with sustainable finance taxonomies and tariffs on emissions-intensive imports. The European Union (EU)'s Carbon Border Adjustment Mechanism is a prominent example of such a tariff, which ensures imported goods with high production emissions cannot undercut low-emissions equivalents produced in the EU or elsewhere.

As Indonesia pursues rapid industrial growth and economic returns, it will need to ensure that what it produces can integrate into low-carbon supply chains and meet growing international demand for sustainable products. Decarbonising its heavy industry – linked to 40 per cent of the country's GDP – will be a prerequisite for maintaining market competitiveness (Climateworks Centre 2025a; World Bank 2024).

Embracing a place-based approach to decarbonise industry offers the country three key advantages: speed and scalability, investor appeal and lower costs.

Operating at a precinct level allows many facilities and industries to decarbonise simultaneously through shared access to renewable energy, shared infrastructure and technology, or workforce development, among other examples. Successful NZIPs can provide a template for other industrial clusters and offer positive proof points for investors.

Accessing investment for low-carbon industry can be a significant barrier to industrial decarbonisation. Due to perceived risks, upfront costs and uncertainty surrounding demand and pricing for low-carbon products, investment is a critical early input. NZIPs bring together industrial, government and investor stakeholders to pursue blended (public-private) finance and co-develop bankable initiatives capable of attracting both financiers and product buyers.

High upfront costs for low-carbon technologies result in cost increases for low-carbon products, known as 'green premiums', compared to their emissions-intensive predecessors. Collective NZIP decarbonisation can help offset the upfront costs by spreading them across multiple users, making initial technology investments more manageable and affordable. NZIPs with industrial production aligned to global ESG expectations attract more buyers and off-takers, and open new markets for green products. Additionally, government support for NZIPs – whether through commitments or clear regulation and policy signals – can help secure domestic and global demand for the low-carbon products made there.

A custom approach for Indonesian heavy industry

Climateworks Centre's NZIP program, first developed through the Australian Industry Energy Transitions Initiative, uses a precinct-based approach to decarbonise heavy industry in Australia and Southeast Asia.

Our NZIP initiatives are well underway in Vietnam and Indonesia, where heavy industry plays a central role in the countries' plans for economic prosperity and social advancement. Climatework Centre's NZIP approach is tailored to fit different national contexts and dynamics, including local industry, energy infrastructure, government policies and the extent of available investment.

The approach we have outlined for NZIPs in Indonesia draws on insights and best practices from past and ongoing projects in Australia and Vietnam – knowledge that underpins our understanding of how to implement NZIPs throughout Indonesia. The five stages of this work are shown in Figure 1 below.

To begin, Climateworks Centre set out to identify what a successful Indonesian NZIP would ultimately look like, using findings from past NZIP projects and Indonesia's legislated emissions reduction targets. The program then transitions into more analytical work to identify industries relevant to Indonesia's long-term economic development and to map their geographical locations. Using this mapping exercise, we identify clusters of key industries – 'precincts' where industrial estates and sole actors are co-located – that are best suited for a place-based approach to industrial decarbonisation. This is the stage we completed as of the writing of this report. In the next stage of work, we will identify the specific opportunities and barriers to decarbonisation that each precinct and industry would likely face. Using this knowledge, we can identify the best combination of precinct-specific policies and market mechanisms to overcome barriers and catalyse investment. The process culminates with an investment-grade transition plan, tailored to each precinct, with actions for governments, industries and precinct stakeholders.

FIGURE 1: Stages of Climateworks Centre's Indonesian NZIP program

SET GOALS	ANALYSE CONTEXT	IDENTIFY SITES	DEVELOP PATHWAYS	DELIVER NZIP
Determine what a successful NZIP looks like	**Establish country priorities and identify partners**	**Identify suitable precincts**	**Determine what's needed to seize opportunities**	**Create a plan to achieve a successful NZIP**

+ Identify legislated targets
+ Articulate NZIP goals
	+ Map existing industries
	+ Understand country-specific economic, social and infrastructure systems and priorities
	+ Identify local resources
		+ Create site selection methodology
		+ Identify relevant stakeholders
			+ Conduct market analysis
			+ Analyse energy use and emissions
			+ Contextualise industrial decarbonisation pathways
			+ Identify policy levers
			+ Engage stakeholders
			+ Refine goals
				+ Create transition plan
				+ Create investment plan, including:
				  + Cost-gap analysis
				  + Technology investment schedule
				  + Energy infrastructure investment schedule

Define Indonesian NZIP goals by combining Climateworks Centre's industrial decarbonisation expertise with government decarbonisation targets to outline an ideal precinct: low-cost, rapid transition to producing globally needed low-carbon goods.	Analyse Indonesia's economic, social, energy and infrastructure priorities to identify industries best placed for decarbonisation and the data and partners needed to support the NZIP program.	Apply a four-part methodology – industrial, geographic, technical and stakeholder assessments – to shortlist five candidate sites from thousands for piloting the NZIP approach.	Assess opportunities and challenges for each candidate precinct to determine funding, resources, infrastructure and policy support, engaging stakeholders to create feasible technology and energy transition timelines toward net zero.	Develop precinct transition plans and investment-ready prospectus with stakeholders to unlock industries, government and international actors' confidence to support and invest in an NZIP.
COMPLETED WORK			UPCOMING WORK	


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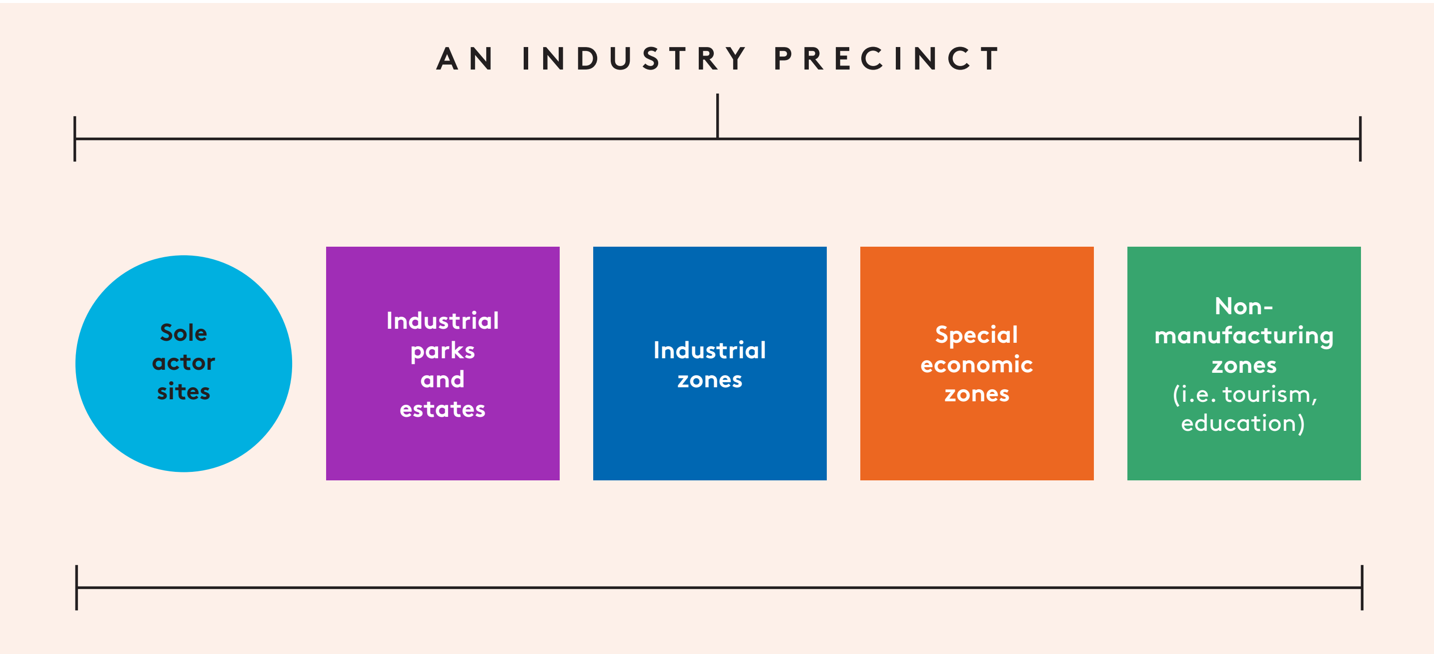
Climateworks Centre's project to identify NZIP candidate sites in Indonesia

Climateworks Centre has developed the foundational knowledge and analysis needed to help establish NZIPs in Indonesia.

Over the past year, we conducted industrial sector research showing how an NZIP approach might be applied to existing industrial areas and facilities, and, based on key criteria, which are well placed to become net zero precincts. Through this analysis, we identify candidate sites where an NZIP approach might be piloted. If successful, these pilot sites could help position Indonesia as a regional leader in industrial decarbonisation and provide a model for other precincts to emulate.

The process of identifying potential NZIPs began with a pool of thousands of industrial sites. A precinct is where actors are co-located and can include a combination of any of the following: industrial sole actors (individual companies); industrial estates; industrial zones; special economic zones; and non-manufacturing zones, see Figure 2.

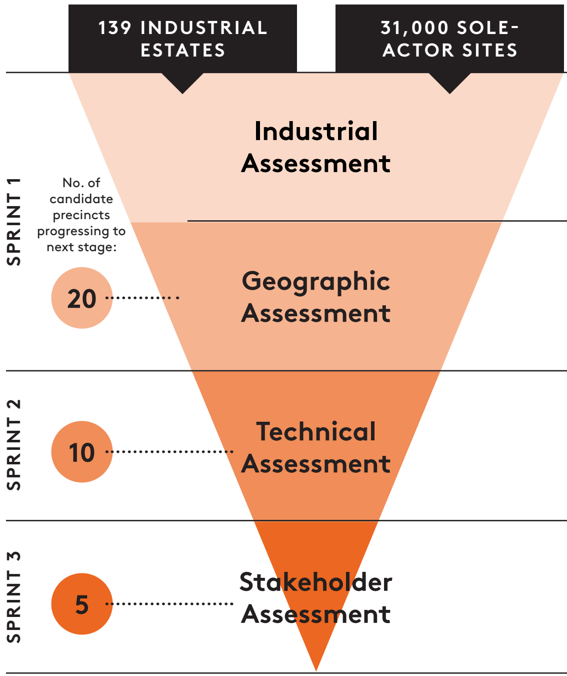
FIGURE 2: Types of industrial sites included in Climateworks Centre's NZIP assessments



To assess the sites' NZIP potential, we employed a cascading methodology to identify a shortlist of sites that would be best-suited to adopt an NZIP approach to decarbonising operations.

Our methodology included industrial supply chain analyses, geographic assessments, technical feasibility assessments and stakeholder suitability evaluations, see Figure 3. Each assessment builds on the previous outcome, ensuring a comprehensive evaluation of both the technical and socio-political aspects of potential NZIPs.

FIGURE 3: Climateworks Centre's industrial site assessment and selection method



+ Identify high-value industries in Indonesia based on: - national importance or economic value - contribution to global low-carbon supply chains - decarbonisation potential + Identify all sole-actor facilities and industrial estates related to high-value industries	Seven high-value industries identified	~31,000 sole-actor facilities narrowed down to 65	140 industrial estates narrowed down to 40
+ Develop GIS tool to map the locations of shortlisted sole-actor facilities and industrial estates + Identify 20 candidate precincts by grouping co-located shortlisted sole-actor sites and industrial estates	20 candidate precincts	65 sole-actor facilities narrowed down to 34	40 industrial estates narrowed down to 23
+ Produce heat maps to assess industry and energy data against chosen criteria to determine potential opportunities for, and impact of, NZIP-based decarbonisation at each of the 20 precincts + Identify top 10 candidate precincts for NZIP-based decarbonisation	10 candidate precincts	34 sole-actor facilities narrowed down to 20	23 industrial estates narrowed down to 10
+ Identify five candidate sites based on assessments of: - stakeholder ambition - ESG factors - investment opportunities - feasibility of applying NZIP approach	Five candidate precincts		

Industrial assessment

To begin narrowing down the pool of thousands of industrial sites, Climateworks Centre first looked for industrial supply chains of national significance, identifying seven high-value industries suited for NZIPs in Indonesia. Supply chains were selected based on their economic significance, future global supply chain importance and emissions reduction potential (those with high scope 1 and 2 emissions and known decarbonisation solutions). Findings from Climateworks Centre's Australian Industry Energy Transitions Initiative and the IESR industrial decarbonisation roadmap were critical sources (Climateworks Centre and Climate-KIC Australia; Lawrence Berkeley National Laboratory and IESR 2024).

The seven industrial supply chains are:

+ iron and steel
+ cement
+ textiles
+ chemicals
+ aluminium and alumina
+ pulp and paper
+ nickel.

We next identified the facilities responsible for 70 per cent or more of production within their respective supply chain.

Iron and steel

By 2050, global steel demand is forecast to increase by a third to support growing populations and urbanisation and is a critical material for clean energy transitions (IEA 2020). Indonesia is among the top 20 largest crude steel producers in the world, producing 15.8 million tonnes (Mt) in 2023 (Parapat and Hasan 2023). There has been a 14 per cent annual increase in Indonesia's steel production over the last decade (Lawrence Berkeley National Laboratory and IESR 2024).

The products selected for our Indonesia NZIP analysis were crude iron, crude steel, stainless steel and galvanised steel.[3] Both basic oxygen furnaces (BOF) and electric arc furnaces (EAF) that produce crude iron or steel involve significant process emissions and industrial heat emissions. These have the potential to be decarbonised either through the electrification of industrial heat or by using green hydrogen to displace coal in the reduction process. Decarbonisation is predicated on implementing energy and material efficiencies and renewable energy for production.

For the selected iron and steel products, we identified four producers – PT Krakatau Steel Tbk, PT Gunung Raja Paksi Tbk, PT Krakatau Posco and PT Dexin Steel Indonesia – that account for nearly 100 per cent of total annual production.

Cement

Indonesia is one of the top ten largest cement producers in the world, producing 65 Mt in 2023. Cement is one of the most energy-consuming and carbon-intensive manufacturing subsectors in Indonesia. Total cement production in Indonesia could increase between 28 and 59 per cent by 2060 (Lawrence Berkeley National Laboratory and IESR 2024).

The products selected for our Indonesia NZIP analysis were clinker and bagged cement. The manufacturing process to produce clinker with cement kilns involves both significant process emissions and emissions from industrial heat. These have the potential to be decarbonised through either carbon capture and storage (CCS) or carbon capture and utilisation (CCU) or by switching to low-carbon fuels, such as hydrogen or bioenergy, for industrial heat. Decarbonisation is predicated on implementing energy and material efficiencies and renewable energy for production. The use of supplementary cementitious materials could also play a role in decarbonising cement.

For the selected cement products, we identified three producers – PT Semen Indonesia Tbk (six subsidiaries and facilities), PT Indocement Tunggal Prakarsa Tbk and Bosowa Semen – that make up over 70 per cent of total annual production.

Textiles

The Indonesian textiles sector is economically and socially significant, with an export value of around US$12 billion and more than 540,000 enterprises operating within the subsector (Lawrence Berkeley National Laboratory and IESR 2024).

Our Indonesia NZIP analysis focused only on sites involved in 'midstream' production processes of the supply chain (i.e. fibre-spinning or fabric production that produces yarn, fibres and dyed and undyed fabrics). Most of these production processes – spinning and low-temperature heat to dry fabric – can be decarbonised through electrification. Decarbonisation is predicated on implementing energy and material efficiencies as well as renewable electricity for production.

Our analysis included the top Indonesian textile producers involved in these 'midstream' processes by market share: PT Indorama Synthetics TbK, PT Sri Rejeki Isman Tbk (three subsidiaries and facilities), PT Ever Shine Tex TbK, PT Kahatex, PT Frans Putratex, PT Ricky Putra Globalindo Tbk, PT Asia Pacific Investama TbK and PT Trisula International Tbk (Lawrence Berkeley National Laboratory and IESR 2024).

[3] Plants that produced other downstream iron or steel products (e.g. steel coils or rods) were kept in if they were sited within strategically located industrial estates.

Chemicals

Indonesia is the fifth-largest ammonia producer in the world, accounting for 5 per cent of total ammonia production globally in 2023 (Lawrence Berkeley National Laboratory and IESR 2024). Ammonia is one of the components used to produce hydrogen, and Indonesia's National Hydrogen Strategy signals the country's ambitions to be a hydrogen exporter. Green hydrogen (hydrogen produced using renewable energy) is an alternative fuel source for decarbonising industrial heat processes, which Indonesia could deploy domestically.

The products selected for our Indonesia NZIP analysis were liquid grey ammonia, urea and methanol. Plants producing ammonia and urea on-shore can decarbonise using green hydrogen as a replacement for fossil fuels. Methanol production can also use green hydrogen feedstock to cut emissions. Ammonia and methanol are also potential 'hydrogen carriers' that might be used in the future to transport hydrogen as molecules. Decarbonising these chemical products is predicated on implementing energy and material efficiencies as well as renewable electricity for production.

We included producer PT Pupuk Indonesia (five subsidiaries and facilities) in our analysis, based on findings that they produce 98 per cent of domestic ammonia; they are also the only producer of urea and methanol (Lawrence Berkeley National Laboratory and IESR 2024; International Centre for Sustainable Carbon 2022; Freshdi 2025).

Aluminium and alumina

The Ministry of Industry has set an ambitious target for national aluminium production to hit 2 million tonnes by 2025, up from 250,000 tonnes in 2023 (AL Circle 2024). The Ministry of Energy and Mineral Resources, Mining and Coal Bureau is also looking to ramp up alumina production with the construction of eight new alumina plants. Once operational, these facilities could produce 8.5 million metric tonnes of alumina per year, nearly doubling national production (Shanghai Metals Market 2024).

The products selected for our Indonesia NZIP analysis were crude alumina and crude aluminium.

Smelter sites that produce crude alumina and electrolyser sites that produce crude aluminium can decarbonise through energy and material efficiencies as well as by electrifying industrial heat. Alumina smelters can use hydrogen to displace coal in the calcination process.

We included the two currently operational aluminium smelters in the country – PT Indonesia Asahan Aluminium and PT Kalimantan Aluminium Industry – with a combined production capacity of 500,000 tonnes per year. We also included three alumina refineries, PT ANTAM Tbk, PT Bintan Alumina Indonesia and PT Well Harvest Winning, with a combined production capacity of around 4.3 Mt per year, according to our analysis.

Pulp and paper

In 2023, Indonesia was the world's seventh-largest producer of pulp for paper, accounting for 5 per cent of global production (Food and Agriculture Organization of the United Nations 2023). Most of the pulp produced in Indonesia is used for paper, and by 2060, the country's total paper production is projected to more than double (Lawrence Berkeley National Laboratory and IESR 2024).

The products selected for our Indonesia NZIP analysis were pulp and recycled pulp. Sites that produce pulp, called pulping mills, can be decarbonised largely by electrifying low-temperature heat. Across all products, facilities can decarbonise through energy and material efficiencies, as well as the use of renewable electricity.

The vast majority of Indonesia's pulp production occurs at six pulping mills – PT APP Purinusa Ekapersada (three facilities), Asia Pacific Resources International Ltd (two facilities), and PT Tanjung Enim Lestari Pulp and Paper (one facility) – which produce close to 100 per cent of the country's 12 Mt annual production. We included all six pulping mills in our analysis.

Nickel

Indonesia is home to over 40 per cent of the world's nickel reserves, making it the largest reserve by a significant margin; it is also the world's largest nickel producer (U.S. Geological Survey 2024). In 2024, it produced more than 2 million metric tonnes, over 50 per cent of total global output. And the industry is still expanding. By 2027, Indonesia aims to become one of the world's top three producers of EV batteries (ANTARA January 2023). The four largest nickel companies in Indonesia plan to expand output by 197 per cent with an additional 530,000 tonnes of capacity by 2028 (Peh 2024).

The products selected for our Indonesia NZIP analysis were nickel pig iron, ferronickel, nickel matte and nickel mixed hydroxide precipitate (MHP).[4] Decarbonising nickel production in Indonesia is predicated on implementing energy and material efficiencies and replacing coal power with renewable energy. Emerging technological innovations, including high-pressure acid leaching and bioleaching solutions, are other potential routes to cut nickel production emissions.

Domestic nickel ore smelting is a recent development in Indonesia. Most of Indonesia's nickel smelters are located within industrial estates. In 2023, there were 14 operating smelters with 3.05 Mt total annual production capacity and 16 under construction with 2.52 Mt total annual production capacity (Parapat and Hasan 2023).

Key companies included in the assessment were PT Aneka Tambang, PT Merdeka Battery Materials Tbk, Trimegah Bangun Persada, PT Vale Indonesia Tbk, PT Huake Nickel Indonesia, PT Huafei Nickel Cobalt and PT Youshan Nickel Indonesia. However, much of the data for greenfield sites could not be found, so the market share captured in this assessment was not determined.

[4] Nickel mining and downstream manufacturing involving processed nickel were not included in this analysis.

Nickel production and the opportunity to address ESG concerns

Indonesia is home to the world's largest reserves of nickel. Using these vast reserves, the country aims to become a top producer of EVs and EV batteries before the end of this decade. The effort began in 2014 when the Jokowi administration introduced a ban on raw nickel ore exports, a policy that took effect in 2020, keeping nickel processing in the country. This move changed the face of the industry, pushing companies to produce higher-value intermediate nickel products within Indonesia rather than send nickel overseas for processing. Indonesia's efforts to become a global EV and battery manufacturing hub soon attracted international attention and investment from Korean, European and Chinese companies.

With high ambition, government backing and an influx of capital, nickel production took off. In 2014, there were two nickel smelters in the country. By 2025, the number had increased exponentially, with some sources showing more than 40 operational smelters; some government statements suggest the number could be over 50 (Subarna 2024; Rinaldi 2025).

The nickel industry's rapid expansion has been powered in large part by coal. Captive coal-fired power plants (CFPPs) operated by individual facilities not connected to the grid saw a threefold increase from 2019 to 2024 – 5.7 gigawatts (GW) to 15.2 GW (Hasan and Hummer 2024). Captive coal power is the dominant energy source for nickel facilities, with damaging environmental and health impacts for surrounding communities.

Facilities in North Maluku and Central Sulawesi have recently made headlines for causing environmental and ecological damage (Sawal 2025; Milko et al. 2024; Reuters 2025; Strangio 2025). These are indicative of shared challenges in the nickel industry, which now spans seven provinces (Nasution et al. 2024). Nickel's rapid and unevenly regulated expansion in the country has come at a high social and environmental cost (Rosada 2025).

Decarbonising these industrial parks and many others like them can achieve better outcomes for all. Connecting these facilities to renewable energy instead of coal would benefit neighbouring communities and ecosystems. Strong sustainability practices and regulations can lead to improved health and environmental outcomes for local communities. Decarbonised nickel products are poised to become more competitive in global markets. The London Metal Exchange is proposing a price premium for low-carbon nickel, and certified 'green nickel' has already traded at a premium, showing how decarbonisation and sustainability certification directly affect market competitiveness (Michel 2025).

Swift action is needed on all fronts for one of Indonesia's most prolific industries. NZIPs offer an efficient approach to decarbonisation that can help these facilities cut emissions quickly, and in collaboration with local governments and communities, to ensure beneficial outcomes beyond industry fencelines.

Geographic assessment

Once we identified high-production estates and facilities for the seven supply chains, we mapped all sites – 65 sole actor facilities and 40 industrial estates – using an ArcGIS tool to identify where co-located and proximal facilities might be combined into a single 'precinct'.

Our mapping exercise identified the geographic locations of sole actor-based and industrial estate-based industrial facilities, to understand their potential for inclusion into an NZIP. This exercise drew on the outputs of our site-selection methodology's 'industrial assessment', which provided the names and approximate locations of the industrial facilities of interest. We then used a mixture of publicly available data, including:

+ corporate publications
+ news articles
+ the Batam Industrial Estate Book (Badan Pengusahaan Batam 2022)
+ the Center for Global Sustainability's (n.d.) Industrial Parks Dashboard
+ Google Maps

to create geospatial datasets with exact latitude and longitude coordinates for these facilities. These datasets were then combined and uploaded onto ArcGIS, a web-based mapping software. For more information on the mapping methodology, see Appendix 2. Figure 4, shows 20 precincts in Java, Sulawesi, Kalimantan, West Papua, Riau Islands and Sumatra in which high-value industries might decarbonise through the collective action of NZIPs.

FIGURE 4: Location of 20 precincts representing majority production for high-value supply chains

These precincts were formulated according to two key principles: that they contained facilities (within or outside of industrial estates) across multiple supply chains of interest, and that these facilities were located closely enough to facilitate decarbonisation as a single NZIP. For example, our mapping in Central Java showed that three sole actor facilities for pulp and paper, textiles and cement near the Kawasan Industri Wijayakusuma industrial park could be clustered together with the estate to form a 'Semarang' precinct.

Precincts were chosen to ensure representation across areas of different industrial densities – low-density areas include facilities that are more dispersed, and high-density areas include facilities that are more closely located – which require different NZIP implementation strategies. To account for greater distances between facilities, with significant potential due to industrial synergies, low-density precincts were identified using an expanded geographic radius (facilities clustered within 150 kilometres [km]) relative to high-density precincts (facilities clustered within 20 km). Table 1 provides additional detail on the facilities and industrial composition of these 20 precincts. In some cases, precincts include industrial sole actors or estates with primary industries outside of our selected supply chains. These were included based on data from the Ministry of Industry and due to their geographic proximity.

TABLE 1: Precincts representing majority production for high-value supply chains

PRECINCT	LOCATION	INDUSTRIAL ESTATES WITHIN PRECINCT	SOLE ACTORS WITHIN PRECINCT	INDUSTRIES
Sumatra Utara‡	North Sumatra	+ Sei Mangkei Industrial Estate*	+ PT Indonesia Asahan Aluminium + PT Toba Pulp Lestaari Tbk + Gunung Raja Paksi	+ Aluminium and alumina + Iron and steel + Pulp and paper
Palembang‡	South Sumatra	+ –	+ PT OKI Pulp and Paper	+ Chemicals + Pulp and paper
Cilegon	Banten	+ Krakatau Industrial Estate Cilegon	+ PT Krakatau Steel + PT Krakatau Posco	+ Iron and steel
Bekasi	West Java	+ Bekasi International Industrial Estate	+ Gunung Raja Paksi + Fajar Surya Wisesa	+ Iron and steel + Pulp and paper
Citeureup	West Java	+ Cibinong Center Industrial Estate	+ Solusi Bangun Indonesia + Semen Indonesia + Indocement Tunggal Prakarsa + PT Ricky Putra Globalindo	+ Cement + Textiles
Karawang	West Java	+ Indotasei Industrial Estate + Kujang Cikampek industrial park	+ Pupuk Indonesia	+ Aluminium and alumina + Chemicals + Textiles
Bandung	Central Java	+ –	+ PT Trisula International Tbk	+ Textiles
Semarang	Central Java	+ Kawasan Industri Wijayakusuma	+ PT Primayudha Mandirijaya + PT Bitratex Industries + PT Sinar Pantja Djaja + Asia Pacific Investama + Indocement Tunggal Prakarsa	+ Cement + Pulp and paper + Textiles
Batam	Riau Islands	+ Wiraraja Industrial Park + Cammo Industrial Park	+ -	+ Textiles
Bintuni Bay	West Papua	+ Kawasan Industri Teluk Bintuni†	+ PT Pupuk Indonesia Teluk Bintun†	+ Chemicals
Bontang‡	East Kalimantan	+ Kawasan Industri Kariangau	+ Pupuk Kaltim	+ Chemicals + Nickel
Bulungan	North Kalimantan	+ Kalimantan Industrial Park Indonesia*	+ PT Kalimantan Aluminium Industry	+ Aluminium and alumina + Chemicals + Iron and steel + Nickel
Gresik‡	East Java	+ Maspion Industrial Park + Gresik Industrial Park	+ PT Petrokimia Gresik + PT Ispat Indo	+ Cement + Chemicals + Iron and steel
Halmahera‡	North Maluku	+ Indonesia Weda Bay Industrial Park* + Kawasan Industri Buli + Kawasan Industri Emerald + Ferrochromium Industry	+ -	+ Iron and steel + Nickel
Morowali	Central Sulawesi	+ Indonesia Morowali Industrial Park*	+ PT Dexin Steel Indonesia	+ Iron and steel + Nickel
Motui	South East Sulawesi	+ Kawasan Industri VDNI + Motui Industrial Park*	+ -	+ Iron and steel + Nickel
Pomalaa	South East Sulawesi	+ Indonesia Pomalaa Industry Park* + Antam Timur Industrial Park	+ -	+ Nickel
Riau	Riau	+ -	+ PT Indah Kiat Pulp and Paper + PT Riau Andalan Kertas	+ Pulp and paper
Sulawesi Selatan‡	South Sulawesi	+ Takalar Integrated Industrial Park*† + Bantaeng Industrial Park*†	+ Semen Tonasa	+ Aluminium and alumina + Cement + Nickel
Tuban	East Java	+ Kawasan Industri Tuban	+ PT Semen Gresik + Solusi Bangun Indonesia	+ Cement + Iron and steel (downstream steel)

Note: Some of the sole actors identified in the Table are located within an estate. Decarbonisation strategies and responsibilities differ between the estate and facility level – this approach does not change if the sole actor is in the estate.
*Indicates a facility or industrial estate earmarked by the Indonesian Government as a 'national strategic project'
† Indicates a greenfield site
‡ Indicates a low-density precinct

Technical assessment

Next, a technical assessment evaluated whether the 20 candidate precincts had available resources and industrial synergies (e.g. similar technology or low-carbon fuel needs to decarbonise) to cohere as an NZIP. The technical assessment, comprising feasibility and quantitative components detailed below, was used to halve the candidate pool from 20 to 10 precincts based on their readiness to implement decarbonisation technologies and their potential to reduce emissions.

Technical feasibility

Climateworks Centre used technical criteria to assess each precinct's potential for decarbonisation; see Appendix 2 for detailed criteria.

The feasibility assessment looked at all sites and facilities within a precinct to determine if they had the potential to incorporate green hydrogen production, electrification, bioenergy, CCS or other commercial-scale technologies. We examined precincts from both technical and resource-availability perspectives. From a technical perspective, we assessed whether the processes in those facilities were technologically capable of switching to decarbonised technologies. From a resource-availability perspective, we evaluated whether the surrounding region had the potential for renewable energy or shared infrastructure to support the electricity or low-carbon fuels required for these decarbonised technologies. Higher scores were given to precincts where multiple facilities showed potential to deploy one or more technologies.

Quantitative analysis

Through an analysis of industry and energy data, we sought to understand which precincts could experience the greatest potential impact on emissions and fuel use with the implementation of an NZIP strategy. We used publicly available sources, including a comprehensive dataset from the University of Maryland's Center for Global Sustainability (n.d.), as well as peer-reviewed articles and publications from NGOs or governments to estimate energy consumption, fossil fuel usage, process heat requirements and emissions at each facility, based on the production processes onsite. This information was used to understand relative emissions and energy use of different precincts, and should not be used to infer specific emissions or energy use data for these facilities. Precinct energy consumption and emissions estimates were scored as 'high' when they were within the top third of estimates (66th percentile), and those in the bottom third were scored as 'low'.

High electricity consumption was used to indicate greater potential emissions reductions if the electricity source could be converted to renewable energy. For this analysis, all precincts are considered to have high potential for solar-powered renewables due to Indonesia's abundant solar exposure of 600 watts per square metre (W/m^2) and above. For direct fossil fuel use, higher consumption was also used as an indicator of high potential for emissions reduction. The amount of energy used for process heat was also considered, as transitioning high-heat processes away from fossil fuels frequently benefits from a precinct-based approach to help reduce costs. Precincts with greater heat transformation potential were deemed more appropriate for an NZIP strategy. Finally, total facility emissions were assessed using emissions factors for each supply chain. An NZIP approach can have greater impacts at precincts with higher total emissions; therefore, those with higher total emissions were deemed more suitable for consideration as an NZIP. See Appendix 2 for more information on the data used for each of the above criteria.

The criteria used in the technical feasibility and quantitative analysis were assigned scoring components, allowing the 20 precincts to be ranked, with 10 moving on for further assessment. Scoring was one component of the information used to advance the group of 10. Halmahera precinct was advanced based on our consultations with the Ministry of Industry about 'national strategic projects'. Tuban precinct was also promoted into the group of 10 when other precincts with greenfield status (Bintuni Bay and Sulawesi Selatan) were removed. The exclusion of greenfield sites was mainly due to uncertainty around the development of industry facilities and the lack of tenants in industrial parks or estates. Details about energy plans, decarbonisation potential and NZIP impact for the 10 precincts are in Table 2, while the precincts' geographic distribution can be seen in Figure 5.

FIGURE 5: Location of ten precincts with technical capabilities to support an NZIP approach

TABLE 2: Ten candidate precincts' technical capabilities to adopt an NZIP approach

PRECINCT	PRIMARY INDUSTRIES	DETAILS ON TECHNICAL CAPABILITIES
Citeureup	+ Cement + Textiles	+ **Energy and emissions profile:** PT Ricky Putra Globalindo has a captive CFPPs of unknown generation capacity, but no entities have commitments for future captive CFPPs. Indocement Tunggal Prakarsa's facility has rooftop solar; they and Solusi Banun Indonesia have plans for upcoming renewable energy projects. All entities are grid-connected. We estimate the precinct has high levels of fossil fuel electricity consumption and total emissions. + **Supply chain decarbonisation potential:** The textiles facility has a high electrification potential. The integrated cement plant has potential applications for hydrogen, bioenergy, supplemental cementitious materials and CCS. + **Geography:** All facilities are located within 20km of each other and are within 100km + **Techincal assessment overview:** Across the technical metrics assessing NZIP potential and impact, Citeureup precinct scored high.
Cilegon	+ Iron and steel	+ **Energy and emissions profile:** Krakatau Posco currently has a 200 MW captive CFPP (Krakatau Posco Energy n.d.). Plans for a 120 MW captive CFPP have been announced for Krakatau Industrial Estate (Global Energy Monitor Wiki 2025a). A 40 MW floating solar PV project is in the pipeline, aiming to be fully online in 2025 (Power Technology 2024). All entities are grid-connected. Total emissions and levels of direct fossil fuel consumption are estimated to be high. + **Supply chain decarbonisation potential:** Steelmaking facilities using blast furnaces have a high potential for electrification and hydrogen. Basic oxygen blast furnace and galvanised steel facilities could use bioenergy. There are potential applications of other technologies, such as biochar and gas-direct reduced iron (DRI) and hydrogen-DRI, for steelmaking. + **Georgraphy:** This precinct can take advantage of its compact footprint, with all facilities located in a 20km radius, and within 100 km of a port. + **Techincal assessment overview:** Across the technical metrics assessing NZIP potential and impact, Cilegon precinct scored high.

Sumatra Utara	+ Aluminium and alumina + Iron and steel + Pulp and paper	+ **Energy and emissions profile:** Steel facilities within the precinct operate captive CFPPs, and while there are no plans for future CFPPs, there are no renewable energy projects in the pipeline. All entities are grid-connected. We estimate this precinct has high electricity consumption and total emissions. + **Supply chain decarbonisation potential:** The steel blast furnace facility and alumina smelter have high electrification potential and potential applications for hydrogen. There is potential for bioenergy, biochar and gas-DRI and hydrogen-DRI applications at the facility. + **Geography:** Low-density precinct. Facilities are spread roughly 100 km apart, which presents a challenge for NZIP implementation; however, there is a port within 100 km of the precinct. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Sumatra Utara precinct scored high.
Bekasi	+ Iron and steel + Pulp and paper	+ **Energy and emissions profile:** While there is no plan for future captive CFPPs, one of the precinct entities, Gunung Raja Paksi, has renewable energy projects in the pipeline with expected generation capacity of 33 MW (Gunung Raja Paksi n.d.). All entities are grid-connected. Our analysis estimated moderate levels of direct fossil fuel consumption and high levels of electricity consumption, with moderate levels of total emissions. + **Supply chain decarbonisation potential:** There is a high electrification potential at the integrated pulp and paper facilities and the steelmaking facilities using blast furnace–basic oxygen furnace (BF-BOF), which also have potential applications for hydrogen, bioenergy, biochar and gas-DRI and hydrogen-DRI. + **Geography:** High-density precinct. All facilities are clustered within a 20 km range and within 100 km of two seaports, rail and airport. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Bekasi precinct scored high.
Morowali	+ Iron and steel + Nickel	+ **Energy and emissions profile:** Dexin Steel Morowali has a 1100 MW thermal power plant (Global Energy Monitor Wiki 2025b). Morowali Industrial Park generates 2840 MW from captive CFPPs, in addition to 200 MW from solar power (Center for Global Sustainability n.d.). Within the industrial park, nickel facilities and Tsingshan Holding Group (one of the park's largest shareholders) have renewable energy projects in the pipeline. None of the entities is grid-connected, as they are dependent on captive CFPPs. We estimate high levels of direct fossil fuel consumption and total emissions, and that there are moderate levels of electricity consumption. + **Supply chain decarbonisation potential:** There is a high electrification potential across high pressure acid leaching (HPAL) nickel processing facilities and the steel facility with BF-BOF, and potential applications for bioenergy. There is potential for hydrogen-DRI and gas-DRI and biochar at the BF-BOF facility. + **Geography:** High-density precinct. All facilities are clustered within 20 km, which presents advantages for an NZIP approach. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Morowali precinct scored moderate.
Gresik	+ Cement + Chemicals + Iron and steel	+ **Energy and emissions profile:** At least one entity has captive CFPPs planned with committed capital through a locked Final Investment Decision. PT Petrokimia Gresik Pupuk Indonesia signed a joint development agreement with Perusahaan Listrik Negara (PLN) and ACQA Power to develop a green hydrogen and green ammonia ecosystem. Our analysis estimates moderate levels of direct fossil fuel consumption and total emissions, and high levels of electricity consumption. + **Supply chain decarbonisation potential:** There is a high electrification potential at chemical facilities using the Haber-Bosch process and at the integrated cement plant. The cement plant has potential applications for bioenergy, supplemental cementitious materials and CCS. + **Geography:** Low-density precinct. Facilities are located within 40 km of each other, which is further than the ideal distance for NZIP implementation. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Gresik precinct scored moderate.

Tuban	+ Cement + Iron and steel (downstream steel)	+ **Energy and emissions profile:** While there are no central captive CFPP plans or renewable projects, a 6.4 megawatt (MW) rooftop solar project is underway. Most entities are grid-connected with some gas access. Although no captive fossil plants are present, emissions from grid electricity are high. High emissions and energy demand present a clear opportunity for shared decarbonisation solutions like renewable procurement and CCS. + **Supply chain decarbonisation potential:** Electrification options are few, particularly for cement and steel processes. Bioenergy potential is modest, and other alternative technologies are still in early stages. While CCS and hydrogen may be viable for cement, there is no clear strategy or readiness across facilities, indicating the need for further technical support. + **Geography:** High-density precinct. The precinct's facilities are all within a 20 km radius and have access to ports and infrastructure. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Tuban precinct scored low.
Motui	+ Iron and steel + Nickel	+ **Energy and emissions profile:** There are no existing or planned renewable energy projects or planned captive CFPPs, and most facilities are not connected to the national grid. Energy supply is heavily reliant on coal, with a 2.37 GW captive CFPP currently operating. The grid has extremely high emissions intensity. Gas infrastructure is absent. Electricity use and direct fossil fuel consumption place Motui in the top third of electricity consumers and emitters across the precincts. It was one of the highest-emitting precincts assessed, which presents a significant mitigation opportunity if decarbonisation pathways are deployed strategically. + **Supply chain decarbonisation potential:** Electrification potential exists across more than three facilities; however, applications for bioenergy and other alternative technologies are virtually absent. No CCS potential was identified across the facilities. Heat demand is estimated to be high, indicating potential for transformation. + **Geography:** High-density precinct. The precinct has a compact footprint, all facilities within 20 km, and a coastal location with export access. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Motui precinct scored low.
Halmahera	+ Iron and steel + Nickel	+ **Energy and emissions profile:** The precinct is heavily reliant on coal, with 3.4 GW of captive CFPP and no confirmed renewable projects. Shared renewable energy is not feasible due to distance and terrain. Some grid and gas access exists, but fossil fuel use is high, and renewable energy infrastructure is minimal. Emissions are significant, and high coal dependency poses a major challenge for NZIP development without significant intervention. + **Supply chain decarbonisation potential:** Electrification potential exists in some facilities, but bioenergy, CCS and alternative technologies cannot be applied. Heat demand is high, though hydrogen use to decarbonise heat processes here is only technically feasible. Overall, decarbonisation readiness is low. + **Geography:** Low-density precinct. Despite port access, more than 100 km separates facilities, which may limit clustering benefits. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Halmahera precinct scored low.
Semarang	+ Cement + Pulp and paper + Textiles	+ **Energy and emissions profile:** While there are no existing or planned renewable energy projects or captive CFPPs, the area has PLN grid access for multiple entities, including large textile and cement producers. Grid emissions intensity is moderately high, and electricity demand is relatively modest. No gas infrastructure was confirmed, and fossil fuel use is moderate. Only one facility, an integrated cement plant, shows potential for hydrogen use or CCS. Emissions are relatively low, but electrification potential in key industries offers a scalable pathway for decarbonisation. + **Supply chain decarbonisation potential:** Within the precinct, the textile facilities show high potential for electrification. Bioenergy options exist at several facilities, although other alternative technologies are limited. Direct fossil fuel consumption is moderate, but there is little data on process heat. CCS is a possibility for only one facility. + **Geography:** High-density precinct. An NZIP here could take advantage of industry-specific clustering and strong export activity, particularly for the textiles industry. Precinct facilities spread across a 40 km radius, with good access to ports and cities. + **Technical assessment overview:** Across the technical metrics assessing NZIP potential and impact, Semarang precinct scored low.

Stakeholder assessment

The next step in determining which precincts might best suit an NZIP approach was to assess their progress toward clean energy adoption, emissions reduction and sustainability goals as well as their overall willingness to participate in the transition to low-carbon production. We achieved this by assessing precinct stakeholders, a process that included independently screening sole actors and industrial estates, as well as conducting interviews with individuals working within and with precincts. Through this assessment, we also looked for areas where targeted support and recommendations could accelerate the development of NZIPs in line with national decarbonisation goals.

Climateworks Centre's stakeholder screening

Candidate precincts were evaluated based on their stakeholders' reputation, ambition and interest in pursuing industrial decarbonisation. Climateworks Centre screened both sole actors and industrial estates, allowing for a comprehensive view across the entire precinct.

Companies – sole actors and those within industrial estates – in each precinct were screened based on their ESG practices and reputation. ESG performance was one consideration used to understand how well precincts might adopt NZIP practices and goals.

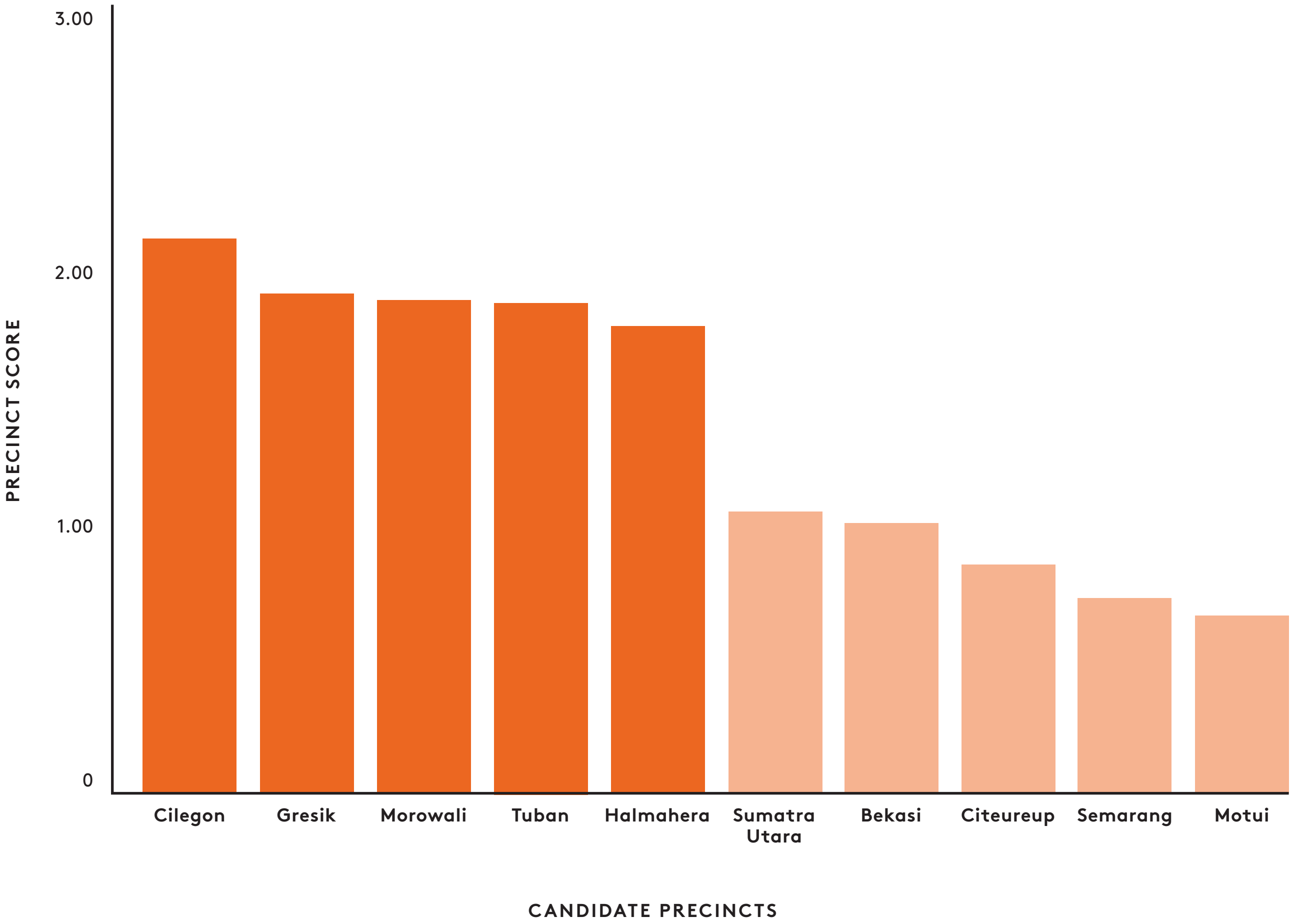
Stakeholder self-reporting

While we looked at ESG performance independently, we also used questionnaires in which participants self-reported ESG performance. Both sources helped us understand what ESG successes or shortcomings might impact future NZIP undertakings. Poor ESG performance, while noted, did not eliminate a precinct from consideration. However, ESG violations or abuses would need to be addressed directly for a precinct to become an NZIP, as these issues could deter external support and funding.

We prepared a questionnaire for individual stakeholders, including estate managers and industrial operators, to understand their perspectives on industrial decarbonisation at their company or facility. These questions helped assess the feasibility of applying an NZIP approach at each site based on stakeholder ambition and technology readiness, feasibility of deployment, investment potential, governance and business resilience, social impact and employee wellbeing, environmental responsibility, and innovation. Stakeholder responses also help identify those who might be active partners to an NZIP approach in the future, willing to help secure necessary investments or create policies and practices to support low-carbon transitions.

Stakeholder questionnaire responses each received a numerical score between 0–3, based on predefined criteria. Figure 6 shows precincts in order of overall precinct score. See Appendix 2 for more information on this scoring, including questions included on the questionnaires and the 'decarbonisation readiness' scores earned by sole actors, industrial estates and each precinct overall based on their questionnaire responses.

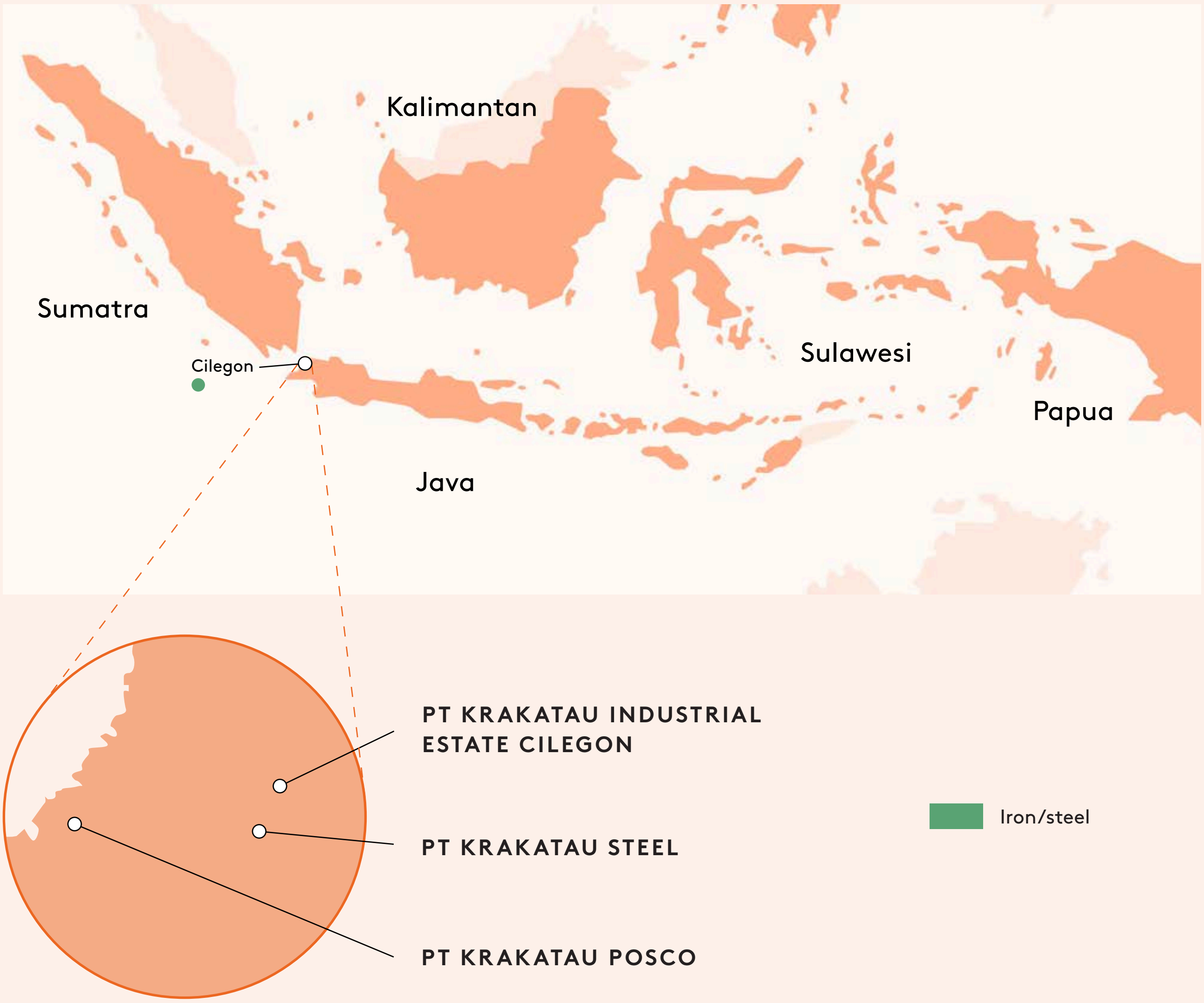
FIGURE 6: Decarbonisation readiness scores for the 10 candidate precincts



Five sites for NZIP pilot consideration

Through the industrial, geographic, technical and stakeholder assessments detailed in this report, our analyses present five sites for consideration as future Indonesian NZIPs. In upcoming work, shown in Figure 1 previously, Climateworks Centre aims to develop transition plans and investment cases at pilot precincts, as part of our effort to establish fully fledged NZIPs in Indonesia. The five sites detailed below, also shown in Figure 7, could be considered for NZIP pilots.

FIGURE 7: Location of precincts for pilot consideration



Cilegon precinct overview

Cilegon precinct in Banten province stands as Indonesia's largest hub for steel manufacturing, and it is home to two major state-linked enterprises: PT Krakatau Steel and PT Krakatau Posco, which is a joint venture between Krakatau Steel and South Korea's POSCO. Krakatau Posco alone contributes up to 3 million tonnes per year (Mt/yr) of crude steel, while Krakatau Steel operates a 4 Mt/yr crude steel facility and an idle 1.35 Mt/yr crude iron plant.

Krakatau Industrial Estate Cilegon, the industrial estate housing these facilities, also supports petrochemical and chemical industries and is managed by PT Krakatau Industrial Estate Cilegon. Recent infrastructure developments include plans for a 40 megawatt (MW) floating solar photovoltaic (PV) project, which aims to be online by 2025.

The precinct is a critical asset in Indonesia's industrial decarbonisation agenda, and it is well-positioned to evolve into an NZIP. Krakatau Steel reports advanced ESG practices and shows higher electrification potential, while Krakatau Posco reports structured but still maturing sustainability efforts. The industrial estate, by comparison, did not show the same level of sustainability engagement, highlighting the need for broader estate-level interventions.

NZIP enablers include:

+ **Grid connection and accessibility:** All main actors are connected to Perusahaan Listrik Negara (PLN), enabling access to cleaner electricity sources. The estate has a 120 MW gas power plant, and Krakatau Posco has an on-site captive 200 MW plant, totalling 320 MW.
+ **Renewable energy pipeline:** Although currently-operational renewable energy use is limited, the pipeline includes a notable 40 MW floating solar PV project scheduled for 2025.
+ **Hydrogen and CCS potential:** Both Krakatau Steel and Krakatau Posco operate blast furnace plants, which present opportunities for decarbonisation through hydrogen and CCS technologies. The presence of an idle blast furnace further enhances pilot flexibility.
+ **Electrification potential:** There is already one electric arc furnace in operation, and more are planned, indicating readiness for a shift from fossil-intensive to electric steelmaking.
+ **Process heat and emissions:** With an estimated 50 petajoules per year (PJ/year) used for process heat and more than 20 $MtCO_2$/year in total estimated emissions, the site ranks among the highest industrial energy users in Indonesia. Addressing this will be critical for emissions reduction pathways.
+ **Proximity to export infrastructure:** Located on the coast and within 100 km of export nodes, the precinct is strategically placed for low-carbon steel export ambitions, potentially leveraging international green trade incentives.

Challenges and gaps:

+ **Limited renewable energy deployment:** While a solar project is in the pipeline, no large-scale renewables are currently operational, and no clear data is available on renewable energy power purchase agreements or utility-scale wind potential.
+ **Gas infrastructure:** There is insufficient clarity regarding regional gas pipeline integration or plans to support future green hydrogen blending.
+ **Estate-level decarbonisation planning:** Compared to its tenants, the estate lags in integrated sustainability planning, suggesting a need for coordinated governance mechanisms, zoning for clean technologies and shared infrastructure for energy and emissions management.

Gresik precinct overview

Gresik precinct, located in East Java, demonstrates emerging leadership in clean industrial practices across its core sectors: ammonia, iron and steel and cement. With forward-looking actors undertaking renewable energy initiatives and early-stage hydrogen developments, Gresik is one of the more promising hubs for industrial decarbonisation in Indonesia.

The precinct is home to two facilities that will be key for its transition. The first, PT Petrokimia Gresik (a subsidiary of Pupuk Indonesia), operates a 1.1 Mt/year grey ammonia facility and is progressing toward green hydrogen and green ammonia production through a joint venture with PT PLN and ACWA Power. The second, PT Ispat Indo (located within the Gresik Industrial Park), runs a 0.7 Mt/year electric arc furnace steel facility, which is lower-emissions than blast furnace production.

Two industrial parks – Maspion Industrial Park and Gresik Industrial Park – host a mix of steel and cement producers. While both estates are grid- and gas-connected, they have yet to scale up renewable energy use, requiring further action to improve clean energy integration and emissions performance.

NZIP enablers include:

- **Green hydrogen development:** PT Petrokimia Gresik's planned green hydrogen and solar projects represent a significant transformation opportunity for ammonia production in the region.
- **Renewable energy initiatives:** Although deployment remains limited in scale, pilot efforts by Petrokimia Gresik, including 471 kilowatt peak (kWp) rooftop solar and renewable energy certificate procurement, provide examples of clean electricity sourcing.
- **Strong grid and gas connectivity:** All major sites are connected to the PLN grid and have established gas infrastructure, which supports industrial heating and the potential integration of hydrogen-based fuels.
- **Hydrogen and CCS potential:** Both ammonia and steel processes have high potential for CCS and hydrogen use, which can be further developed to decarbonise core processes.
- **Export infrastructure:** Proximity to major seaports (0–20 km), airports (30–38 km) and urban centres (Gresik and Surabaya) strengthens the precinct's potential for low-carbon commodity trade.

Challenges and gaps:

- **Low renewable energy uptake:** The precinct lacks utility-scale renewable projects. Scaling beyond pilot rooftop solar installations remains a priority.
- **Moderate electrification and bioenergy potential:** While electric-furnace-produced steel provides a low-carbon option, other industries in the precinct show limited potential for electrification or bioenergy integration in the short term.
- **Emissions and energy use:** The precinct consumes an estimated 2.7 terawatt hours per year (TWh/year) of electricity and emits an estimated 9.5 $MtCO_2$/year, largely from fossil-based ammonia production and cement operations. This energy- and emissions-intensive usage also presents an opportunity to improve efficiency and build a renewable-powered electricity supply.
- **Fragmented decarbonisation across estates:** While individual companies within industrial estates are advancing sustainability, collectively, estates lack integrated planning for precinct-level decarbonisation.

Morowali precinct overview

Morowali precinct, home to the expansive Indonesia Morowali Industrial Park, is located within one of Indonesia's most active industrial zones. It is primarily focused on nickel processing and steel manufacturing, serving as a vital node in the global EV battery supply chain. The precinct includes actors such as PT Dexin Steel Indonesia and a wide array of nickel companies, including Huayue Nickel Cobalt, Nickel Industries and several subsidiaries of Tsingshan Holding Group and CATL.

Morowali outperforms other precincts on clean energy integration, due in part to Indonesia Morowali Industrial Park's long-term plans for large-scale renewable energy projects. However, challenges remain in fossil fuel dependence, limited gas access and extremely high emissions intensity.

NZIP enablers include:

+ **Clean energy pipeline:** Indonesia Morowali Industrial Park has pledged to halt coal expansion and aims to deploy 2 GW of solar and wind power, as well as a 5 GW hydropower project. Nickel industries have also implemented 450 kWp solar with battery energy storage system (BESS) and signed a 200 MW solar with 20 megawatt hour (MWh) BESS power purchase agreement to support future operations.
+ **Renewable energy resource availability:** Morowali benefits from access to hydro and wind resources, offering a solid foundation for long-term renewable deployment.
+ **Process electrification potential:** The basic oxygen blast furnace steel process and high pressure acid leaching (HPAL) nickel operations use a lot of energy, but also present strong opportunities for electrification and heat recovery technologies.
+ **Consolidated industrial estate:** All actors are located within a 20 km radius, simplifying infrastructure development and shared decarbonisation services.
+ **Strategic export infrastructure:** The estate is within 5 km of both a seaport and an airport, giving it a competitive advantage in green supply chain positioning for nickel, MHP and stainless steel exports.
+ **National strategic priority:** The industrial estate within the precinct has been designated as a 'national strategic project', and this high level of government support could help accelerate NZIP action.

Challenges and gaps:

+ **Heavy reliance on coal:** Indonesia Morowali Industrial Park's captive power capacity is dominated by CFPPs (3.9 GW total), resulting in high direct fossil fuel use (estimated at just below 400 PJ/year) and emissions (estimated at just over 40 $MtCO_2$/year).
+ **Off-grid and isolated power systems:** Indonesia Morowali Industrial Park operates its own grid and is not connected to the national PLN system, limiting its ability to access cleaner centralised electricity options.
+ **Hydrogen and CCS potential limited:** While PT Dexin Steel's basic oxygen blast furnace process may support CCS or hydrogen in the future, such technologies are still in the early stages of readiness in this region.
+ **Environmental, human rights and governance concerns:** Concerns around environmental degradation, labour and community rights and approval conditions may hinder investments unless mitigated through transparency and improved monitoring.

Tuban precinct overview

Tuban's industrial identity is firmly rooted in cement production, led by two major company plants – PT Semen Gresik and Solusi Bangun Indonesia, both subsidiaries of Semen Indonesia. The precinct is home to two integrated cement plants, with a combined maximum production capacity of over 16 Mt/year. These facilities are among Indonesia's largest and both showcase mature strategies for emissions reduction, including the integration of alternative fuels, nitrogen oxides reduction programs and clinker substitution initiatives. The Solusi Bangun Indonesia Tuban plant has also begun developing a 6.4 megawatt peak (MWp) rooftop solar project to partially substitute grid electricity.

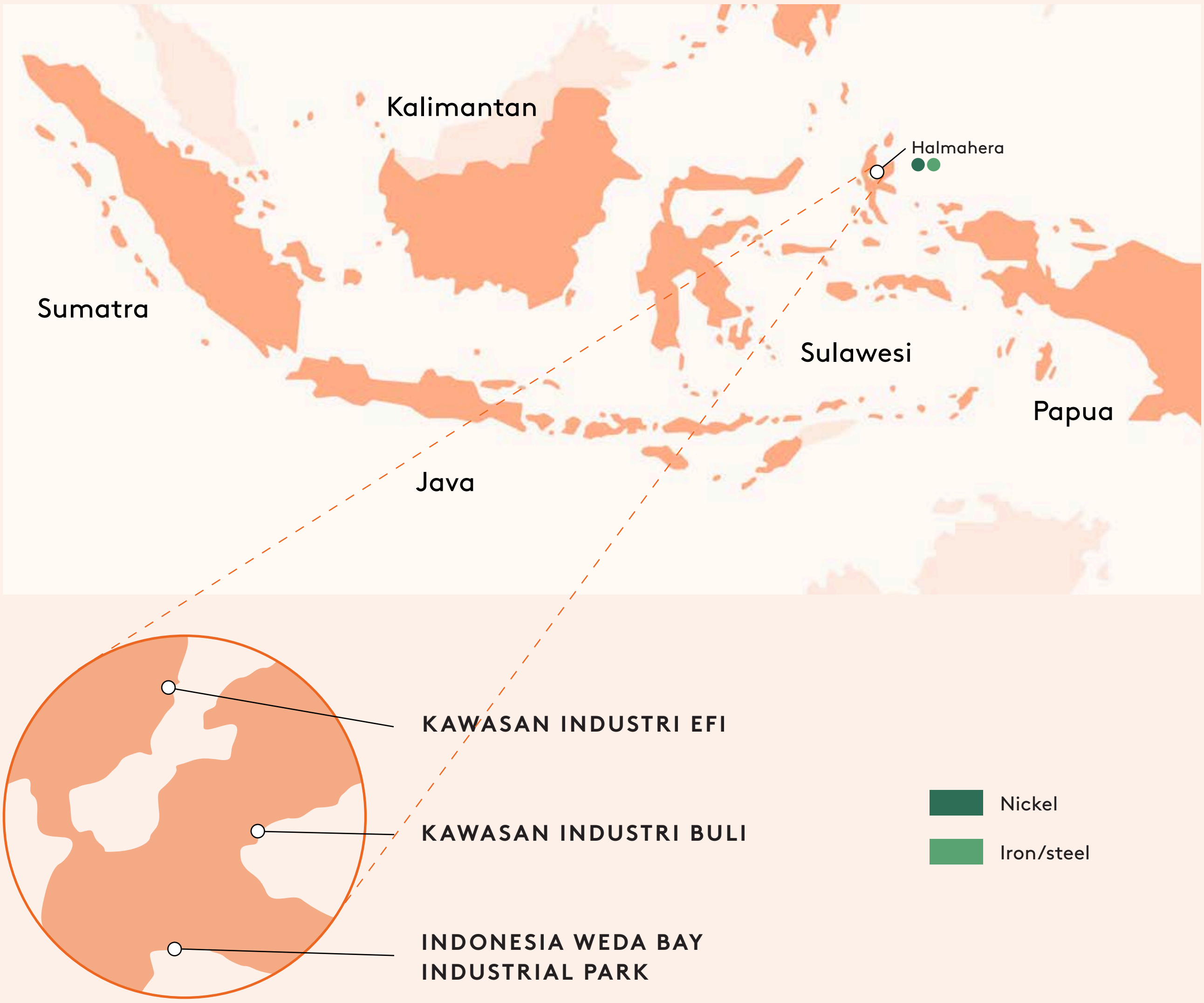
While the precinct demonstrates a commitment to sustainability, the Kawasan Industri Tuban estate lags behind, highlighting the need for estate-wide decarbonisation planning and broader adoption of low-carbon technologies.

NZIP enablers include:

- **Integrated clean energy plans:** Solusi Bangun Indonesia's solar PV project, is the precinct's only known operational renewable energy deployment. Both Solusi Bangun Indonesia and PT Semen Gresik have strategic plans to lower scope 1 and 3 emissions, including employee EV transport trials.
- **CCS potential:** The clinker manufacturing process in both integrated plants presents a clear opportunity for CCS deployment, particularly for residual emissions that cannot be mitigated through efficiency alone.
- **Alternative fuels and waste heat recovery:** Solusi Bangun Indonesia has installed a waste heat recovery plant, and both cement producers are exploring bioenergy and waste-derived fuel options to reduce their reliance on fossil energy.

Challenges and gaps:

- **Low renewable energy uptake:** Current renewable energy usage remains in the pilot phase, with no confirmed large-scale power purchase agreements or utility-scale installations.
- **Limited electrification potential:** Cement kilns have low electrification potential, and steel-related activities at the industrial estate primarily involve steel casting, rather than primary steel production, which limits the sector's decarbonisation impact.
- **Limited grid and gas coverage:** Although PLN and gas networks exist, not all entities have been confirmed to be connected or are actively transitioning to cleaner fuels.
- **Emissions intensity:** Total emissions are estimated to be just below 4 $MtCO_2$/year, which is moderate compared to Morowali or Cilegon, but still substantial given the high process heat demands in cement production.
- **Estate planning:** The industrial estate currently lacks cohesive, clean energy infrastructure or shared services to support net zero transitions among smaller tenants.



Halmahera precinct overview

The Halmahera precinct has emerged as a significant hub for nickel, iron and steel processing, driven by Indonesia's EV battery ambitions. The precinct hosts three major industrial parks: Kawasan Industri (KI) Weda Bay, KI Buli and Kawasan Industri EFI, which collectively form the industrial backbone of North Maluku. The precinct demonstrates moderate sustainability performance, led by KI Weda Bay's plans for decarbonising.

KI Weda Bay houses a vertically integrated value chain – covering nickel ore mining, ferronickel smelting, stainless steel production, HPAL plants and EV battery components – making it one of Indonesia's most strategically important industrial complexes. However, coal-powered energy, limited renewable deployment and environmental concerns constrain Halmahera's overall sustainability outlook.

NZIP enablers include:

+ **Electrification potential:** Multiple smelters and HPAL facilities in the precinct offer high potential for electrification, particularly as processes evolve toward electric furnaces and battery-grade nickel production.
+ **Hydrogen viability:** The concentration of iron, steel and nickel smelting processes makes Halmahera an attractive future candidate for hydrogen-based process heat or reduction, although no pilot projects have commenced.
+ **Existing export infrastructure:** Each estate is equipped with dedicated port facilities, ensuring seamless exports of nickel matte, MHP and stainless steel products.
+ **National strategic priority:** Industrial development within the precinct has been designated as a 'national strategic project'. This high level of government support could help accelerate NZIP action.

Challenges and gaps:

+ **Heavy dependence on coal:** KI Weda Bay operates 3.4 GW of coal-fired captive power plants, with three 380 MW facilities under development. No renewable energy projects are currently operational, and none have been officially confirmed.
+ **Underdeveloped grid integration:** KI Weda Bay produces its own power, while KI Buli and KI Emerald Ferrochromium Industry are partially grid-connected. This limits the role of national decarbonisation through PLN's cleaner generation mix.
+ **Lack of renewable energy or bioenergy:** Despite public aspirations (e.g. Tsingshan's 2 GW solar announcement), no credible renewable projects have reached confirmed status, nor is there meaningful use of bioenergy.
+ **Environmental and social risk:** The precinct has drawn criticism for toxic sediment dumping, forest disruption and land conflicts, particularly at KI Buli and KI Weda Bay. These issues pose material ESG risks and can deter financing.
+ **Geographic dispersion:** With sites up to 100 km apart, building shared infrastructure (e.g. interconnected renewable energy generation or transmission) is difficult due to rugged terrain and forest cover.
+ **Environmental, human rights and governance concerns:** Concerns around environmental degradation and labour and community rights may hinder investments unless mitigated through transparency and improved monitoring.

What comes next for our Indonesian NZIP program

Climateworks Centre is championing the use of place-based decarbonisation strategies in Indonesia.

Our ambition is to contribute to a nationally coordinated, inclusive transition that reduces emissions at scale and ensures both economic competitiveness and social benefits for Indonesian communities and industries. The NZIP program offers a practical pathway for translating the country's climate ambition into local economic opportunities that benefit workers, small- and medium-sized enterprises and communities.

This report captures the foundational analysis of the NZIP program's first year in Indonesia, an important building block for establishing the net zero industrial clusters and hubs in Indonesia. The candidates presented for consideration in the report will be where our NZIP program picks up in the next phase of work.

In upcoming work, we will develop transition plans for NZIP candidate sites, including detailed action plans to shift high-value, heavy industry from emissions-intensive production to more competitive, low-carbon production. These transition plans will consider the unique infrastructure, energy, workforce and industry profiles of each precinct – no two precincts will decarbonise in exactly the same way. Transition plans will show each precinct's 'decarbonisation pathway' to reach net zero by 2050, in keeping with the Ministry of Industry's sector target.

In addition to guiding on-site decarbonisation efforts, these plans will be invaluable in attracting investment, an essential component for decarbonisation. We will work closely with NZIP candidate sites to develop an investment prospectus, enabling them to access global and regional funding.

While we work closely with precincts, we will also collaborate with government ministries to co-develop a national NZIP framework for Indonesia, helping to scale the precinct approach to high-value industrial sites across the country.

Decarbonising Indonesia's industrial base is vital for meeting its climate commitments and also for securing long-term economic competitiveness and resilience. Systemic hurdles, including fragmented coordination between government and industry, overlapping policy and regulatory frameworks, constrained access to renewables in industrial zones, and subdued investor confidence, hinder the progress Indonesia could make.

Government and industry can come together to create a cohesive action plan, supported by robust collaboration, to drive decarbonisation. Through the NZIP program, we will work to build a more collaborative ecosystem, facilitating stronger connections between central and local governments, industrial players, financial institutions and civil society. This will help ensure that NZIP transition and investment plans align with national targets and local development plans.

Recognising that these efforts cannot succeed without stimulating market demand for low-carbon products, we will work with the government to support a 'green growth' strategy. In particular, we plan to develop policies that drive demand for low-carbon products, ensuring that sustainability becomes a core driver of economic growth.

Climateworks Centre's NZIP program is working to tackle these systemic challenges, including the challenge to ensure a just industrial transition in which local communities and workers benefit from industrial decarbonisation.

Industrial decarbonisation in Indonesia presents a generational opportunity to reshape industry–community dynamics, placing workers and communities at the centre of change. By embedding just transition principles into the NZIP program from the outset, we aim to ensure decarbonisation supports decent work, reskilling and upskilling opportunities, social protections for workers in legacy sectors and the creation of high-quality jobs in emerging low-carbon industries. This approach can help unlock broader development gains – from equitable regional growth to improved environmental outcomes – and build the social license and collaboration needed for long-term success.

As our NZIP program progresses, we will work across government, industry and community groups to co-design precinct and workforce transitions that not only reduce emissions but also expand the role of industry as a driver of inclusive, sustainable development.

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Appendix 1

Cilegon precinct industrial decarbonisation profile

Location: Banten
Primary industry: Iron and steel
Sole actors: PT Krakatau Steel and PT Krakatau Posco
Industrial estate: Krakatau Industrial Estate Cilegon

SUMMARY TABLE: Cilegon precinct decarbonisation profile

CATEGORY	INDICATOR	VALUE/STATUS	REMARKS
Location and industry	Main industry	Iron and steel	Major facilities include Krakatau Steel and Krakatau Posco
	Total crude steel capacity	7 Mt/year	Krakatau Steel: 4 Mt (Suhartono 2024) Krakatau Posco: 3 Mt (Adhinegara et al. 2025; Reuters 2022)
	Crude iron facility	1.4 Mt/year (idle)	Potential for future conversion or repurposing (Swastika and Hasan 2024)
Energy and emissions	Current electricity consumption estimate	19.7 TWh/year	High demand requires a clean supply
	Current process heat consumption estimate	54 PJ/year	High, significant decarbonisation potential
	Current total emissions estimate	24.5 $MtCO_2$/year	Among the highest industrial emitters
	Current grid emissions intensity	0.8 tCO_2/MWh	Based on the West Java provincial factor
Infrastructure	Captive fossil fuel power capacity	320 MW	Krakatau Steel: 120 MW planned (Global Energy Monitor Wiki 2025a) Krakatau Posco: 200 MW (Global Energy Monitor Wiki 2025c)
	Renewable energy in operation	None	Current gap
	Renewable energy pipeline	40 MW floating solar PV, expected 2025	Under development (Power Technology 2024)
Decarbonisation levers	EAF capacity	Present	Supports electrification pathways
	Hydrogen potential	High (two blast furnace plants)	BF-BOF process compatible and hydrogen-DRI potential
	CCS potential	High (two blast furnace plants)	Capture-ready facilities
	Bioenergy feasibility	Moderate	Potential, but needs further assessment
Logistics and market access	Export infrastructure	Coastal; <100 km from port	Strategic advantage for green steel exports

Gresik precinct industrial decarbonisation profile

Location: East Java
Primary industries: Chemicals (ammonia), iron and steel and cement
Sole actors: PT Petrokimia Gresik and PT Ispat Indo
Industrial estates: Maspion Industrial Park and Gresik Industrial Park

SUMMARY TABLE: Gresik precinct decarbonisation profile

CATEGORY	INDICATOR	VALUE/STATUS	REMARKS
Location and industry	Main industries	Chemicals (ammonia), iron and steel and cement	Major facilities include Petrokimia Gresik and Ispat Indo
	Total ammonia capacity	1.1 Mt/year (grey ammonia)	PT Petrokimia Gresik (n.d.)
	Total steel capacity	0.7 Mt/year (EAF)	PT Ispat Indo (n.d.)
Energy and emissions	Current electricity consumption estimate	2.7 TWh/year	Primarily by chemical and cement facilities
	Process heat consumption estimate	9.2 PJ/year	Lower than steel-dominated precincts
	Total emissions estimate	9.6 $MtCO_2$/year	High, largely from grey ammonia and cement
	Grid emissions intensity	0.8 tCO_2/MWh	Based on the East Java provincial average
Infrastructure	Captive fossil fuel power capacity	Limited	Most actors rely on the PLN grid
	Renewable energy in operation	471 kWp rooftop solar	Petrokimia Gresik and renewable energy certificate purchases (Petrokimia Gresik 2023)
	Renewable energy pipeline	Green hydrogen and solar PV (Joint Development Agreement with PLN and ACWA Power)	Operational target 2025
Decarbonisation levers	Hydrogen development	Active development	Green hydrogen and ammonia ecosystem
	CCS potential	High	Fertiliser and cement sectors
	Electrification potential	Moderate	EAF-based steel in place (no electrification potential), ammonia synthesis (high electrification potential)
	Bioenergy feasibility	Low to moderate	Some potential but underdeveloped
Logistics and market access	Export infrastructure	<20 km to ports, <40 km to airport	Strong logistics connectivity

Morowali precinct industrial decarbonisation profile

Location: Central Sulawesi
Primary industries: Nickel and iron and steel
Sole actor: PT Dexin Steel Indonesia
Industrial estate: Indonesia Morowali Industrial Park

SUMMARY TABLE: **Morowali precinct decarbonisation profile**

CATEGORY	INDICATOR	VALUE/STATUS	REMARKS
Location and industry	Main industries	Nickel and iron and steel	Home to major HPAL, nickel pig iron (NPI) and BF-BOF facilities
	Nickel capacity (NPI + MHP)	4.2 Mt NPI, 90 kt MHP/year	Largest in Indonesia (Minor Metals Trade Association 2024)
	Steel capacity	7 Mt/year	Dexin Steel BF-BOF process (South East Asia Iron and Steel Institute 2023)
Energy and emissions	Electricity consumption estimate	1 TWh/year	Powered largely by captive coal plants
	Process heat consumption estimate	3 PJ/year	Very high, energy-intensive processes
	Total emissions estimate	41.2 $MtCO_2$/year	Highest among all precincts reviewed
	Grid emissions intensity	0.91 tCO_2/MWh	Highest in this comparison set
Infrastructure	Captive fossil fuel power capacity	3.94 GW	Dexin Steel (Global Energy Monitor Wiki 2025b; Center for Global Sustainability n.d.)
	Grid connection	Isolated grid	Indonesia Morowali Industrial Park operates independently from PLN
	Renewable energy in operation	450 kWp solar + BESS	Hengjaya Mine and renewable energy certificates under development (Nickel Industries 2023)
	Renewable energy pipeline	2 GW solar and wind + 5 GW hydro (planned)	Indonesia Morowali Industrial Park and nickel facilities' agreements (Ginting and Moore 2021)
Decarbonisation levers	Electrification potential	High	Steel (BF-BOF) and nickel (HPAL)
	CCS potential	Medium	Limited to PT Dexin Steel Indonesia; not viable for stainless steel processing
	Hydrogen development	Emerging	Potential for future steel applications
Logistics and market access	Export infrastructure	<5 km to seaport and airport	Excellent for 'green' export potential

Tuban precinct industrial decarbonisation profile

Location: East Java
Primary industries: Cement and iron and steel (fabrication)
Sole actors: PT Semen Gresik and Solusi Bangun Indonesia
Industrial estate: Kawasan Industri Tuban

SUMMARY TABLE: Tuban precinct decarbonisation profile

CATEGORY	INDICATOR	VALUE/STATUS	REMARKS
Location and industry	Main industries	Cement and iron and steel (casting/fabrication)	Dominated by Semen Indonesia subsidiaries
	Cement production capacity	16.9 Mt/year (PT Semen Gresik and Solusi Bangun Indonesia)	Among the largest integrated facilities in Indonesia PT Semen Gresik and Solusi Bangun Indonesia (PT Semen Indonesia (Persero) Tbk 2024)
Energy and emissions	Electricity consumption estimate	2.1 TWh/year	For cement kiln operation, grinding, etc.
	Process heat consumption estimate	Not reported	High, typical for cement kilns
	Total emissions estimate	3.9 $MtCO_2$/year	Moderate, driven by clinker production
	Grid emissions intensity	0.8 tCO_2/MWh	Based on the East Java provincial factor
Infrastructure	Captive fossil fuel power capacity	N/A	
	Renewable energy in operation	6.39 MWp rooftop solar (Q3 2024)	Solusi Bangun Indonesia Tuban Factory (Laoli 2024)
	Renewable energy pipeline	In the feasibility stage	No confirmed power purchase agreements or utility-scale projects
	Waste heat recovery and alternative fuels	Installed or under expansion	Waste heat recovery at Solusi Bangun Indonesia; fuel substitution strategies in both plants
Decarbonisation levers	CCS potential	High	Two integrated cement plants with clinker processing
	Hydrogen development	Moderate potential	Under exploration for kiln heating
	Bioenergy integration	Active exploration	Solusi Bangun Indonesia targets 25 per cent fuel substitution by 2030
Logistics and market access	Export infrastructure	<1 km to port; <130 km to city/airport	Strong logistics for cement and materials export

Halmahera precinct industrial decarbonisation profile

Location: Halmahera, North Maluku
Primary industries: Nickel and iron and steel
Key industrial estates: Indonesia Weda Bay Industrial Park, KI Buli and KI Emerald Ferrochromium Industry

SUMMARY TABLE: Halmahera precinct decarbonisation profile

CATEGORY	INDICATOR	VALUE/STATUS	REMARKS
Location and industry	Main industries	Nickel, iron and steel	Focused on battery supply chains and integrated nickel processing
	Nickel processing capacity	Multiple HPAL plants and rotary kiln electric furnaces (RKEF)	KI Weda Bay, KI Buli and PT Emerald (under construction)
	EV battery supply chain	Present	PT Youshan produces battery components at KI Weda Bay
Energy and emissions	Electricity consumption estimate	1.4 TWh/year	Across the three estates
	Process heat consumption estimate	8.4 PJ/year	Driven by smelting and HPAL
	Total emissions estimate	1.6 $MtCO_2$/year	Relatively low emissions data, but likely underestimated due to CFPP scale
	Grid emissions intensity	0.7 tCO_2/MWh	Provincial average; varies across estates
Infrastructure	Captive fossil fuel power capacity	3.4 GW operational with 1.14 GW under development	Captive CFPP at KI Weda Bay (Global Energy Monitor Wiki 2025d)
	Renewable energy in operation	None	No operational renewable energy assets
	Renewable energy pipeline	2 GW solar (unconfirmed)	Tsingshan's plan is still unverified (McBeth 2021)
Decarbonisation levers	Electrification potential	High	HPAL, smelting and RKEF applications
	CCS potential	Low	Not currently viable due to plant scale and lack of infrastructure
	Hydrogen potential	High technical readiness	Applicable across HPAL and smelting
	Bioenergy integration	None	No reported usage
Logistics and market access	Export infrastructure	Strong, all parks have ports	Enables direct export of nickel and stainless steel

Appendix 2

Industrial and geographic assessment details

The initial project analysis identified seven industrial supply chains of national or global significance, followed by the key industrial contributors to those supply chains ('industrial assessment'), and then mapped the physical locations of these companies ('geographic assessment'). The process identified 20 candidate 'precincts' from ~31,000 sole actor facilities and 139 industrial estates.

Supply chains of interest (priority industries) were assessed against the following criteria:

+ significant economic value (GDP contributions and market share relative to the rest of the world)
+ future global supply chain importance (projected growth based on future demand)
+ emissions reduction potential (high scope 1 and 2 emissions), and with a well-defined decarbonisation pathway, such as those featured in the Lawrence Berkeley National Laboratory and IESR (2024) roadmap or Australian Industry Energy Transitions Initiative's 2023 report (Climateworks Centre and Climate-KIC Australia).

To define the products of interest within these supply chains, upstream and mid-stream products were assessed according to their decarbonisation potential and emissions intensity. A shortlist of priority industries and products was produced to guide the identification of key facilities that might be able to decarbonise industry as an NZIP.

Identifying key facilities of interest for NZIP implementation

Aiming to capture more than 70 per cent of Indonesia-wide total production within the priority industries, all major facilities were identified (sole actor facilities and industrial estates hosting one or more facilities of interest). Key products, annual production capacities, facility types and site managers across these sites were documented. Some industrial estates were included in the list of 20 if they had been earmarked by the Indonesian government as a 'national strategic project'. In some instances, facilities or industrial estates were included whose primary industry was not one of the seven supply chains. This was done using data from the Ministry of Industry in precincts where the facility's geographic proximity was beneficial for creating a precinct.

Identifying co-located industry for NZIP implementation

Location data for sole actors and industrial estates was imported into an ArcGIS to produce Climateworks Centre's mapping tool. The mapping tool helped identify groups of closely-clustered shortlisted sole actors and industrial estates, or 'precincts'. Radial proximity varied depending on which island the facilities were located on, to account for the differing densities of built-up areas. Radial distances of 20 km were used for facilities located on Java, and 150 km for facilities on all other islands. The selection process prioritised groupings with multiple supply chains of interest. The selection of the 20 candidate precincts was predicated on ensuring a distribution between high-density industrial areas and lower-density areas.

Assumptions and limitations

INDUSTRIAL ASSESSMENT

In conducting the industrial assessment, seven industries that met the selected criteria were included in the analysis. Despite their economic significance, petrochemical industries and palm oil were excluded from the assessment.

Industrial estates listed as 'under construction' in the Center for Global Sustainability (n.d.) dataset were not included, resulting in the exclusion of 16 estates. However, several non-operational (greenfield) industrial estates were included in the shortlist, alongside estates listed as 'national strategic projects' operating outside of the selected industries. Due to data limitations, specific companies and production capacities for these industrial estates remain unknown.

For greenfield sites, particularly nickel smelters, production capacity data were largely unavailable. Where data gaps existed, a soft correlation was applied between a company's industrial importance and the availability of published production capacity data. For sites classified as sole actors, the availability of production capacity information was used as a key criterion for their inclusion in the mapping exercise.

GEOGRAPHIC ASSESSMENT

The 20 candidate precincts were identified based on the presence of co-located facilities. However, limitations on the number of high-density precincts that could be chosen may have led to the exclusion of potential high-impact precincts. Additionally, co-located sites were not selected based on their potential for industrial synergies. Instead, it was assumed that all shortlisted sole actor facilities and industrial estates were suitable for NZIP development. Production capacity data for 12 industrial estates could not be found, posing a limitation to the geographic assessment.

Technical assessment detail

We created a list of all products and facility types present across the 20 precincts, including for sole actor facilities and facilities within industrial estates. The energy intensity values and fuel mixes for each product on this list were obtained from peer-reviewed articles or publications from government or NGOs. Emissions intensity factors for each fuel type were also collected, as were grid factors for each Indonesian province.

To estimate process emissions, factors for specific products such as crude steel, cement, aluminium, nickel, clinker, ammonia and methanol were used, based on peer-reviewed sources, NGO publications and Climateworks Centre's Australian Industry Energy Transition Initiative findings. This analysis also took into account the share of total energy used for heat.

The total energy demand for each facility was estimated using the annual production capacity and energy intensity of each product. To estimate the amount of energy derived from fossil fuels at each facility, overall energy demand (GJ/year) and fuel mix data (percentage split between fuel types and electricity) were used. Biofuels were not included. This was then calculated for each precinct in terajoules per year (TJ/year).

The amount of energy used for process heat was estimated by multiplying the total energy demand (GJ/year) by the percentage of energy allocated to heat. The total heat energy for each precinct was calculated in TJ per year.

For electricity consumption, the energy demand (GJ/year) and fuel mix split data were used to calculate the electricity share for each facility in gigawatt hours per year (GWh/year), with totals calculated for each precinct. Total emissions were calculated using product-specific energy emissions factors (tCO_2/GJ) for each product type, taking into account the fuel mix, emissions intensity factors ($kgCO_2$/GJ), and the Indonesia-wide grid emissions factor ($kgCO_2$/MWh) for electricity. Using these emissions factors and energy demand data, total energy emissions for each facility were estimated in metric tonnes of CO_2 (tCO_2/year), as were total emissions for each precinct.

We used a Ministry of Energy and Mineral Resources (2024) map of solar generation potential (W/m^2) to identify the average solar potential within 100 km of each precinct.

Criteria weighting

A series of criteria was developed to compare and contrast the suitability of each candidate precinct. This was informed by contextual analysis of the Indonesian context and Climateworks Centre's industrial decarbonisation expertise from the Australian NZIP projects (Climateworks Centre and Climate-KIC Australia 2023; and Climateworks Centre 2025b). Each criterion was assigned scoring components for an overall ranking and shortlisting, and the ten highest-scoring candidates were identified.

Higher levels of grid connectivity – measured by the number of entities connected to the grid – were assumed to be optimal for NZIP implementation, given the high electrification requirements. However, PLN grid connection could present challenges for decarbonisation, as it would require the procurement of offsets or reliance on grid decarbonisation, which is unlikely to be achieved within this project's scope.

Precincts with higher heat transformation potential are deemed more appropriate for an NZIP strategy, as low-carbon heating frequently benefits from a collective, precinct-based approach.

The assessment of technological feasibility – including hydrogen, electrification, bioenergy and other commercially available decarbonisation technologies – did not capture stakeholder ambition or the practical challenges of deploying these technologies, which were addressed in the stakeholder assessment.

CCS or CCU potential was only considered for supply chains where other decarbonisation technologies were unsuitable, such as clinker production. The analysis assumed that CCS would be more viable within an NZIP framework rather than as an isolated solution for individual industrial players.

All criteria were weighted equally when scoring sites, reflecting the broad range of considerations relevant for NZIP implementation. Feasibility assessments for facility decarbonisation did not extend to end-to-end solar and downstream steel products. Further investigation is required to assess the potential for hydrogen, electrification, bioenergy and CCS/CCU across these manufacturing processes.

Assumptions and limitations

An effort was made to collect industry-specific data for Indonesia. When local data was unavailable, global or Australian data was used as a replacement.

There were industrial estates and sole actors for which we were unable to find information against each of the qualitative criteria after a reasonable effort. Industrial estates with no known production capacity were excluded from the quantitative analysis. In both cases, there were implications for precincts on the scoring system.

The analysis was based on annual production capacities rather than actual annual production values, which may not be fully representative of real production levels. A simplified product list was used, which may have overlooked subtle differences in production across precincts. Furthermore, direct fossil fuel consumption was generalised for each product type using publicly available data, which may not accurately reflect site-specific energy consumption.

The proportion of energy allocated to process heat and electricity consumption within the energy mix was also generalised for each product type, limiting the granularity of the findings. Furthermore, grid emissions differ by province, but a national grid factor was used to calculate electricity emissions. The goal is to compare these findings to emissions calculated using province-level grid factors to identify potential discrepancies.

Stakeholder assessment detail

Interviews were conducted as part of the stakeholder assessment to understand the commitment, capacity and coordination of key actors in each precinct. This was carried out through questionnaires distributed to relevant sole actors and industrial estate managers. The questionnaire aimed to gather insights into their sustainability priorities, existing clean energy initiatives, planned investments, coordination mechanisms and perceived challenges in achieving decarbonisation targets.

The list of key questions used in the stakeholder questionnaires is provided below, offering transparency into the information-gathering process and the themes that shaped the analysis.

Questions for sole actors

1. Does your company have a specific plan to adopt clean energy technologies?
2. Is your company considering the use of hydrogen for industrial operations or energy consumption?
3. Is your company exploring Carbon Capture and Utilisation/Storage (CCU/CCS) as part of its emissions reduction strategy?
4. Has your company considered measures to adjust production in response to market demand – such as demand response management (e.g. flexibility in monthly production targets or facility operation times)?
5. How likely is the implementation of low-carbon technologies in your company, considering the available infrastructure?
6. Are there regulatory or financial barriers to adopting low-carbon technologies?
7. Are there policies that support the integration of clean energy solutions?
8. Does your company have ongoing or planned investments in net zero technologies?
9. Has your company explored partnerships with financial institutions, government bodies, or investors?
10. Does your company have a sustainability roadmap with measurable targets?
11. Are there company efforts to ensure responsible supply chain management (e.g. regular supplier audits, sustainable procurement practices)?
12. Does your company have processes in place to assess and manage environmental, social and governance (ESG) risks in its operations?
13. Are there policies to promote transparency and prevent corruption?
14. Is there a dedicated team or role responsible for ESG and sustainability efforts?
15. Does your company provide fair wages and benefits aligned with local regulations and industry standards?
16. Are there initiatives in your company to promote diversity, equity and inclusion (e.g. gender balance, leadership opportunities)?
17. Is there an official grievance mechanism for employees and external stakeholders?

18. Is your company actively engaged with local communities or partnerships to support socially impactful projects?
19. Does your company provide health and wellbeing support for employees (e.g. health and life insurance, mental health initiatives, flexible work policies)?
20. Does your company measure and track its energy use, emissions and waste?
21. Has your company taken steps to improve energy efficiency or integrate renewable energy sources?
22. How does your company manage and reduce water consumption and waste generation?
23. Does your company have a strategy to achieve net zero emissions or improve environmental performance?
24. Is there a plan or commitment to transition toward a low-carbon or net zero industrial zone?

Questions for industrial estates

1. Are there any tenants within the estate supporting the transition to net zero emissions?
2. What is the level of interest within the estate in adopting hydrogen production (grey, blue or green)?
3. What is the level of interest in using hydrogen for industrial processes?
4. What is the level of interest in carbon capture and utilisation (CCU) or carbon capture and storage (CCS)?
5. Are there any plans to adopt electrification technologies to reduce reliance on fossil fuels?
6. Have bioenergy solutions (e.g. biogas and biomass) been considered to meet energy needs?
7. Are there other clean technologies being considered for commercial-scale deployment?
8. How likely is the adoption of low-carbon technologies, based on the infrastructure available within the estate?
9. Are there any regulatory or financial barriers to implementing low-carbon technologies?
10. Are there policies in place that support the integration of clean energy solutions?
11. Does the estate have ongoing or planned investments in net zero technologies?
12. Has the estate explored partnerships with financial institutions, government bodies or investors?
13. Does the estate have an ESG strategy aligned with national or global sustainability goals?
14. Is there a dedicated team responsible for ESG implementation within the estate?
15. Are there efforts to monitor and enforce ESG compliance among tenants?
16. Are there initiatives to provide incentives or support for tenants to adopt ESG practices?

17. Does the estate engage with regulators and local authorities to align with sustainability policies?
18. Does the estate have policies in place to promote workplace safety and fair labour practices throughout the estate?
19. Are there initiatives to support skills development and employment opportunities for the local workforce?
20. To what extent does the estate ensure that industrial development does not negatively impact surrounding communities?
21. Does the estate facilitate collaboration among tenants to advance sustainability performance?
22. Are there emergency response and disaster preparedness measures in place across the estate?
23. Does the estate have centralised waste management and recycling infrastructure?
24. Are there measures in place to ensure efficient water use and wastewater treatment across all tenants?
25. To what extent are estate-wide policies implemented to promote energy efficiency and reduce carbon emissions?
26. Does the estate provide green spaces or biodiversity initiatives to balance industrial activity?
27. Is there a plan or commitment to transition towards a low-carbon or net zero industrial estate?

Feedback received from stakeholders was synthesised and directly fed into the overall analysis, informing both the precinct scoring and the development of the stakeholder assessment. This integration of stakeholder input ensures that the assessment reflects not only observable performance but also internal dynamics and future readiness. The results serve as both a benchmarking tool and a strategic guide to prioritise interventions that can accelerate the development of NZIPs, in alignment with Indonesia's national decarbonisation and industrial transformation agenda.

The Table below presents decarbonisation readiness scores for sole actors and industrial states, as well as an overall precinct score. It also includes a brief analysis of precinct readiness to adopt an NZIP approach to decarbonising industry there.

The scores come only from the stakeholder assessment. Each response received a numerical score between 0–3 based on predefined criteria:

+ 0 = No efforts currently in place
+ 1 = Some initial steps, but no structured implementation
+ 2 = Structured measures in place, but with room for improvement
+ 3 = Strong policies and practices fully implemented.

Sole actor scores are derived directly from the individual company responses. Industrial estate scores were aggregated based on the estate's overall sustainability initiatives. Finally, precinct scores were calculated by averaging:

+ average estate-level scores within the precinct
+ average scores of sole actors within the precinct.

SUMMARY TABLE: Decarbonisation readiness scores for precincts and component facilities

PRECINCT NAME	SOLE ACTOR SCORING	INDUSTRIAL ESTATE SCORING	PRECINCT SCORE	ANALYSIS
Cilegon (Banten)	PT Krakatau Steel (iron and steel): 2.58 PT Krakatau Posco (iron and steel): 2.33	Krakatau Industrial Estate Cilegon (Iron and steel): 1.93	2.14	Cilegon's score is primarily driven by the iron and steel sector, with both PT Krakatau Steel and PT Krakatau Posco demonstrating a strong commitments to sustainability. PT Krakatau Steel scores 2.58, reflecting strong ESG practices, while PT Krakatau Posco scores 2.33, indicating structured ESG measures with room for improvement. The industrial estate, Krakatau Industrial Estate Cilegon, achieves a score of 1.93, showing some sustainability efforts but still requiring further development. The overall precinct score of 2.14 highlights a positive trend toward clean energy adoption but underscores the need for broader integration of these practices across the estate.
Gresik (East Java)	PT Petrokimia Gresik (ammonia): 2.71 PT Ispat Indo (iron and steel): 2.42	Maspion Industrial Park (cement): 1.04 Gresik Industrial Park (iron and steel): 1.59	1.94	Gresik has strong actors in the ammonia and iron and steel sectors. The precinct score 1.94 reflects good performance in adopting sustainability practices, but industrial estates like Maspion Industrial Park and Gresik Industrial Park still have room to improve in clean energy adoption and emissions reduction.
Morowali (Central Sulawesi)	PT Dexin Steel Indonesia (iron and steel): 1.92	Indonesia Morowali Industrial Park (nickel): 1.93	1.92	Morowali shows engagement with sustainability, particularly driven by plans from nickel facilities at Indonesia Morowali Industrial Park. The precinct score 1.92 indicates solid engagement with clean energy adoption, though the iron and steel sector, represented by PT Dexin Steel Indonesia, could still improve its sustainability practices.
Tuban^ (East Java)	PT Semen Gresik (cement): 2.38 Solusi Bangun Indonesia (cement): 2.54	Kawasan Industri Tuban (mixed industries*): 1.37	1.91	Tuban is dominated by the cement sector, with PT Semen Gresik and Solusi Bangun Indonesia showing strong sustainability efforts. The precinct score of 1.91 reflects good performance, although the industrial estate needs additional efforts to align with clean energy and emissions reduction goals.
Halmahera^ (North Maluku)	N/A	Kawasan Industri Emerald Ferrochromium Industry (iron and steel and nickel): 1.56 Indonesia Weda Bay Industrial Park (iron and steel and nickel): 2.22 Kawasan Industri Buli (nickel): 1.67	1.81	Halmahera shows solid engagement through sustainability plans, driven by Indonesia Weda Bay Industrial Park's reported plans, with a precinct score of 1.81. Responses indicate potential for improving sustainability practices with room for growth across industrial estates.
Sumatra Utara (North Sumatra)	PT Indonesia Asahan Aluminium (aluminium and alumina): 2.50 Gunung Raja Paksi (iron and steel): 2.58 PT Toba Pulp Lestaari Tbk (pulp and paper): N/A	Sei Mangkei Industrial Estate (palm oil*): 0.52	1.11	Sumatra Utara benefits from PT Indonesia Asahan Aluminium and Gunung Raja Paksi, which reported strong engagement on sustainability. However, PT Toba Pulp Lestaari Tbk and Sei Mangkei Industrial Estate reflect lower engagement in clean energy practices. The precinct score 1.11 indicates that while some companies are active, the overall region needs significant improvements in adopting clean technologies.

Bekasi (West Java)	Gunung Raja Paksi (iron and steel): 2.58 Fajar Surya Wisesa (pulp and paper): 0.00	Bekasi International Industrial Estate (manufacturing*): 0.85	1.07	Bekasi features Gunung Raja Paksi, a leader in the iron and steel sector, reporting strong sustainability engagement. However, Fajar Surya Wisesa in the paper sector and the estate overall show lower performance, with a precinct score of 1.07, reflecting the need for improved clean energy adoption and environmental practices at the estate level.
Citeureup (West Java)	Solusi Bangun Indonesia (cement): 2.54 Semen Indonesia (cement): 2.33 Indocement Tunggal Prakarsa (cement): N/A PT Ricky Putra Globalindo (textile): N/A	Cibinong Center Industrial Estate (mixed industries*): 0.56	0.89	Citeureup's cement sector is well-represented with companies like Solusi Bangun Indonesia and Semen Indonesia showing strong sustainability engagement. However, responses from Indocement Tunggal Prakarsa and the textile industry indicated no engagement with clean energy practices. The precinct score of 0.89 suggests that while some companies are performing well, the precinct as a whole has a lot of room for improvement.
Semarang (Central Java)	PT Primayudha Mandirijaya (textile): N/A PT Bitratex Industries (textile): N/A PT Sinar Pantja Djaja (textile): N/A Asia Pacific Investama (cement): N/A Indocement Tunggal Prakarsa (cement): N/A	Kawasan Industri Wijayakusuma (mixed industries*): 1.56	0.78	Semarang had minimal reporting engagement from companies in the textile and cement sectors. Industrial estate Kawasan Industri Wijayakusuma showed some sustainability engagement, scoring 1.56, but the precinct as a whole requires much more attention to clean energy and sustainability practices.
Motui (South East Sulawesi)	N/A	Kawasan Industri VDNI (iron and steel and nickel): 1.37 Motui Industrial Park (nickel): N/A	0.69	Motui has the lowest performance in terms of sustainability, with a precinct score of 0.69. Kawasan Industri VDNI shows moderate engagement, but overall, the region is underperforming in adopting clean energy and sustainable practices, requiring urgent interventions.

Note: Facilities that did not respond to Climateworks Centre's questionnaire are marked above with 'N/A' as a score. In calculating the overall precinct score, N/A was treated as 0.00.

*Industries outside Climateworks Centre's selected supply chains; these estates were included based on Ministry of Industry data and recommendations.

^ Halmahera precinct was included in the top ten based on consultations with and recommendations from the Ministry of Industry about 'national strategic projects'. Tuban precinct was also promoted as part of top ten due to the exclusion of other precincts with greenfields status (Bintuni Bay and Sulawesi Selatan). Exclusion of greenfields was mainly due to uncertainty around the development of industry facilities and the lack of tenants in industrial parks/estates

Assumptions and limitations

While stakeholder perspectives are valuable for transparency around decarbonisation actions and plans, we acknowledge that self-reporting comes with limitations. Reported decarbonisation measures may be more aspirational than action-based, and progress may be overstated while challenges are understated. Stakeholder scoring took reported engagement with decarbonisation and sustainability at face value. However, this exercise is intended to indicate general engagement, willingness, or momentum on these topics, rather than verifying specific actions. Scoring is not intended to be used outside the context of this analysis.

Appendix 3

Climateworks Centre NZIP program roadmap for Indonesia

SET GOALS	ANALYSE CONTEXT	IDENTIFY SITES	DEVELOP PATHWAYS	DELIVER NZIP
Determine what a successful NZIP looks like	**Establish country priorities and identify partners**	**Identify suitable precincts**	**Determine what's needed to seize opportunities**	**Create a plan to achieve a successful NZIP**

+ Identify legislated targets
+ Articulate NZIP goals
	+ Map existing industries
	+ Understand country-specific economic, social and infrastructure systems and priorities
	+ Identify local resources
		+ Create site selection methodology
		+ Identify relevant stakeholders
			+ Conduct market analysis
			+ Analyse energy use and emissions
			+ Contextualise industrial decarbonisation pathways
			+ Identify policy levers
			+ Engage stakeholders
			+ Refine goals
				+ Create transition plan
				+ Create investment plan, including:
				  + Cost-gap analysis
				  + Technology investment schedule
				  + Energy infrastructure investment schedule

Define Indonesian NZIP goals by combining Climateworks Centre's industrial decarbonisation expertise with government decarbonisation targets to outline an ideal precinct: low-cost, rapid transition to producing globally needed low-carbon goods.	Analyse Indonesia's economic, social, energy and infrastructure priorities to identify industries best placed for decarbonisation and the data and partners needed to support the NZIP program.	Apply a four-part methodology – industrial, geographic, technical and stakeholder assessments – to shortlist five candidate sites from thousands for piloting the NZIP approach.	Assess opportunities and challenges for each candidate precinct to determine funding, resources, infrastructure and policy support, engaging stakeholders to create feasible technology and energy transition timelines toward net zero.	Develop precinct transition plans and investment-ready prospectus with stakeholders to unlock industries, government and international actors' confidence to support and invest in an NZIP.
COMPLETED WORK			UPCOMING WORK	

Set program goals

This stage focuses on creating a high-level program scope and identifying the ideal outcomes for a country-level NZIP strategy. Articulating these goals draws on existing industrial decarbonisation pathways and roadmaps, as well as country and regional targets and context, and the organisational goals of the NZIP implementer. This is a necessary step to shape the development of all subsequent stages of NZIP implementation. For NZIP work in Indonesia, for example, program outcomes were synthesised from Climateworks Centre knowledge and values, as well as the decarbonisation targets of the Indonesian government. Goals and outcomes are later refined after the precincts are selected, in collaboration with precinct stakeholders, for alignment with local ambitions and contexts.

Analyse context

At this stage, activities are undertaken to develop an understanding of the industries that are relevant to the country's long-term economic future in a decarbonising global marketplace. This involves an assessment of the current country-level economic, social, energy and infrastructure development priorities. In this stage, we also identified project resources (e.g. data availability and local partner organisations) to carry out program activities, with their availability shaping the scope of the activities in subsequent stages.

Identify sites

Identifying potential NZIP sites is a multifaceted and analysis-rich process that varies between projects, depending on whether potential sites or regions have been pre-selected. Identifying candidate sites for this project involved assessing industrial, geographic, technical and stakeholder factors, which helped narrow the pool of thousands of industrial facilities – sole actors and industrial estates – down to precinct groupings and ultimately a shortlist of precincts that could undertake collective NZIP action. This stage marks the beginning of stakeholder convenings and education to identify and engage potential allies for the precincts' transitions.

Develop pathways

Once candidate precinct(s) are identified, the challenges, barriers and opportunities for each must be understood. A gap analysis looking at funding, resources, infrastructure and policy factors can be used to inform precinct decarbonisation. This analysis can be a decision-making aid for relevant stakeholders and, alongside consideration of stakeholder ambition, help inform precinct-specific targets. This stage of work also includes analysing precinct-specific market opportunities for its industries and developing technology and energy infrastructure deployment timelines for these industries. We will also identify funding opportunities and mechanisms to support investment, map the existing policy landscape and identify relevant stakeholders.

Deliver NZIP-specific strategy

The final stage focuses on creating a precinct transition plan and investment case to coordinate industrial decarbonisation and provide industries, government and cross-regional actors with the certainty they need to take action. Other work to be undertaken at this stage includes a cost-gap analysis to estimate the costs for discrete elements of the transition (e.g. energy infrastructure and industrial technologies), defining roles and responsibilities for the necessary investments, and identifying specific policies that can enable this transition.

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