

IMPACT | WHITE PAPER

The carbon cost of economic growth

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'The Carbon Cost of GDP': how investment in Asia can deliver the energy transition

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- The global population has soared over the past four decades, with much of this growth driven by Asian countries. The continent is now home to 4.68 billion people, accounting for almost 60% of the world total. During this time of rapid demographic and economic change, worldwide CO₂ emissions have almost doubled, but the pace of emissions growth is slowing and critically, the carbon intensity of production and consumption has fallen significantly.
- CO₂ emissions continued to rise across Asia in 2021, reflecting a marginal global increase on 2019 figures. China remains the world's biggest emitter with its output rising from 10.9 billion tons to 11.4 billion tons, more than double that of second-placed United States. India is once again in third place with 2.7 billion tons. The eight Asian countries analysed in this report account for 45% of the world's CO₂ emissions.
- Since 2021, ThomasLloyd has analysed the carbon intensity of economic output to allow for meaningful comparisons to be drawn between countries and regions. The Carbon Cost of GDP (Gross Domestic Product) enables us to identify where progress has been made, and where further interventions and investment are required, as part of ThomasLloyd's commitment to helping deliver the energy transition across Asia. There has been a remarkable 78% reduction in the global Carbon Cost of GDP since 1980, but the Carbon Cost of GDP among Asian countries remains significantly higher than the global average.

WHAT IS THE CARBON COST OF GDP?

As a 100% Impact Investor, reporting under Article 9 of the EU SFDR framework, ThomasLloyd takes seriously its commitment to environmental and social objectives, in accordance with sound governance practices. Our investments directly target four of the United Nations Sustainable Development Goals (SDGs)¹, and have an indirect impact on ten of the 17 SDGs.

One of the key indicators of progress towards SDG 9 – focused on the need to build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation – is 'CO₂ emissions per unit of value added'.

It is in this context that ThomasLloyd adopted the concept of Carbon Cost of GDP, which measures the amount of CO₂ emitted for every trillion dollars of GDP generated.

Carbon Cost of GDP allows us to make meaningful regional and global comparisons by ranking the intensity of country emissions in the context of their economic output, rather than their population. The measure enables ThomasLloyd to better identify country-specific issues, informing how and where we direct investment capital to achieve maximum impact.

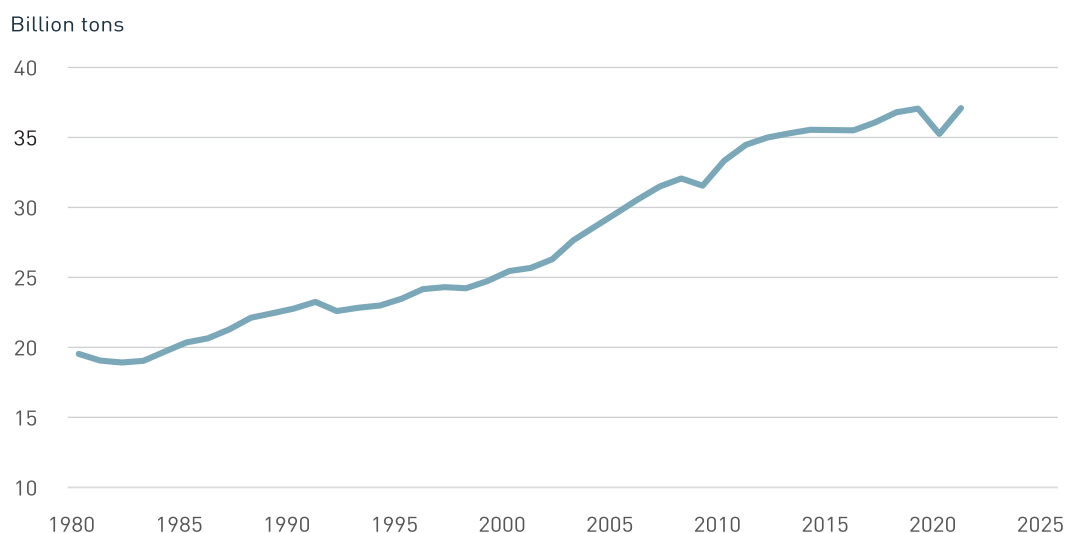
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GLOBAL CO₂ EMISSIONS HAVE DOUBLED SINCE 1980

This third annual report draws on data from 2021, a year marked by the early stages of global economic recovery as the Covid-19 pandemic subsided. 2020 had seen global emissions fall for the first time since the 2008-09 financial crisis, to 35.26 billion

tons, but the return to economic growth in 2021 saw emissions climb to a record 37.12 billion tons. It is the highest figure since records began, surpassing the previous peak in 2019.

Global emissions – increase after COVID recession



Source: Global Carbon Atlas 2023

Total CO₂ emissions have now almost doubled since 1980, and global policymakers are broadly in agreement that the trend must be reversed as a matter of urgency. At COP26, held in Glasgow in late 2021, global leaders agreed to expedite an overall reduction in greenhouse gas emissions in line with the Paris Agreement.

While the pace of emissions growth is slowing, the global picture is decidedly mixed. Comparing countries and regions by Carbon Cost of GDP allows us to determine where good progress is being made, and where investment is required to speed up the energy transition.

¹<https://sdgs.un.org/goals>

THE WORLD'S POPULATION HAS INCREASED BY 75% OVER THE SAME PERIOD

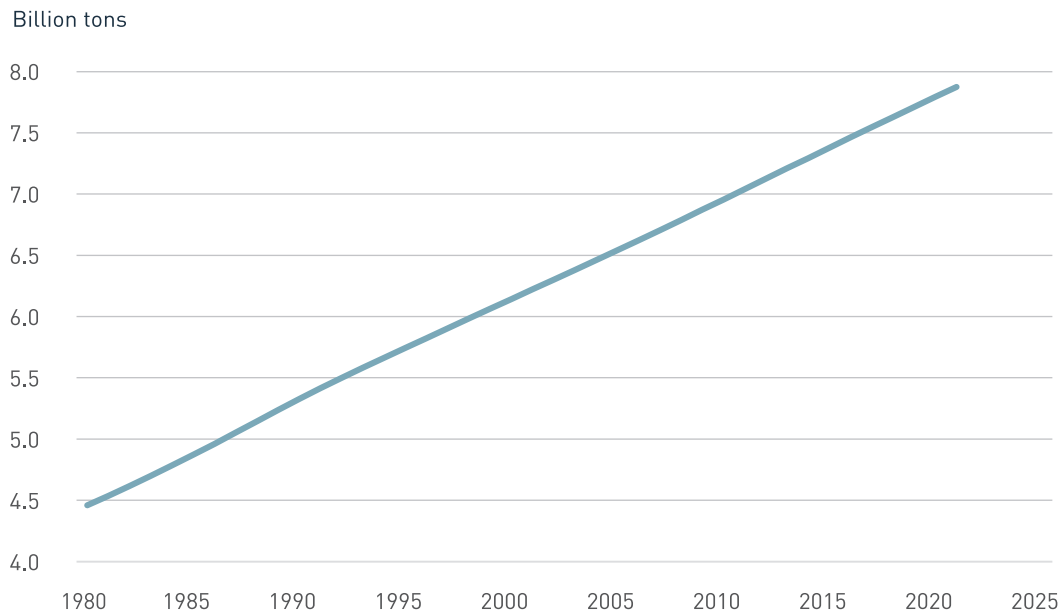
The global population has grown from 4.46 billion people in 1980, to 7.87 billion in 2021 – an increase of more than 75%². Around two thirds of this growth took place in Asia,

whose population has soared from 2.65 billion to 4.68 billion in just four decades. Asia now accounts for almost 60% of the world total.



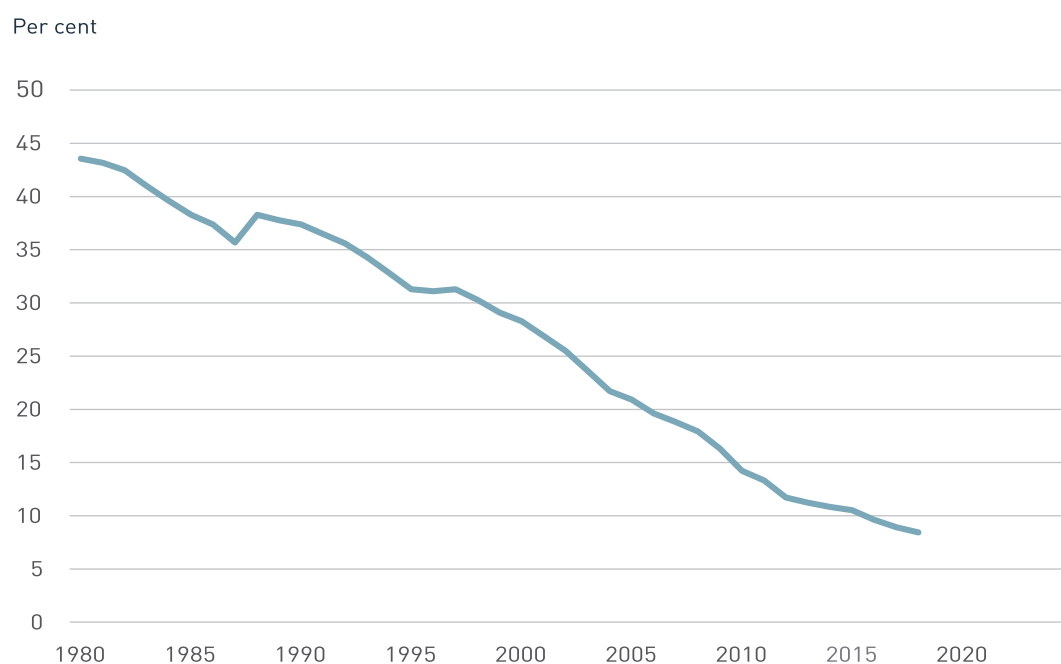
Asia is home to almost 60% of the world's population.

World population growth



Source: United Nations Population Division 2022

World population living in extreme poverty has fallen dramatically



Source: World Bank 2023

²United Nations World Population Division

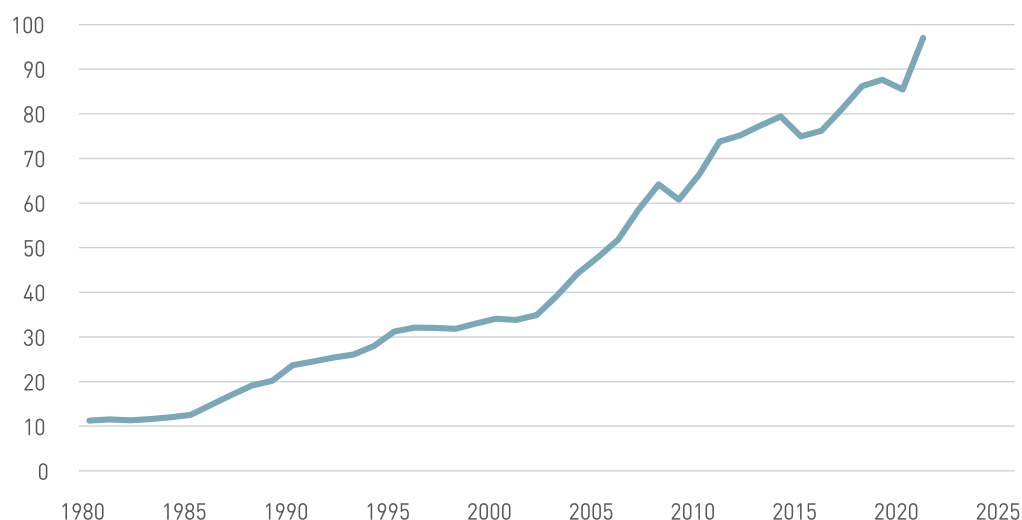
AGGREGATE GDP HAS RISEN NINE-FOLD IN THE LAST 40 YEARS

While the population has grown by 75% and CO₂ emissions have doubled, the global economy has grown almost nine-fold since 1980, with GDP rising from USD11.42 trillion to USD97.08 trillion. The World Bank

estimates the percentage of the world's population living in extreme poverty fell from 43.6% to 8.4% over the period³; perhaps the most significant human achievement of the late 20th century and early 21st century.

World gross domestic product

USD trillion



Source: International Monetary Fund World Economic Outlook October 2022

40 YEARS OF REMARKABLE ECONOMIC PROSPERITY

The economic growth of the past four decades has built on an exponential rise in global living standards during the post-war period. From the billions of people lifted out of extreme poverty, to record life expectancy – the average person in Asia now lives to age of 74, compared to just 41 in 1950 – almost every economic indicator available to us is positive.

The growth of global CO₂ emissions is an alarming exception – but the headline figures do not tell the whole story. The raw numbers conceal huge variation across countries and regions once economic output is accounted for. That is why ThomasLloyd measures global and country-level output by the Carbon Cost of GDP.

 **74 yrs**

Current average life expectancy in Asia.

THE OVERALL CARBON COST OF GDP IS FALLING...

Despite rapid global emissions growth, the carbon intensity of production and consumption has fallen significantly over the past 40 years.

By 1990, it was down to 961 million tons per trillion and by the turn of the millennium, in 2000, the carbon cost of GDP had more than halved to 747 million tons per trillion.

In 1980, when global GDP stood at USD11.42 trillion and CO₂ emissions at 19.50 billion tons, the carbon cost of GDP was 1,735 million tons of CO₂ per trillion.

The latest figures for 2021 show a Carbon Cost of GDP of 382 million tons per trillion, a remarkable 78% reduction from 1980.

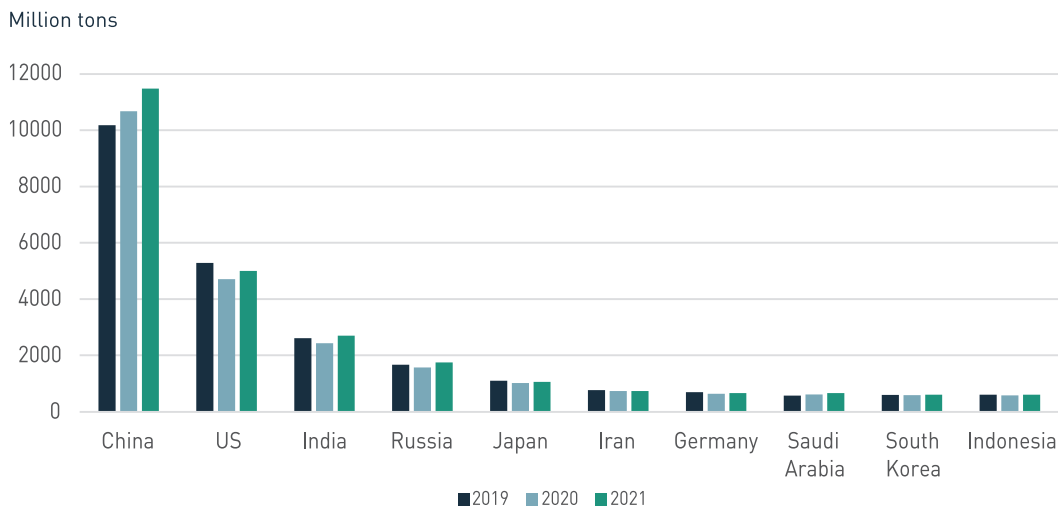
³<https://data.worldbank.org/topic/poverty>

...BUT CHINA, THE WORLD'S LARGEST EMITTER, ADDED HALF A BILLION TONNES OF CO₂ IN 2021

According to the latest available country data for 2021, China again saw its CO₂ emissions rise from 10.9 billion tons to 11.4 billion tons. This was more than twice the level of the United States, which rose from 4.7 billion tons to 5.0 billion tons. India remains in third place with 2.7 billion tons, with Russia and Japan completing the top five. The only change in the top ten saw Saudi Arabia jump to eighth place, surpassing South Korea and Indonesia.

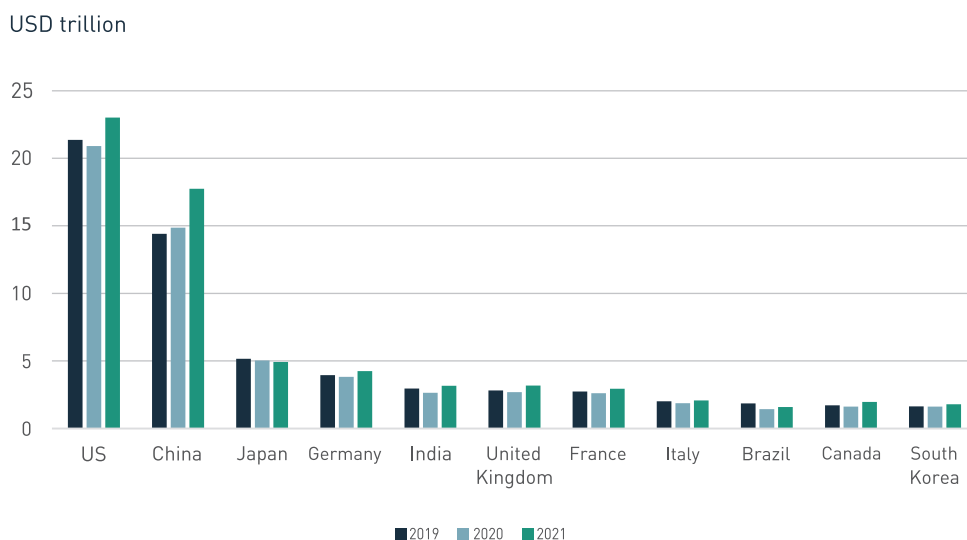
It is perhaps unsurprising that the world's biggest five economies by GDP appear in the top seven global emitters, but the Carbon Cost of GDP varies significantly between the countries appearing on our list. Russia, whose economy is ranked eleventh in the world by GDP, is the fourth largest emitter; Saudi Arabia (ranked nineteenth) is the eighth largest.

The top ten largest emitters: 2019 - 2021



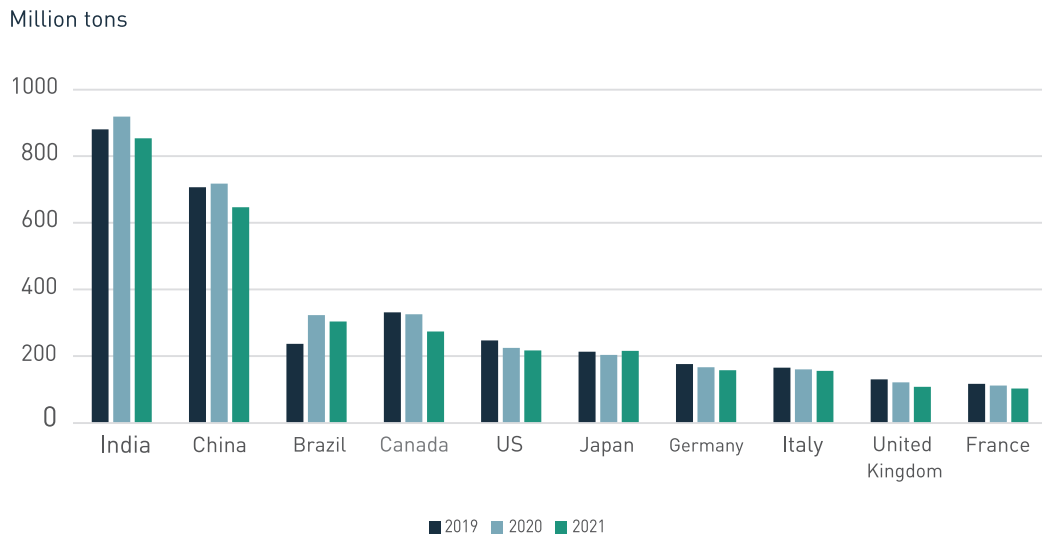
Source: Carbon Atlas 2023

Largest countries ranked by nominal GDP



Source: International Monetary Fund October 2022

Amongst the ten largest economies, India and China have highest Carbon Cost of GDP



Source: IMF, Global Carbon Atlas, ThomasLloyd calculations 2023

The result of our updated analysis is striking. Despite the strong recovery of 2021, which saw the global economy grow by 6.0%, nine of the ten largest economies (with the exception of Japan) saw their Carbon Cost of GDP fall compared with 2020.

ASIA'S CARBON COST OF GDP

Turning our attention to the eight 'emerging and developing economies' of Asia, we can see a substantial variation in the Carbon Cost of GDP compared with other regions. Every one of these countries has a greater carbon cost than any major economy in Western Europe; seven of the eight have a carbon cost of more than twice that of the largest Western European economy.

Vietnam's carbon cost of 890 Mt per trillion dollars is the highest of all, ahead of India.

Amongst these ten largest economies, India retains its position as the world's biggest emitter by Carbon Cost of GDP, with 853 Mt per trillion dollars. There was little movement in the top ten, with Brazil rising into third place above Canada.

Malaysia, China, Thailand, and Indonesia also have a Carbon Cost of GDP greater than 500 million tons. Nonetheless, despite the economic recovery, six of the eight countries we analysed saw their Carbon Cost of GDP fall.

That is not to say that the falling Carbon Cost of GDP among most of these countries is a cause for celebration. These major emitters account for 3.51 billion people – almost half the global population – and five of the eight are home to over 100 million people.

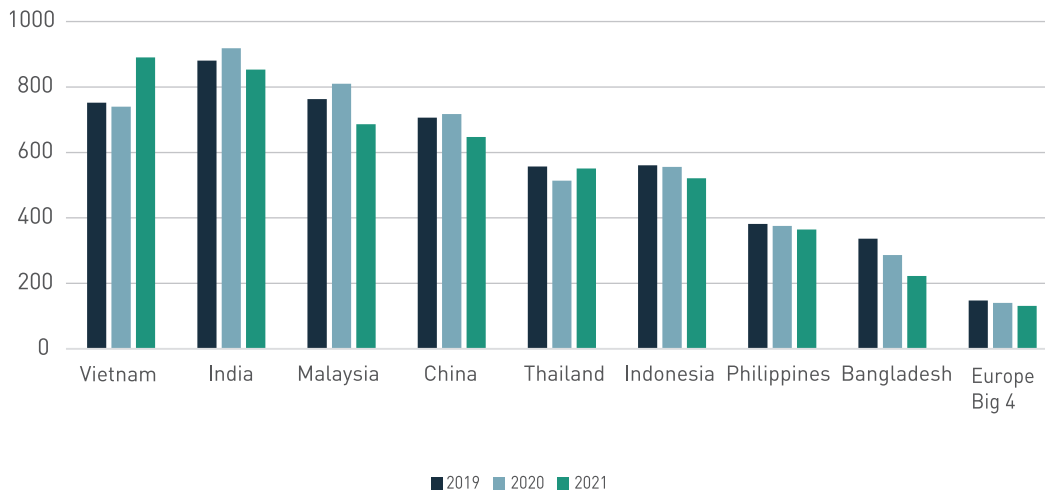
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Carbon Cost of GDP in Asian markets

Million tons CO₂ per USD tn of GDP



Source: IMF, Global Carbon Atlas, ThomasLloyd calculations 2023

EMISSIONS OF LEADING ASIAN ECONOMIES ARE MORE 'COSTLY' THAN THOSE IN THE WEST

2021 saw global CO₂ emissions reach record levels. With the exception of 2015-16, emissions have increased in every single year excluding those which featured a recession in at least one G7 country (1980-81, 1992, 1998, 2009 and 2020). Across many countries, and especially among the emerging and developing economies of Asia, the Carbon Cost of GDP remains stubbornly high.

To some extent, our analysis gives us reason to be very cautiously optimistic. The pace of emissions growth is undoubtedly slowing, and it is being outstripped by the growth of GDP; in the 2010s, global emissions grew by 11%, yet aggregate GDP increased by a third.

In many parts of the world, emissions are falling rapidly. The EU27's CO₂ emissions were lower in 2021 than in any non-COVID year since 1964. In the UK, emissions were at their lowest for 60 years and in the United States, their lowest for 35 years.

For a multitude of reasons – rapid technological innovation, widespread recognition of the climate crisis, behavioural change at the micro level, enhanced energy efficiency, and the 'offshoring' of manufacturing, to name a few – Western countries have been successful in both reducing the absolute level of their CO₂ emissions, and the carbon intensity of their GDP.

In Asia, it is a different story. Of the 19.5 billion tons of global CO₂ emissions in 1980, the eight Asian countries analysed in this report accounted for 2.0 billion tons, barely 10% of total. Today, these eight countries alone account for 45% of global emissions.

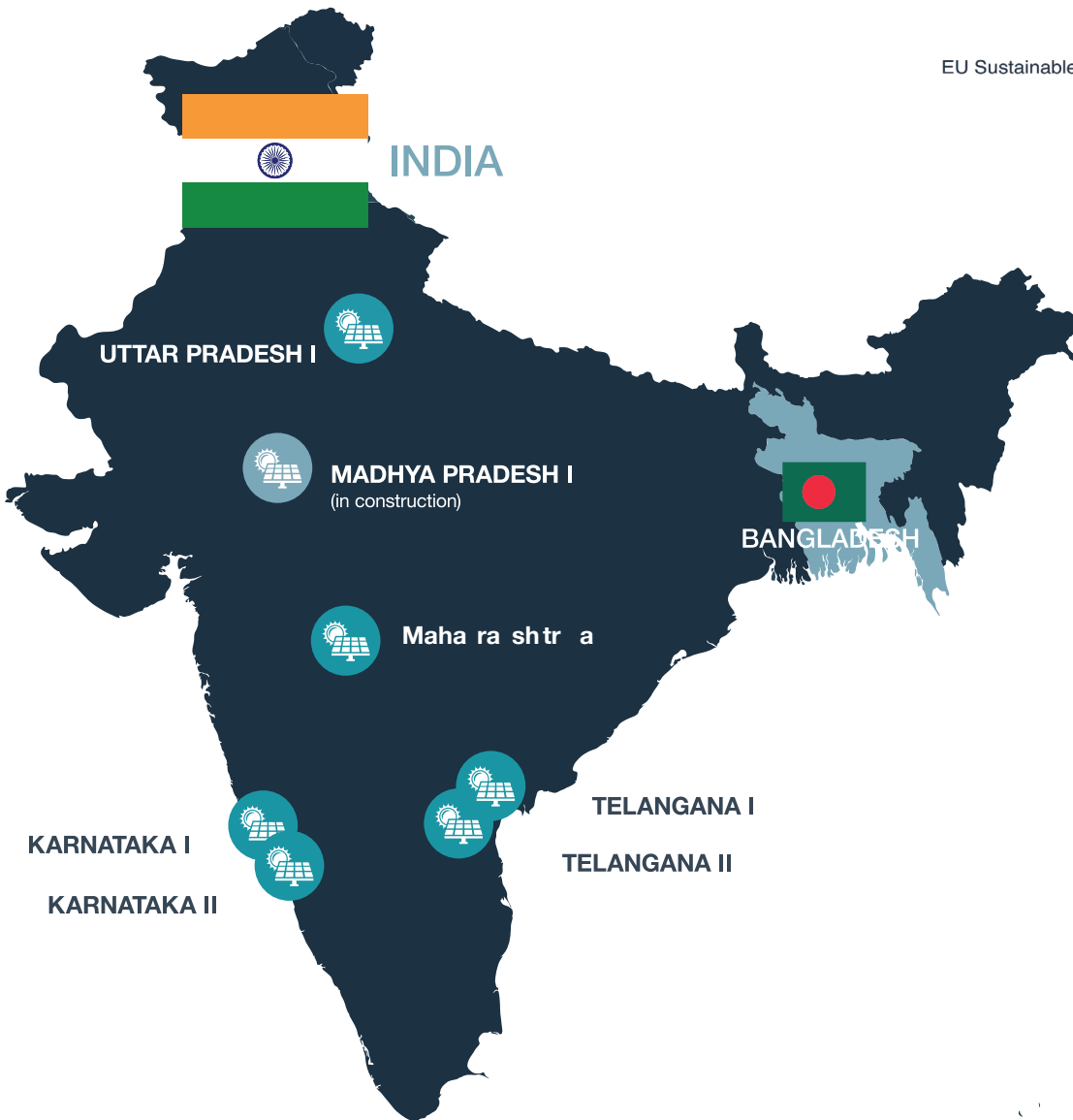
As well as absolute emissions rising, their Carbon Cost of GDP remains substantially higher than either the global average (382 Mt) or the average of the 'Big Four' European countries (132 Mt).

CURRENT PORTFOLIO



Article 9

EU Sustainable Finance Disclosure Regulation



LEGEND

- Solar Power Plant
- Biomass Power Plant

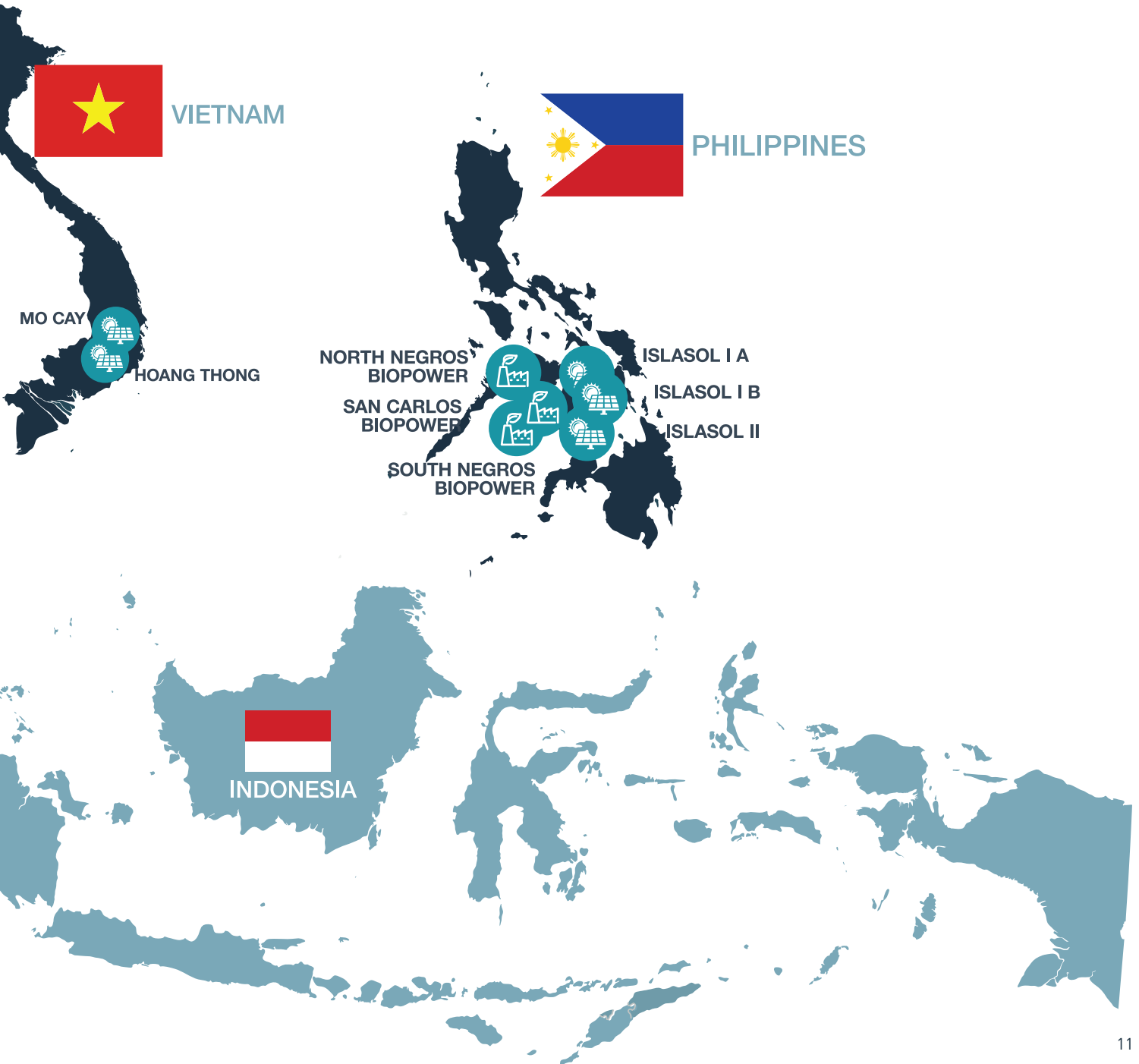
Invest in sustainable real assets in the world's fastest growing markets, where capital creates the greatest impact.

Countries in light blue represent those in which near-term pipeline opportunities have been identified.

HOW CAN INVESTMENT IN ASIA DELIVER THE ENERGY TRANSITION?

This third annual report on the Carbon Cost of GDP underscores the need for major investment in climate infrastructure and renewable energy projects across Asia. Demographic change and rapid urbanisation are driving increased demand for domestic energy, while large-scale industrialisation pushes emissions still higher. This challenge must be met with investment in technologies designed to reduce the region's carbon footprint, providing vital support to Asia's emerging and developing economies as the global economy strives for decarbonisation.

ThomasLloyd is committed to supporting the drive towards an energy transition in Asia. As a developer and financier of sustainable real infrastructure assets, we are proud to play our part in the region's economic transformation. The projects we support generate renewable energy to serve the needs of a rapidly growing population and limit the intensity of carbon production and consumption.



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