Deloitte.

India's turning point

How climate action can drive our economic future

August 2021

MAKING AN IMPACT THAT MATTERS since 1845

We have a narrow window of time. The choices made today and over the next decade will determine our future. We have the opportunity to create a new engine for sustainable economic prosperity while at the same time preventing the worst consequences of a warming world.

Deloitte Economics Institute

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Foreword

Our planet is our most precious asset and yet, without dramatic efforts to address climate change, the world as we know it is at risk.

The stark reality of this crisis is evident from the several climate-related calamities that have threatened lives and livelihoods the world over, this year alone.

No one is immune to the impact of climate change, but for India and Asia Pacific, this crisis also presents a clear opportunity. That is to lead the world and find the next wave of economic growth by accelerating action to mitigate climate change.

By taking bold action now, we can create a new engine for sustainable economic prosperity, while reducing the impact of climate change. In doing so, we can leverage our leadership in the consumer economy and advanced manufacturing to supply the low-emission innovations, processes, and know-how the world needs.

Addressing the climate crisis creates huge opportunities for economic growth.

Through bold action now and in the decades that follow, we could avoid the worst effects of climate change.

This report discusses how this can be achieved and quantifies India's potential gains. Our research challenges one of the main concerns stopping policymakers, businesses, and individuals from acting on climate change—the cost. It reframes the debate to show that what seems like a cost today is an investment in a climate-driven transformation to a better future.

The choices we make today and over the next decade will determine whether the worst effects of climate change are locked in or avoided. We are at a turning point, and it is time to discover how India and Asia Pacific can reshape the arc of economic history. But we can only do it if we do it together and act now.

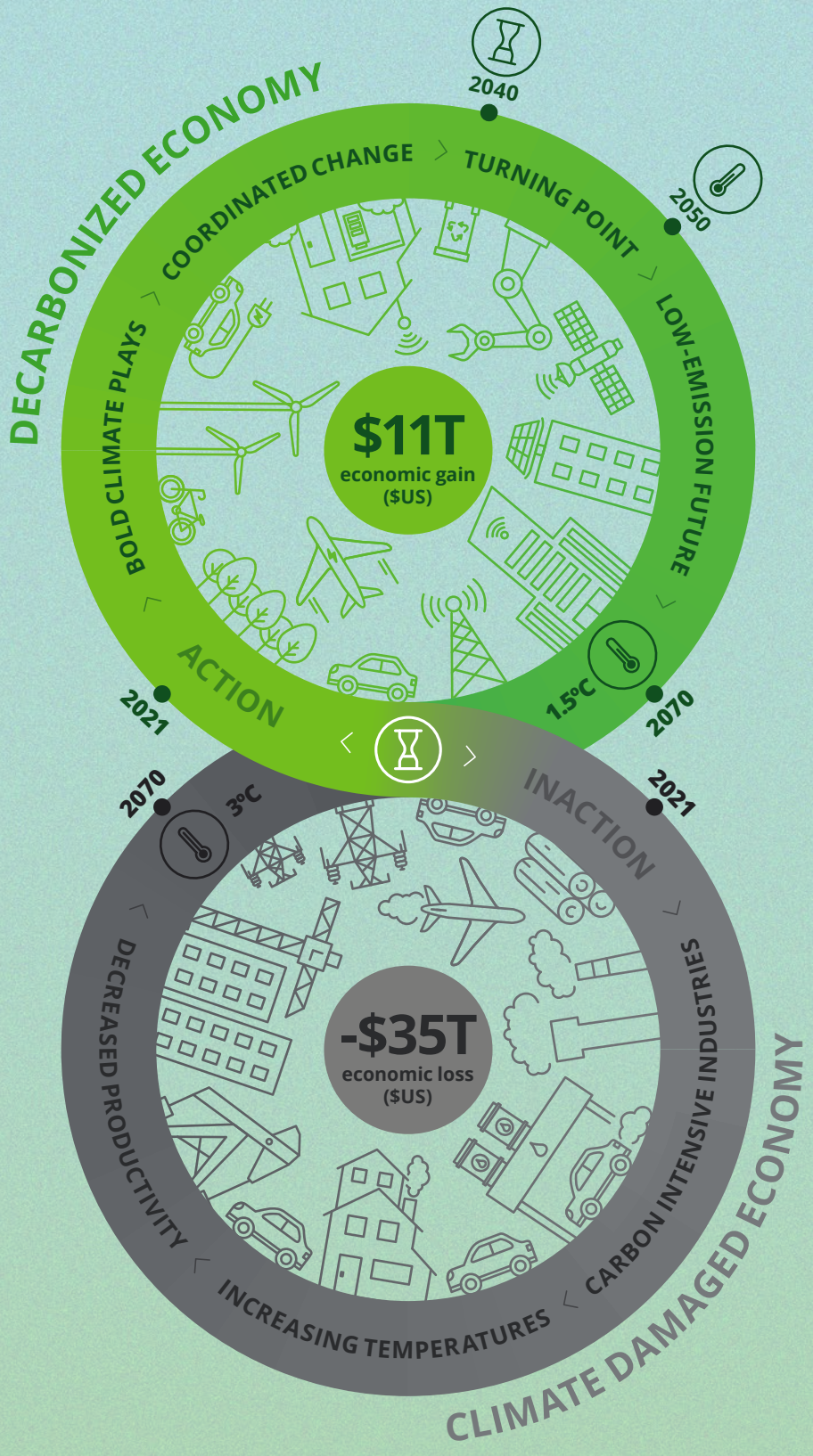
At Deloitte, we have set a bold target to reach net zero emissions by 2030. We are also empowering our professionals, connecting with others, and engaging our broader ecosystem to create solutions that facilitate the transformation to a low-emission economy in Asia Pacific and globally.

We look forward to working with you to help prevent the worst consequences of a warming world and realize the many opportunities presented by decarbonization.

Atul Dhawan
Chairperson,
Deloitte India

Cindy Hook
Chief Executive Officer,
Deloitte Asia Pacific

Executive summary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CLIMATE DAMAGED ECONOMY

Leading the world toward a low-emission future

If left unchecked, climate change will impose steep economic costs on India. These costs will threaten the progress and prosperity the nation has enjoyed in recent decades. But there is an alternative path.

Rapid reductions in emissions in India and across the globe, beginning now and continuing through this next critical decade, offer a way forward to a low-emission future. This potential future not only avoids the worst impacts of climate change, it also creates prosperous long-term economic growth for Asia Pacific and the world.

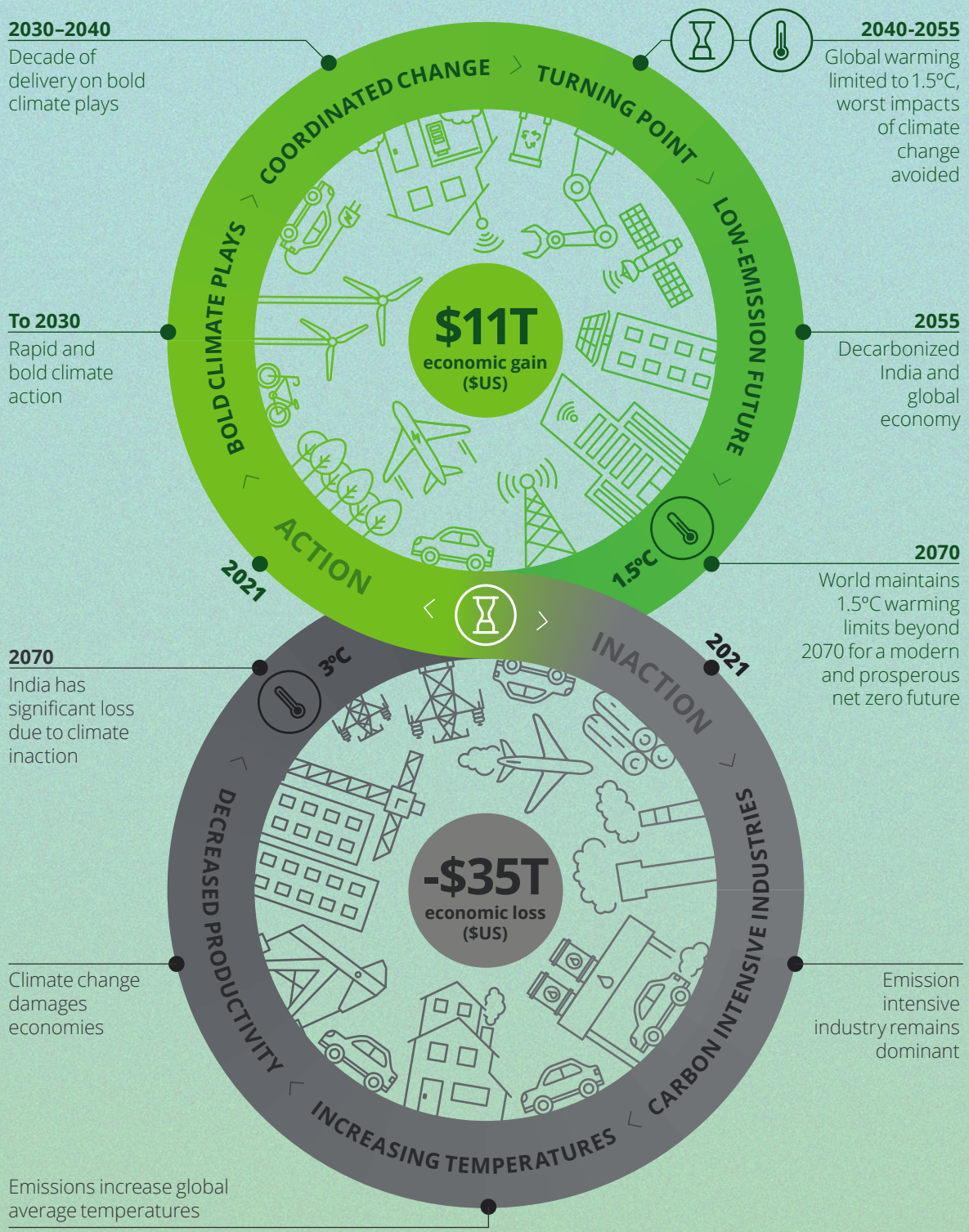
India's future is bright in a decarbonized world that keeps warming within 1.5°C of pre-industrial levels. The country is already a hub for innovative technologies and advanced manufacturing. Now is the time to reorient economic structures to leverage this complexity and reap the economic benefits of a sustainable low-emission future.

However, there is a need to pivot from seeing efforts to limit global warming as optional costs, and instead view them as necessary and new areas of economic opportunity. This will require quantifying the value of climate change mitigation and the benefits that can come from decarbonization. This report aims to help achieve these goals.

At the center of our research is Deloitte's uniquely calibrated Regional Computable General Equilibrium Climate Integrated Assessment Model, the D.CLIMATE model. This model integrates the economic impacts of physical climate change into a baseline economic trajectory to overcome the myopia of many current economic models. By factoring the costs of climate change into the baseline, our model reveals the tremendous economic harms of inaction or inadequate action, and the significant opportunities that present themselves in transforming India's economy.

India's future is particularly bright in a decarbonized world that keeps warming within 1.5°C of pre-industrial levels.

Figure 1.1: Economic growth in India is the trend in a 1.5°C world



Source: Deloitte Economics Institute D.CLIMATE model.

Note: India's stylized economic loss pathway reflects global average warming aligned with the RCP 6.0 baseline. The stylized economic growth pathway reflects limiting global average warming to no more than 1.5°C by 2050, in line with the current ambition of the Paris Agreement.

The cost of climate inaction

In the economic future Deloitte has modeled, India and the rest of the world do not significantly reduce emissions relative to current levels. This future has an emissions pathway that leads to global average warming of more than 3°C by 2070.

This pathway would lead to economic losses of more than US$6 trillion in present value terms by 2050—or approximately 6 percent of India's gross domestic product (GDP) in 2050 alone. On average over the 30 years to 2050, that is an annual loss of 3 percent of GDP.[a]

The result over the next half-century would be climate change–induced economic losses to India of almost US$35 trillion in present value terms.[b] This lost economic potential would total 12.5 percent of GDP in 2070 alone.

Figure 1.2: Economic loss in India due to climate inaction

Source: Deloitte Economics Institute D.CLIMATE model.

a. As this is long-run analysis in nature, and given the uncertainty of ongoing COVID-related economic disruptions, the D.CLIMATE model does not reflect a COVID-corrected GDP trajectory.

b. Total net present value (NPV) of deviation loss to GDP in India over the period to 2070, at a 2 percent discount rate. Refer to the Technical Appendix for a discussion on the selection and application of the discount rate.

Leading the way to a low-emission economy

Fortunately, the temperature changes and costs described above are not fixed. Although some degree of global temperature rise and climate impact is already "locked in" due to historical emissions, there is an opportunity to take bold action to enable economic prosperity and avert the worst impacts of an altered climate. Supported by the right economic framework, these actions can put India—and the world—on a path to realizing strong, equitable, and shared growth.

Doing business will be very different moving forward, given the changes triggered by the pandemic and evolving geopolitical dynamics. The new normal, including shifts in consumer and business preferences, may require a different approach and different strategies. India is at the frontier of a new economic era and the development of a new system of production. By making the right choices now, it could chart a more prosperous path toward a low-emission future.

But time is of the essence. Policy and investment decisions made in the next several years will largely shape the economy and climate that India and the world inherit. This narrow window makes it even more important to understand the economics of a warming world and incorporate them into decision making that addresses the multiple market failures of climate change.

Decarbonization is a new economic engine

Our modeling shows that rapid decarbonization could yield economic gains of almost US$11 trillion (in present value terms) for India's economy by 2070. Compared to a world of climate inaction (the Representative Concentration Pathway (RCP) 6.0 baseline described at right), India's GDP would grow by an average of 1 percent per year over the modeled decades to 2070.

In 2070, this would equate to GDP growth of 8.5 percent and a gain in economic output of about US$4 trillion—equivalent to 20 times the current market value of India's most valuable multinational conglomerate being added to the country's economy in 2070 alone.[1]

Decarbonization and economic development are not mutually exclusive for India. Beyond 2050, India would quickly realize the benefits of rapid decarbonization, particularly the reduced costs associated with avoided climate change damage. By limiting the extent of future climate change, India would secure a greater standard of living for its people and new economic opportunities in a low-emission world.

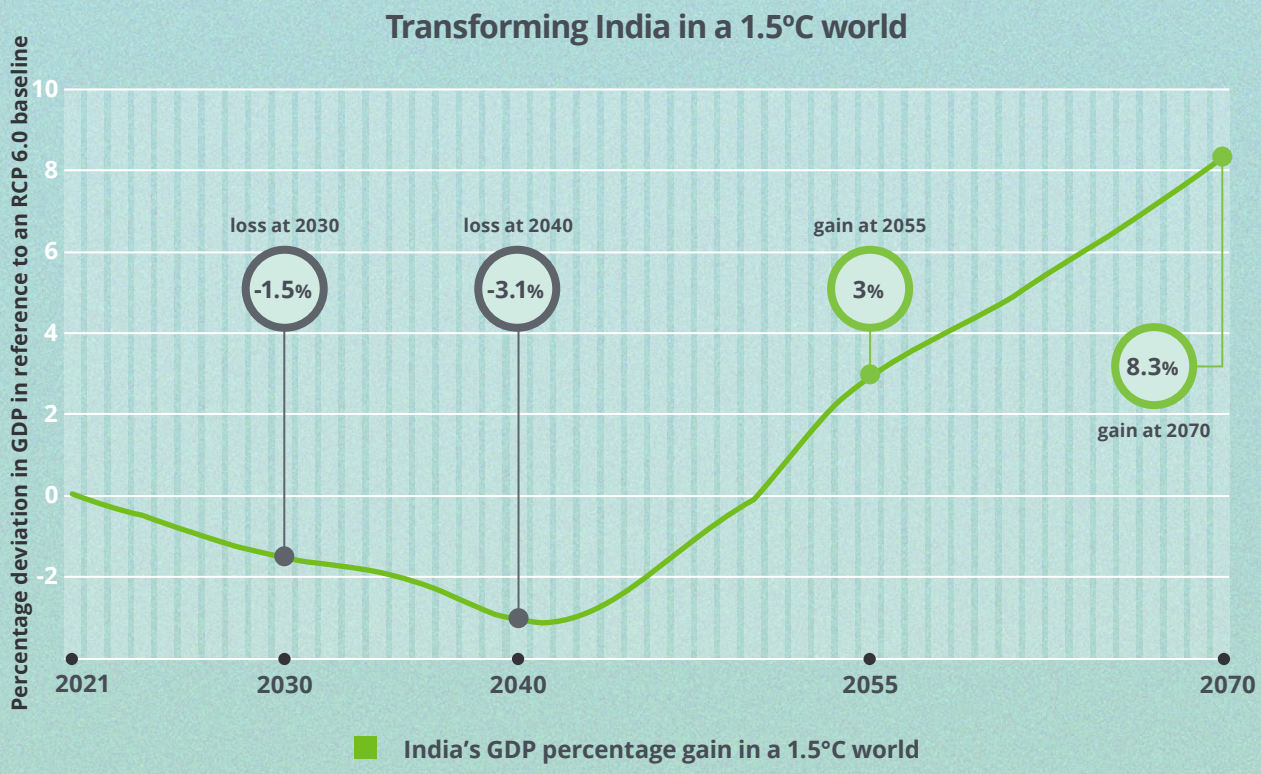
RCP 6.0 explained

RCP 6.0 is an emission scenario used by the Intergovernmental Panel on Climate Change (IPCC). RCP 6.0 assumes the global community largely fails to introduce significant climate mitigation policies, making it an appropriate baseline for forecasting the potential effect of inaction. The IPCC's scenarios vary widely, depending on socioeconomic development and climate mitigation policy settings.

Figure 1.3: Potential economic gain for India due to decarbonization in a 1.5°C world

Source: Deloitte Economics Institute D.CLIMATE model.

Figure 1.4: Four phases of action to achieve a decarbonized India in a 1.5°C world

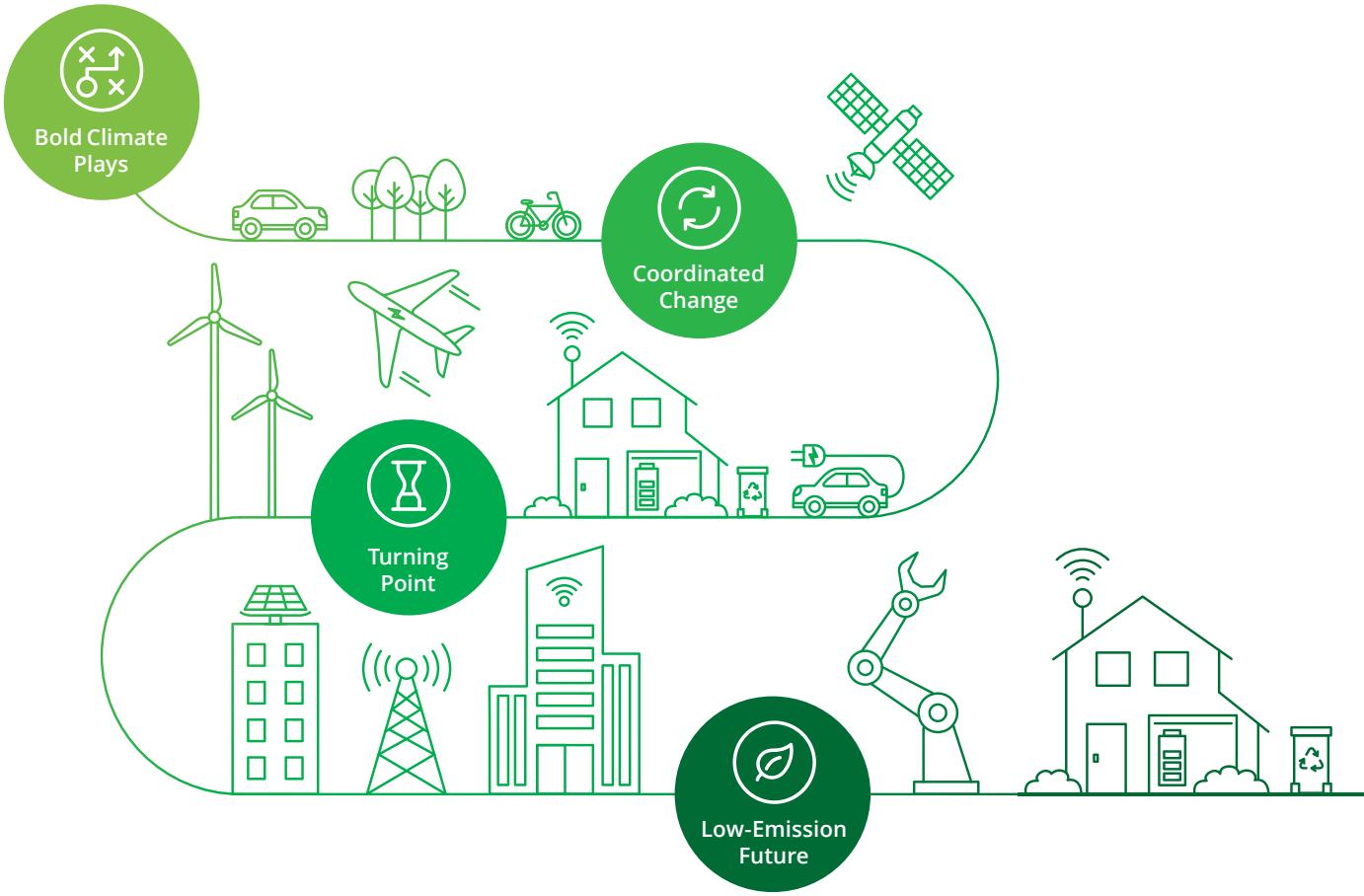


		Largest economic gains during transformation Ordered by largest GDP gain, level terms ($US)
2021–2030	**Bold Climate Plays** Few industries enjoy immediate GDP gains due to bold climate plays toward a 1.5°C world.	New energy
2030–2040	**Coordinated Change** A small number of industries gain consistently in the key decade of change toward a 1.5°C world.	New energy Water and utilities
2040–2055	**Turning Point** A growing number of industries benefit from decarbonization achieved in a 1.5°C world.	New energy Agriculture and forestry Water and utilities Construction
2055–2070	**Low-Emission Future** New economic structures and outputs remake India in a decarbonized 1.5°C world.	New energy Services Agriculture and forestry Retail Construction Water and utilities Manufacturing

Source: Deloitte Economics Institute D.CLIMATE model.

India's turning point

In our modeling, India would spend the next few decades investing in sustainable technologies and systems transformation to avoid the impacts of unchecked climate change, before gradually seeing economic growth around the middle of the century. We also show how rapid decarbonization toward a 1.5°C world[c] would be likely to occur through the following four economic phases.



c. References to 1.5°C in this report describe a situation in which nations successfully achieve rapid decarbonization, limiting global average warming to 1.5°C by the middle of the century and maintaining that average until the end of the century. Under this scenario, India would achieve nearly net zero emissions by 2050. This scenario has been dimensioned and modeled by Deloitte Economics Institute.

Bold Climate Plays
from 2021 to 2030

The next few years set the stage for rapid decarbonization. The decisions by government, regulators, business, industry, and consumers would reinforce initial progress and create the market conditions to deliver decarbonization at pace and scale. This would send price signals, transform supply chains, and lay the foundation for a structural shift that limits global average warming to 1.5°C. During this first phase, India would need to forgo some short-term economic development in favor of significant investment in sustainable technologies.

Coordinated Change
from 2030 to 2040

The hardest shifts in industrial policy, energy systems, and consumer behavior would occur in this period. Businesses and economies would begin to see the consequences of bold climate plays, with different industries and countries transforming at different paces. India would continue to undergo significant structural changes during this decade, and net economic gains of the transformation would still be on the horizon.

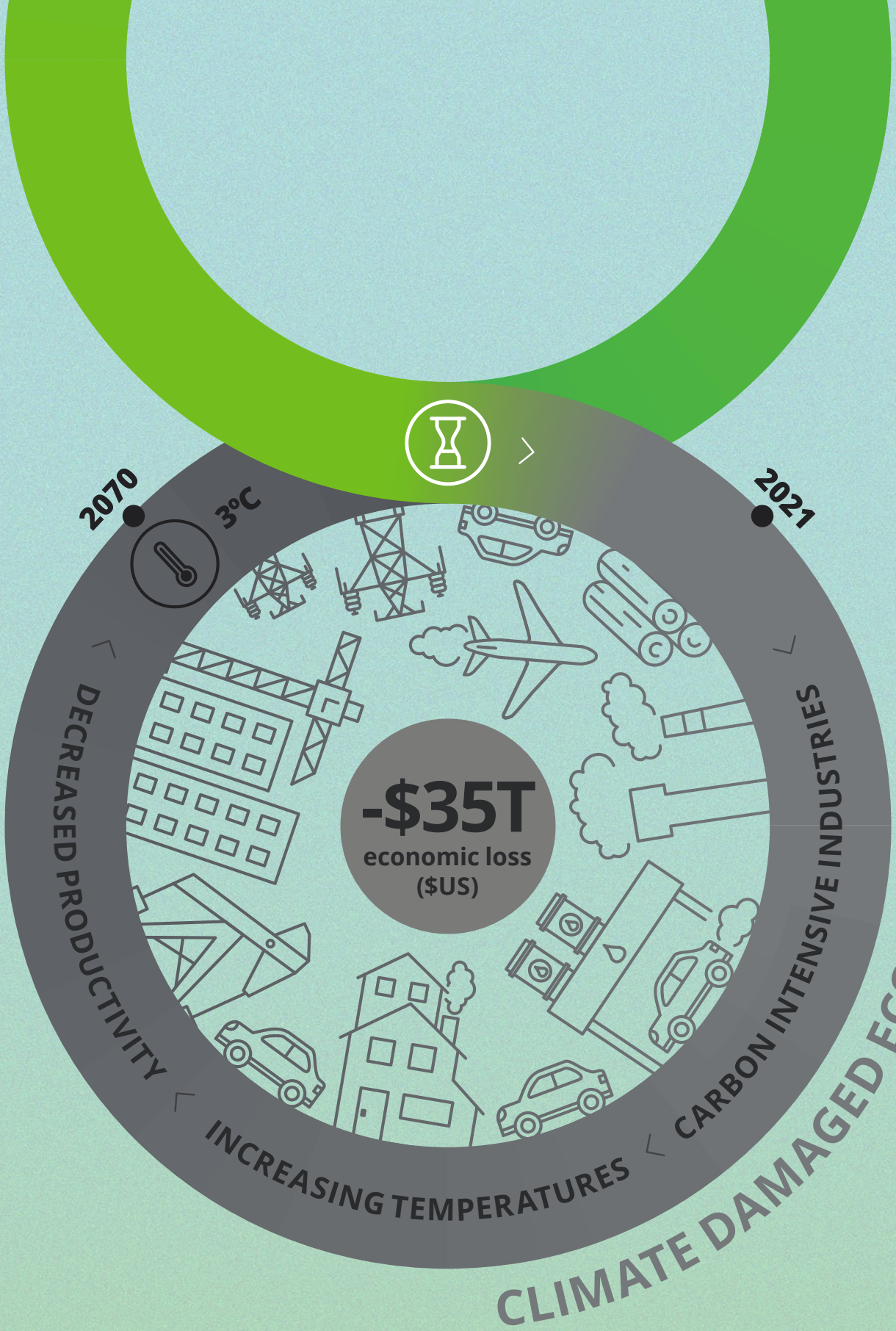
Turning Point
from 2040 to 2055

The decarbonization of high-emitting industries should be nearly complete by this period. The cost of new low-emission technologies would be decreasing and net economic gains would be shared more widely. Efforts to curb emissions would begin to manifest in lower global average temperatures relative to a higher-emitting posture (greater than 0.2°C average decrease across the decades to 2055, compared to the RCP 6.0 baseline). This pathway would result in a 1°C difference in the global mean temperature by 2070, relative to the RCP 6.0 baseline. **This period would be the climatic and economic turning point** that avoids a "locked in" higher-emission pathway and realizes the economic dividends of technological progress. India would enter a net positive economic position by 2051, with gains gradually increasing towards the end of the century—a direct benefit of decarbonization and the avoided cost of climate change.

A Low-Emission Future
after 2055

By the end of the century, India's economy would be near net zero emissions and the world's economic systems of production would be keeping global average warming to around 1.5°C. Economic structures would be radically transformed, underpinned by a series of interconnected, low-emission systems spanning energy, mobility, manufacturing, and food and land use. The energy mix would be dominated by low- or zero-emission sources across every market, with green hydrogen and negative-emission solutions, both natural and technological, playing prominent roles. India would now be rapidly accruing the economic dividends of global decarbonization, in a low-emission future that benefits Asia Pacific and the world.

The economic costs of climate inaction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The new normal: a climate-damaged economy

Most economic thinking has it wrong.

Dominant economic projections do not account for the consequences of climate change, or the world's efforts to adapt to or mitigate the impacts. When they do consider climate change damage and mitigation policy, it is often in scenario analyses that compare alternative future states to the same incorrect starting point—and against an erroneous "business as usual" trend that assumes unconstrained economic growth via emissions-intensive economic production. This is the economic baseline that informs how most decisions and investments are made, for governments and businesses alike.

And no wonder. Since the Industrial Revolution, economic growth has moved nearly in lockstep with rising greenhouse gas (GHG) emissions. As humanity burned fossil fuels, removed forests, and converted land to intensive agriculture, it enjoyed the "fruits" of those actions: economic growth, rising standards of living, and better quality of life.[d] The world economy has expanded almost every year since 1750. While growth has not been constant or even— across regions and individual countries— GDP growth has, on average since the Industrial Revolution, been around 1.5 percent per year.[2]

That emissions-intensive growth has been perhaps most evident in the Asia Pacific region, where the past several decades have seen dramatic economic expansion and hundreds of millions of people rising out of poverty—alongside rapidly increasing carbon dioxide (CO_2) emissions.[3]

Growth with consequences

Throughout the 1980s and into the 1990s, a series of regulatory reforms in India laid the foundations for several decades of strong and sustained income growth,[4] and India's economy has continued to gain momentum ever since. Over the past two decades, annual GDP per capita has grown by an average of 5 percent. In 2019, India's GDP reached US$2.9 trillion and accounted for about 3.3 percent of GDP globally.[5]

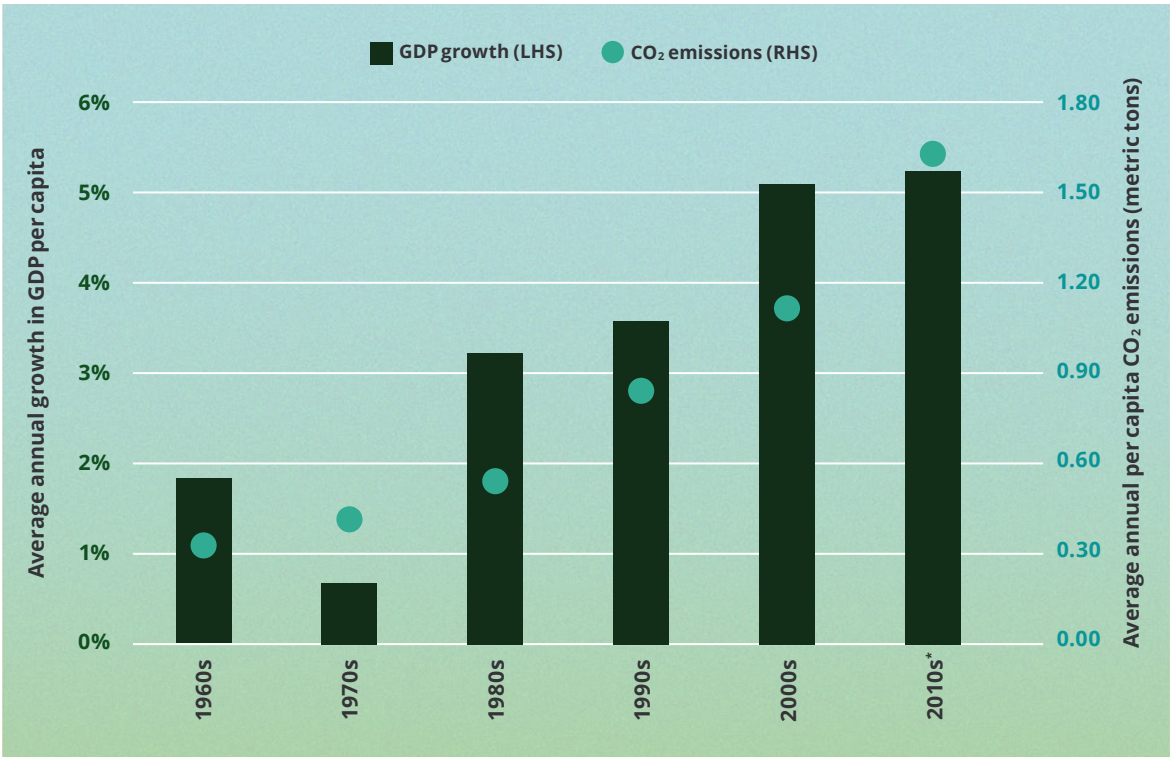
Supporting India's economic expansion has been an equally rapid growth in demand for energy. With the economy expanding rapidly and living standards improving, much of India's energy use continues to come from high-emission sources, predominantly coal, oil, and biofuels from waste. In 2019, these three sources accounted for just over 90 percent of the energy India supplied to the region.[6]

Emissions have been growing rapidly as a result. Throughout the 1960s, India's CO_2 emissions per capita averaged just 0.32 metric tons annually.[7] Over the past decade, however, India's per capita emissions have soared to an average of 1.62 metric tons per year, and India now accounts for around 7 percent of global emissions annually.[8]

Economic growth and rising standards of living have come at a huge cost.

d. Economic growth as measured by GDP, and improved standards of living as measured by increasing GDP per person.

Figure 2.1: Trends in India's per capita GDP growth and emissions[9]



Source: Deloitte Economics Institute analysis of World Bank data.
*Per capita GDP growth to 2019, per capita emissions to 2016.

Changing the economic narrative

Mainstream economic theory and models assume unconstrained emissions do not have negative consequences for economic growth potential.

This view of the world has now come up against the overwhelming scientific consensus—and increasingly our own lived experiences—telling us that the current system of economic production is generating untenable changes in the climate.[10] These changes put at risk India's hard-earned economic growth and prosperity.[11]

India's climate, as well as its large population and economic dependence on agriculture, mean it is particularly exposed to the effects of unchecked climate change.[12] As average global temperatures continue to rise, extreme weather events—such as flooding and heat waves—would become increasingly common and devastating throughout the region. Rising sea levels would impact a large number of communities in coastal areas, particularly through damage to capital infrastructure. With about a quarter of India's rural population currently living in poverty, their capacity to swiftly recover from future climate events would likely be very limited.[13]

Agriculture remains a key sector in the Indian economy, accounting for about 16 percent of GDP in 2019.[14] Climate change is expected to reduce the reliability of seasonal output, impacting revenue. One study found that rising temperatures reduced some Indian crop yields by about 5.3 percent between 1981 and 2009.[15]

India clearly has a strong incentive to act swiftly and limit the extent of any future impacts of climate change. But doing so requires a new economic mindset. Deloitte's D.CLIMATE model integrates the economic impacts of physical climate change into a baseline economic trajectory, to overcome the myopia of many current economic models. By factoring the costs of climate change into the baseline, our framework reveals the tremendous economic harms of inaction or inadequate action, as well as the significant opportunities that present themselves in remaking India's economy.

The high costs of inaction

Climate change threatens to wipe out decades of hard-won economic growth in India. The foundations of the nation's prosperity—its natural and human capital—are at risk, and along with them its standard of living, its prospects for future growth, its place on the global stage, and the wellbeing of its people.[16]

If India's recent economic story is one of growth, unchecked climate change would turn it into one of decline.

Climate change could reverse India's hard-won economic gains.

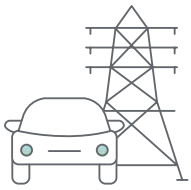
Figure 2.2: How climate change impacts the economy

Impacted workers

Heat stress, the "slowing down" of workers, and their reduced ability to perform results in lower labor productivity.

Lost productive land

A loss of productive land through rising sea levels and a reduced level of productive activity on the land impacts low-lying and coastal areas.



Stalling productivity and investment

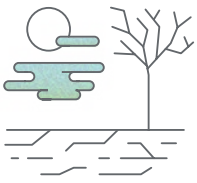
Economies suffer as investment repairs existing assets instead of contributing to new, more productive capital. Climate change stalls economic progress.

Diminished health and wellbeing

Increased incidence of mortality and morbidity disrupts living standards and the lives of the working population.

Disrupted flow of global currency

The scale of loss of tourism and international money circulating in economies impacts business, jobs, and livelihoods.



Agricultural losses

Despite adaptation, climate change inaction limits what farmers can do. Significant variations in crop yields damage the agricultural sector's output.

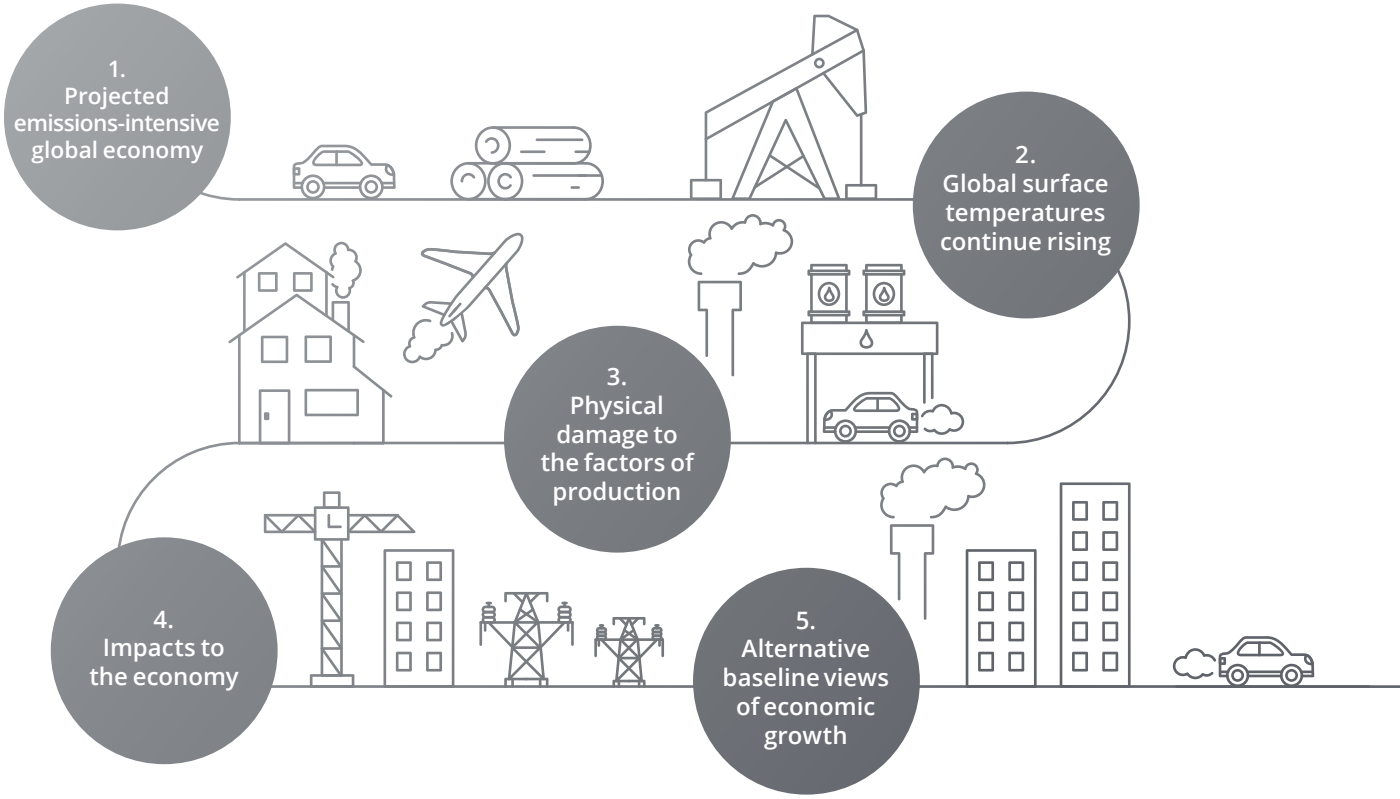
Source: Deloitte Economics Institute.

Modeling climate inaction in India

Global emissions will continue to rise if no further significant action is taken to mitigate climate change. The outcome would be increasing global average warming toward the end of the century. In this world, inaction on climate change would be the baseline path for the economies of India and the world. This baseline scenario would negatively impact economic growth, when compared to a world without climate change (refer to the Technical Appendix for more detail).

This modeling framework involves significant research on region-specific climate and economic impacts across Asia Pacific, which are used as inputs for Deloitte's D.CLIMATE model (refer to the Technical Appendix for more detail).

To quantify this conclusion, Deloitte modeled the economic impacts of a changing climate on long-term economic growth in India, using the following stepped process.



1

The model projects economic output (as measured by GDP) with emissions reflecting RCP 6.0 to the year 2100.[e] RCP 6.0 represents a single scenario without significant additional efforts to constrain emissions (a baseline scenario).[17] This results in a projected emissions-intensive global economy.

2

Increased atmospheric GHGs cause average global surface temperatures to continue rising above pre-industrial levels.[f] In the RCP 6.0 baseline scenario, global average temperatures increase more than 3°C above pre-industrial levels by the end of the century.[g] (Note that present-day temperatures have already risen more than 1.0°C above pre-industrial levels.)

3

Warming causes the climate to change and results in physical damage to the factors of production. The Deloitte model includes six types of economic damage, regionalized to the climate, industry, and workforce structure of each defined geography in Asia Pacific.

4

The damage to the factors of production is distributed across the economy, impacting GDP. Any change in emissions (and, correspondingly, temperatures) over time results in changes to these impacts and their interactions. The economy impacts the climate, and the climate impacts the economy.

5

The key variables of time, global average temperature, and the nature of economic output across industry structures combine to offer alternative baseline views of economic growth. Specific scenario analysis is then conducted, referencing a baseline that includes climate change damage. Scenarios can also include policy actions that either reduce or increase emissions and global average temperatures relative to the RCP 6.0 baseline view.

e. IPCC-adopted emission scenarios vary widely, depending on socioeconomic development and climate mitigation policy settings. RCP 6.0 is chosen as an intermediate baseline scenario as it includes no specific or significant climate mitigation policy effort, making it an appropriate baseline for reference.

f. Pre-industrial is defined in IPCC assessments as the multi-century period before the onset of large-scale industrial activity around 1750.

g. The associated climate data (like annual temperature increases and atmospheric concentrations) are sourced from a synthesis of the models available through the Coupled Modeling Intercomparison Project (CMIP6). See the Technical Appendix for further detail.

Figure 2.3: Sector loss at 2070, in a climate damaged India in a 3°C+ world

Source: Deloitte Economics Institute D.CLIMATE model.

Figure 2.4: Loss to the economy over 50 years

Source: Deloitte Economics Institute D.CLIMATE model.

Note: Total NPV of deviation loss to GDP in India over the period to 2070, at a 2 percent discount rate.
Refer to the Technical Appendix for a discussion on the selection and application of the discount rate.

The economic cost of climate change

In the economic future modeled, India and the rest of the world do not significantly reduce emissions relative to current levels. This future has an emissions pathway that would lead to global average warming of more than 3°C by 2070.[h]

The result over the next half-century, by Deloitte's estimates, would be climate change–induced economic losses to India of approximately US$35 trillion in present value terms.[i] This loss to economic potential would equal 12.5 percent of GDP in 2070 alone.[j]

If substantial actions are not taken, climate change would, in average annual terms, reduce India's economic potential by 5.5 percent a year over the next 50 years.

Without substantial action, climate change will have a devastating effect on India's economic growth in the coming decades.

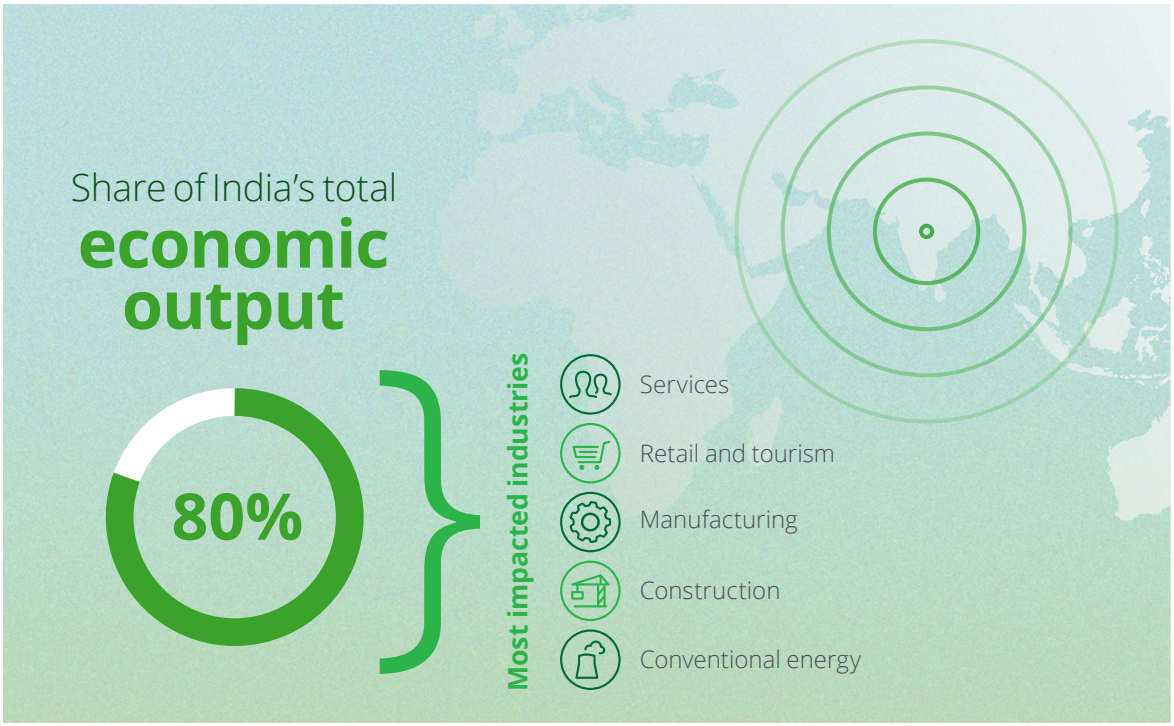
This pathway would lead to economic losses of more than US$6 trillion in present value terms by 2050—or over 6 percent in 2050 and nearly 9 percent by 2060. The losses would increase rapidly as temperatures continued to rise, with net present losses to India's GDP growing more than fivefold between 2050 and 2070.

h. IPCC-adopted emission scenarios vary widely, depending on socioeconomic development and climate mitigation policy settings. RCP 6.0 is chosen as an intermediate baseline scenario as it includes no specific or significant climate mitigation policy effort, making it an appropriate baseline for reference.

i. Total NPV of deviation loss to GDP in India over the period to 2070, at a 2 percent discount rate. Refer to the Technical Appendix for a discussion on the selection and application of the discount rate.

j. As this is long-run analysis in nature, and given the uncertainty of ongoing COVID-related economic disruptions, the D.CLIMATE model does not reflect a COVID-corrected GDP trajectory.

Figure 2.5: Largest industry losses in India due to climate change



Source: Deloitte Economics Institute D.CLIMATE model.

Substantial losses to industries, firms, and workers

India's economy is highly exposed to the economic damage caused by climate change. Over the next 50 years, the top five most impacted industries in terms of economic activity are expected to incur a significant share of climate-related losses.

These industries—services (government and private), manufacturing, retail and tourism, construction, and transport—currently account for more than 80 percent of GDP in India. Together, they form the basis of the country's contemporary economic engine.

Deloitte estimates that by 2070, these five industries alone would experience an annual average loss in the value added to GDP of more than US$1.5 trillion per year.

In our model, the impacts would be most significant for labor and physical capital, and the industries that draw heavily on them would experience the greatest economic losses.

Manufacturing and construction would both suffer from impacts to their asset base and lower levels of labor productivity associated with worsening human health conditions and heat stress.

India's large and growing population means the region is particularly vulnerable to the impacts of climate change. For example, rising sea levels are expected to impact a large number of communities situated in the region's coastal areas, particularly through damage to capital infrastructure. The capacity of these communities to swiftly recover from future climate events is likely to be limited, with about a quarter of India's rural population living in poverty.[18]

The economic gains of rapid decarbonization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A new economic climate

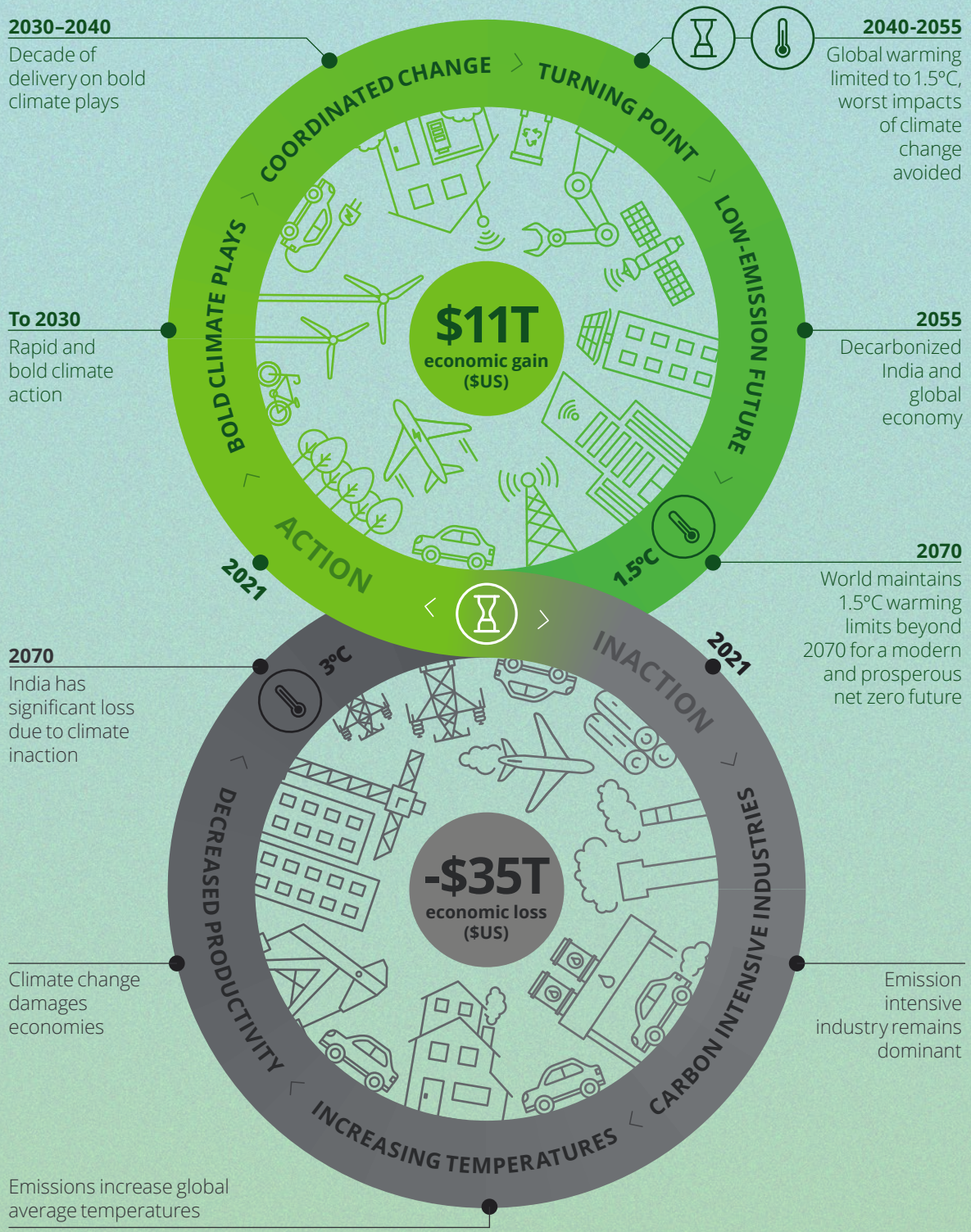
The economic costs of climate change are not fixed. Although some degree of global temperature rise and climate impacts are already "locked in" due to historical emissions, there is an opportunity to take bold action to enable economic prosperity and avert the worst impacts of an altered climate. Supported by the right economic framework, these actions can put India—and the world—on a path to realizing strong, equitable, and shared growth.

India is at the frontier of a new economic era and the development of a new system of production. By making the right choices now, it could chart a more prosperous path toward a low-emission future.

Accelerated decarbonization could bring significant benefits to India and the world. India could use the transition to a low-emission footing to restructure its economy toward growth in advanced industrial sectors, leveraging lower-cost clean energy export markets as energy demand rapidly increases in the region over the coming years.[19]

But time is of the essence. Policy and investment decisions made in the next few years will largely shape the economic and climatic future that India and the world will inherit. That narrow window makes it even more important to understand the economics of a warming world and incorporate them into decision making that addresses the multiple market failures of climate change.

Figure 3.1 Economic growth in India is the trend in a 1.5°C world



Source: Deloitte Economics Institute D.CLIMATE model.

Note: India's stylized economic loss pathway reflects global average warming aligned with the RCP 6.0 baseline. The stylized economic growth pathway reflects limiting global average warming to no more than 1.5°C by 2050, in line with the current ambition of the Paris Agreement.

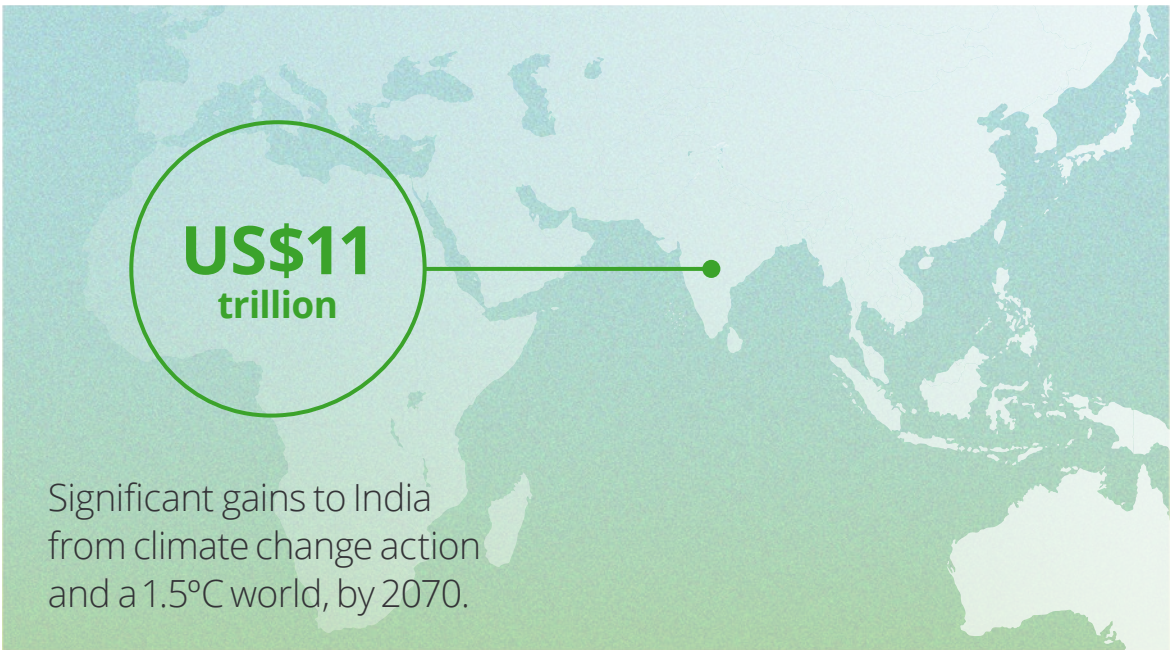
As a developing nation, India's transformation to a low-emission footing is likely to be more complex and challenging than for much of the rest of Asia Pacific. It will have to strike a delicate balance between the need for sustained economic development—and the corresponding rise in energy demand—and investing in and transitioning to emerging, low-emission technologies. The structural adjustment costs associated with reducing India's emissions profile are expected to be significant, but the cost of inaction will be greater.

India has already taken early steps toward a low-emission future. It recently revised its renewables target to have 450 gigawatts of installed renewables capacity by 2030, which would constitute about 50 percent of India's installed capacity. Action plans on climate change are being developed in 32 states across the country.[20]

India's government is increasing its focus on large-scale integration of renewable electricity in the national grid. The multiple initiatives underway include:

- Developing new infrastructure to support growth in renewable energy under the Green Energy Corridor Project[21]
- Investing in strategies to flexibly operate thermal, gas, and hydro power plants[22]
- Developing Renewable Energy Management Centers with the capability to forecast and manage energy supply and demand throughout India.[23]

Figure 3.2: Potential economic gain for India due to decarbonization in a 1.5°C world



Source: Deloitte Economics Institute D.CLIMATE model.

Decarbonization is a new economic engine

Rapid decarbonization could yield gains for India's economy of nearly US$11trillion in present value terms by 2070. Compared to a world of climate inaction (the RCP 6.0 baseline scenario), India's GDP would be an average of 1 percent higher each year over the modeled decades from today to 2070.

In 2070, this would equate to GDP growth of 8.5 percent and a gain in economic output of about US$4 trillion—equivalent to 20 times the current market value of India's most valuable multinational conglomerate being added to India's economy in 2070 alone.[24]

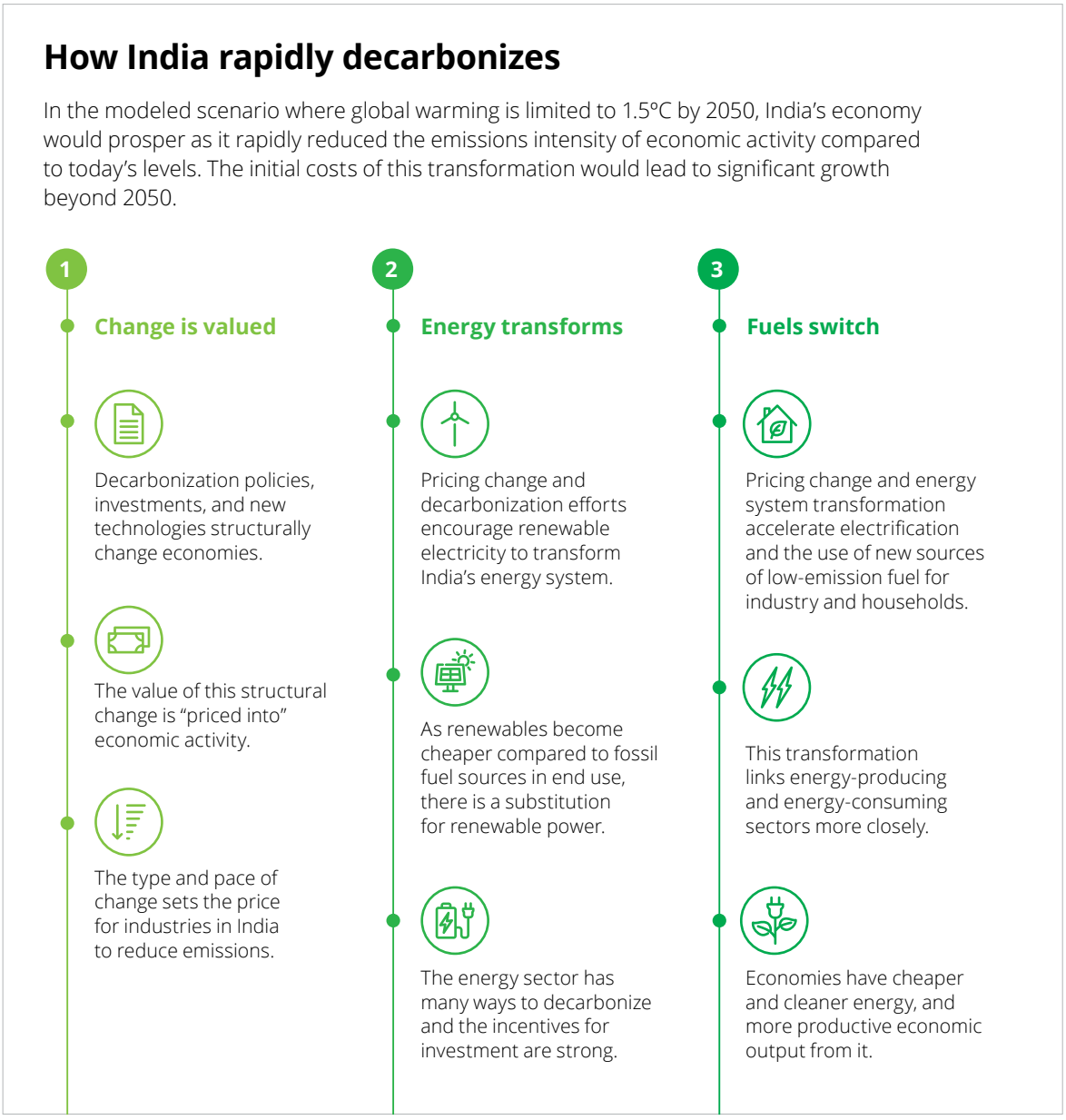
However, reaping these gains will require patience. In our model, the economic benefits of action would not be felt until just after 2050. This is a product of the impacts of "locked in" warming (even keeping to a 1.5°C increase by 2050) combined with higher structural adjustment costs and export restrictions manifesting in any number of policies implemented by any number of countries, over a longer period than in other parts of Asia Pacific.

This slower transformation reflects India's need to balance decarbonization with the economic development that would lead to greater emissions during the first half of this century.

Decarbonization and economic development are not mutually exclusive for India. Beyond 2050, India would quickly realize the benefits of rapid decarbonization, particularly the reduced costs associated with avoided climate change damage. By limiting the extent of future climate change, India would secure a greater standard of living for its people and new economic opportunities in a low-emission world.

By limiting future climate change, India would quickly realize the benefits of rapid decarbonization beyond 2050.

Figure 3.3: The process of economic adjustment to decarbonization in a 1.5°C world scenario



Source: Deloitte Economics Institute D.CLIMATE model.

Note: Total NPV of deviation gains to GDP in India over the period to 2070, at a 2 percent discount rate. Refer to the Technical Appendix for a discussion on the selection and application of the discount rate.

India’s turning point

Realizing the economic benefits of decarbonization will require broad changes across the Indian economy, particularly in its energy mix and industrial base.

In the modeled scenario, renewable energy (primarily solar and wind) is foundational and used in electrolysis to create green hydrogen, which could be transported for use.

India’s energy mix in a decarbonized future would include very few fossil fuels—their share would fall sharply from 95 percent in the early 2020s to 44 percent by 2040 and just 5 percent by 2070.

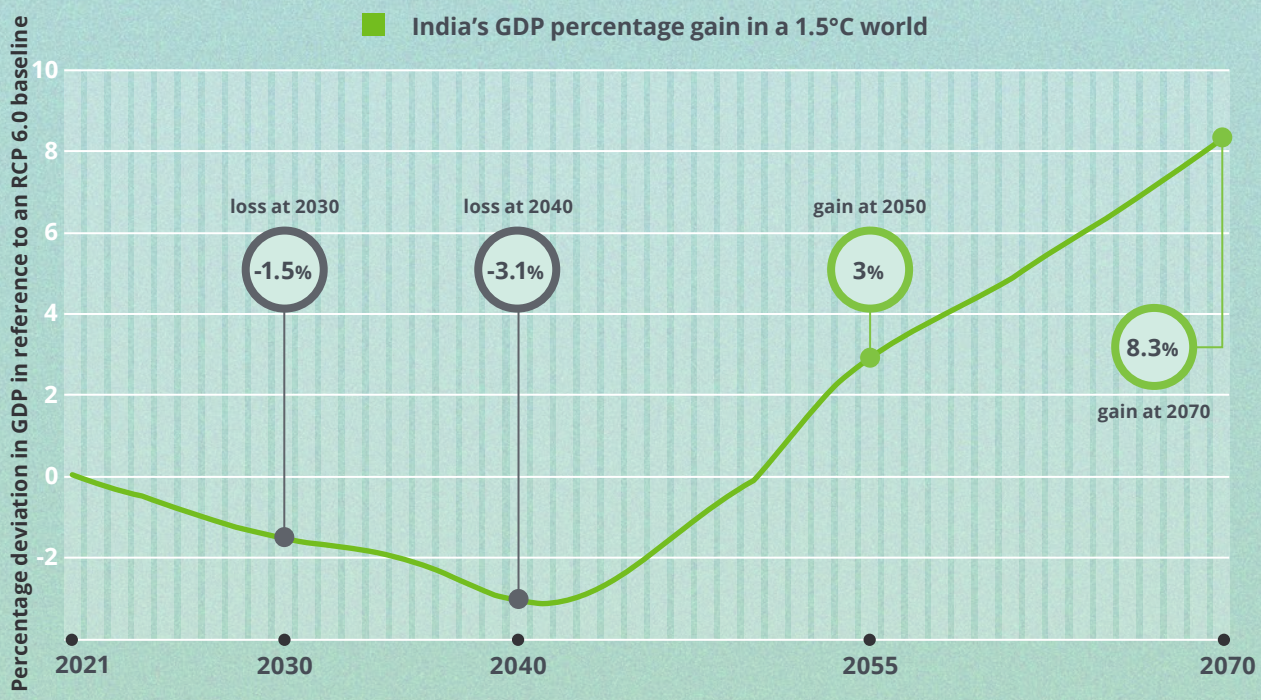
Figure 3.4: India’s fossil fuel usage by 2070

Source: Deloitte Economics Institute D.CLIMATE model.

The path to decarbonization

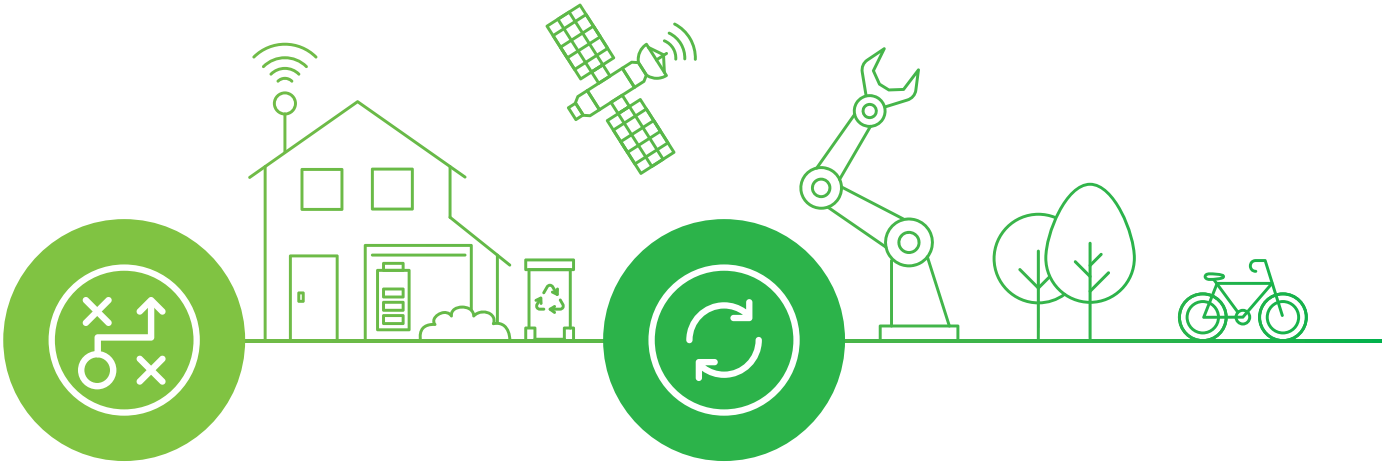
Deloitte expects rapid decarbonization to a 1.5°C world to follow four key economic phases.

Figure 3.5: Four phases of action to achieve a decarbonized India in a 1.5°C world



	Largest economic gains during transformation Ordered by largest GDP gain, level terms ($US)	
Bold Climate Plays 2021–2030	New energy	
Coordinated Change 2030–2040	New energy	Water and utilities
Turning Point 2040–2055	New energy Agriculture and forestry	Water and utilities Construction
Low Emission Future 2055–2070	New energy Services Agriculture and forestry Retail	Construction Water and utilities Manufacturing

Source: Deloitte Economics Institute D.CLIMATE model.



Bold Climate Plays
from 2021 to 2030

The next few years set the stage for rapid decarbonization. The decisions by government, regulators, business, industry, and consumers would reinforce initial progress and create the market conditions to deliver decarbonization at pace and scale. This would send price signals, transform supply chains, and lay the foundation for a structural shift that limits global average warming to 1.5°C.

With India forgoing some short-term economic development in favor of significant investment in sustainable technologies, very few of the region's industries would be better off during this phase.

Coordinated Change
from 2030 to 2040

The hardest shifts in industrial policy, energy systems, and consumer behavior would get underway by this point. This would be the decade in which economies, businesses, and industries began to see the consequences of bold climate plays, with different industries and regions transforming at different paces.

India's climate, as well as its large population and economic dependence on agriculture, mean the region is particularly exposed to the effects of climate change.[25]

The agriculture and forestry sector provides income, as well as food security for many people living in India. However, climate change is expected to reduce the reliability of seasonal output, impacting sectoral revenue. Few industries in India would realize net economic gains during this phase of ongoing structural change.

Turning Point
from 2040 to 2055

Our model suggests the decarbonization adjustments in industry should be almost complete by this period. The cost of new low-emission technologies would continue to decrease and the net economic gains would be more widely shared. This is when the material benefits of limiting global average warming through decarbonization would be likely to materialize, in the form of a greater than 0.2°C average difference in the global mean temperature in the decade leading up to 2055, compared to the RCP 6.0 baseline.

This would be the climatic and economic turning point, preventing the shift to a "locked in" higher-emission pathway while realizing the economic dividends of technological progress. India would reach a net positive economic position by 2051, and economic gains would continue to gradually rise toward the end of the century, exceeding 8 percent by 2070. These wins would be a combined product of the economic benefits of decarbonization and the avoided costs of unmitigated climate change.

A Low-Emission Future
after 2055

Beyond 2055, our model predicts India's economy would be near net zero emissions and the economic systems of production would keep global average warming to around 1.5°C by the end of the century. Economic structures would be radically transformed, underpinned by a series of interconnected, low-emission systems spanning energy, mobility, manufacturing, and food and land use.

The energy mix would be dominated by low- or zero-emission sources across every market, with green hydrogen and negative-emission solutions, both natural and technological, playing prominent roles.

Notably, India would now be rapidly accruing the economic dividends of global decarbonization, in a low-emission future that benefits Asia Pacific and the world. India's economic gains would continue to gradually rise toward the end of the century, exceeding 8 percent by 2070.

Endnotes

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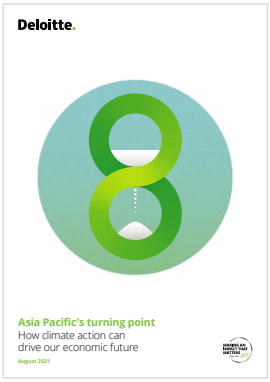

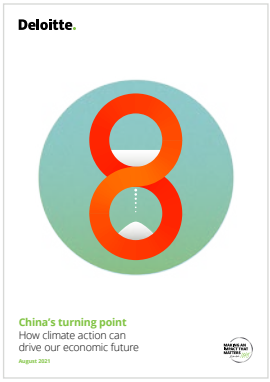

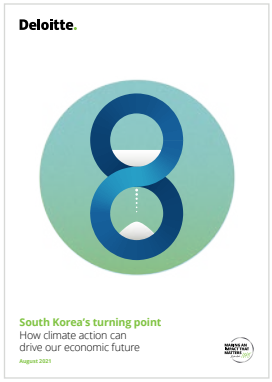

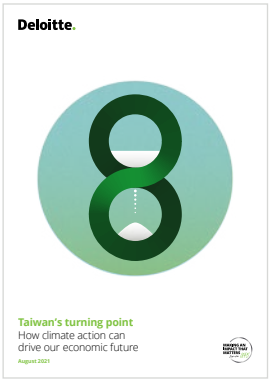

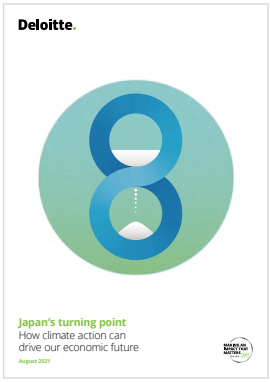

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