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China’s Belt and Road must adapt to survive a hotter world

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ABSTRACT

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In December 2022, fireworks lit up the sky over Lusail stadium, north of Doha. At the centre stood Lionel Messi, arms raised, World Cup trophy in hand, as thousands celebrated around him. It was a moment of triumph for Messi, for Argentina and for Qatar, the first Middle Eastern country to host one of the world’s most iconic sporting events.

Qatar had won the bid in 2010. In the 12 years that followed, the country underwent an infrastructural transformation. Stadiums rose from scratch, highways were laid, hotels reshaped the skyline. A nation readied itself to be seen.

And yet, as the World Cup unfolded, another group became impossible to ignore. Not those inside the stadium that December night, but those who had built it. Hundreds of thousands of migrant workers who had laboured under a desert sun worsened by climate change. Many died. They showed what extreme heat can do to those who construct the world’s grandest visions.

This is more than a cautionary tale. It is a glimpse into a future where extreme heat disrupts labour forces, reshapes economies and challenges the very foundations of global infrastructure development schemes.

One such scheme is the Belt and Road Initiative (BRI) launched by China in 2013.

The scale is clear. Thus far, China has allocated around USD 1 trillion in loans and investments to BRI projects, including power plants, railways, ports, telecommunications networks, and other large infrastructure developments. But what is also clear is that the BRI is unfolding in some of the world's most heat-vulnerable regions, spanning Africa, South Asia, and the Middle East.

> *Many nations along these corridors already struggle with fragile infrastructure and limited resources to combat climate shocks. As the heat intensifies, the cost of strategies to keep workers safe – cooling systems, adjusted work schedules, reduced hours – will rise, straining the very projects meant to drive economic development.*

Construction, agriculture and extraction depend on long hours of outdoor work. Yet our modelling suggests that by the end of the century, heat stress could reduce feasible working time by up to 25% in the worst-affected sites.

Because much of the BRI is financed through long-term loans that mature decades after completion, these chronic hits to output can translate into weaker cash flows and delayed repayment. The economics of labour-intensive projects could be undermined by the rising cost of keeping workers safe.

Such pressures raise a critical question: Can China's BRI remain financially and operationally sustainable under intensifying heat stress? As temperatures climb, so too does the likelihood of the answer being no.

Rising temperatures push down productivity

We have modelled two possible futures. The first follows a low-emission pathway, where aggressive climate action drives global CO2 emissions to net zero by around 2075. The second envisions a world without effective climate policies, leading to a medium-to-high emission trajectory.

The contrast between these scenarios is stark.

Under the high-emission pathway, labour productivity could plummet by more than 30% in some regions by the late 21st century. Productivity losses in industries such as agriculture and construction could be three times greater than in a low-emission future.

Desert coal miners face an uncertain future

Take the Thar Desert in south-eastern Pakistan, a region with relentless heat, minimal rainfall and land too parched for cultivation. Here, amid the sand and the dust, lies one of the world's largest lignite coal deposits.

In 2014, the Engro Thar coal power project (Thar-II) was launched to help alleviate Pakistan's chronic energy shortages. This cornerstone of the BRI's China-Pakistan Economic Corridor

was completed five years later, but now faces a future increasingly imperilled by rising temperatures.

Our model shows that if emissions continue on a medium-to-high scenario, labour productivity at the Thar Engro project could drop by nearly a quarter. This will mean about three months of lost work each year by 2100, as rising heat makes it harder for workers to endure long hours outdoors.

For those who call the Thar desert home, life has always been precarious, dependent on the success of an unpredictable monsoon. Locals rely on rearing livestock and seasonal agriculture. Women walk miles to collect water. And a single failed monsoon can mean acute fodder shortages for livestock. In this world, the promise of a stable job offers a way out of the cycle of drought.

Since operations began in 2019, drawn by this promise, young men have flocked to the open-air Thar mine, working even during the hottest part of the day. Last summer, temperatures reached 44C at the nearest official weather post to the coalfield – the Chhor station in eastern Sindh, on the edge of the Thar region. That reading, from 12 June 2025, captures only the ambient air temperature; wet-bulb conditions at the open-pit mine, factoring in humidity and direct sun exposure, would be considerably more punishing for workers on shift. The relentless heat blurs the line between economic opportunity and physical peril.

In the Thar Desert, heat shapes how the mine operates. Reporting from the site by media outlet Dawn describes a workday structured around peak temperatures, including long pauses in the middle of the day. One driver told Dawn his dumper cab is air-conditioned and noted strict safety protocols, including carrying water.

Such adaptations – adjusted shifts, cooling infrastructure, hydration protocols – are the minimum required to keep operations running. But they add cost, and if temperatures continue to climb, they raise hard questions about the long-term financial viability of coal mining in one of the hottest places on Earth.

Adaptation, transition and greening BRI

While coal remains central to Pakistan's energy strategy, the escalating burden of climate adaptation signals a pressing need to rethink the country's reliance on fossil fuels. The Thar region faces a dilemma: whether to continue exploiting one of the world's largest lignite deposits or to accelerate a transition toward cleaner, more sustainable energy sources.

Coal burning causes an estimated 1.1-1.3 million global deaths annually from pollution, with women and children living near coal mines being particularly vulnerable due to soil and water contamination. Worse still, Thar's lignite, has a lower heating value than many other types of coal, so more must be burned to generate the same amount of power, meaning higher CO2 emissions.

Global momentum is also shifting toward just energy transitions, with many countries and regions actively moving away from fossil fuels. China, too, has pledged to build a greener Belt and Road. Our research adds another crucial reason to support this transition: unless emissions are curbed quickly, rising temperatures could make regions like Thar too hot for workers to operate safely.

For policymakers and investors, this underscores a broader reality: climate risk must be integrated into every stage of major project planning. Without substantial investment in resilience strategies, these projects face significant risks to their sustainability and profitability. Climate-conscious infrastructure, improved building codes, and disaster-resistant design are increasingly essential.

The Thar coal power project serves as an urgent reminder that infrastructure built today must be resilient enough for the climate of tomorrow. By embracing green technologies, strengthening adaptive infrastructure, and reforming unsustainable practices, the BRI has an opportunity to not only survive climate risks, but to lead the way toward a more resilient and equitable future.