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Policy brief

Lessons from financing green industrial policy under financial constraints in India

Summary

- Annual investments in India's energy sector need to triple to around US$200 billion to meet the country's 2070 net zero ambition, suggesting that energy will likely require the most capital of any sector. Yet annual state expenditure is currently just US$1.8 billion for all renewable energy, and international capital supplements are minimal.
- However, India is using tools outside the state budget to address this gap and the country's green industrial policy has far exceeded expectations, notably in the space of solar power.
- India recently became the second-largest manufacturer and installer of solar panels globally. Solar module manufacturing capacity grew from 15GW in 2020 to 74GW by March 2025, while solar installations reached 26GW in 2024, making up 71% of all additions in the power sector.
- India's approach can be summarised as 'state-organised financing with limited fiscal expenditure', highlighting a distinction between two categories of state spending: fiscal spending from the parliament-approved state budget and other forms of government-organised financing.
- Direct fiscal expenditures from the state budget are kept at a minimum and are narrowly scoped to specific technologies, such as through the Production Linked Incentive (PLI) scheme for solar manufacturing.
- Most state financing comes from tools with no direct state budget impacts. This includes state-owned enterprises (SOEs) investing in renewable energy projects, state-owned financial institutions being mandated by the state to increase green lending, and sub-national state-owned distribution companies ('discoms') providing financial de-risking through advantageous price and uptake terms for renewable power generation. This is complemented by state demand and import barriers to improve the profit case and incentivise the private sector to scale up investment.
- India's experience provides key lessons globally but particularly for emerging markets and developing economies, where financing needs are as great and financial resources are frequently as constrained as India's. The findings suggest that green industrial policy may be feasible even under severe financial constraints.

Policy briefs provide analysis on topical issues, presenting specific recommendations to inform ongoing policy debates. Drawing on the Grantham Research Institute's expertise, they summarise either our research findings or the state of knowledge about a particular issue.

This policy brief was written by **Mathias Larsen**.

This policy brief sets out India's approach to financing green industrial policy, and particularly the expansion of solar power, in the context of limited fiscal resources and India's 2070 net zero goal. The cost of meeting that goal is estimated at US$10 trillion; in the energy sector alone, annual investments need to triple to around US$200 billion, suggesting that energy will likely require the most capital of any sector. India does not currently have the state finances to reach this scale. Annual state expenditure is just US$1.8 billion for all renewable energy, an amount supplemented with only small international capital inflows.

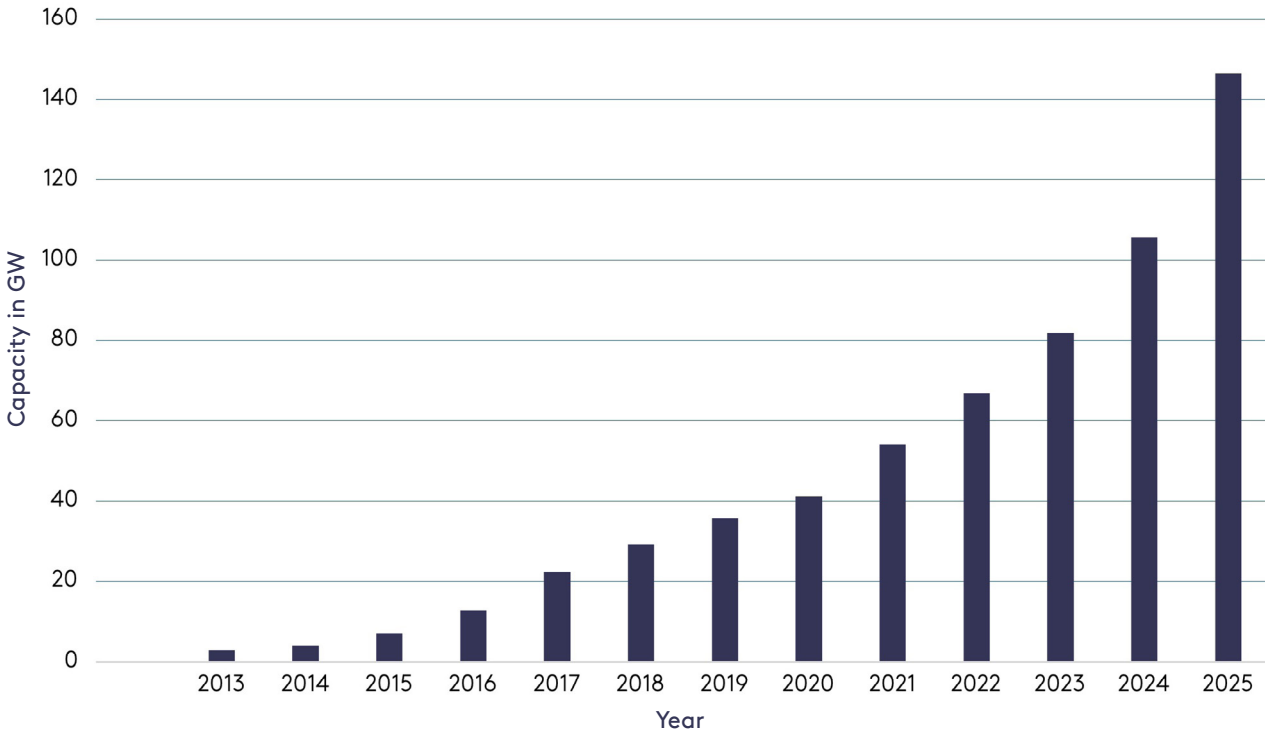
The brief describes the success of state-organised financing policies for solar power and lessons that can be applied to other emerging markets and developing economies (EMDEs).

Background: the embedding of solar power in India's political economy model

India's solar industrial policies are intimately tied to the country's political economy model. These policies have a long history, dating from the 1970s when India dealt with an energy crisis by scaling up coal power while recognising that solar could supplement this by being suitable for places where 'infrastructural modernisation' could not be delivered (Chatterjee, 2023). However, a significant scale-up of solar did not take place until the 2010s (see Figure 1). This was tied closely to Narendra Modi's Governorship of Gujarat from 2001–14, with that state still providing 40% of the country's solar power generation today.

"India's solar industrial policies are intimately tied to the country's political economy model."

Figure 1. India's cumulative solar power capacity by year



Source: MNRE (2025a)

Since Modi's prime ministership began in 2014, the 'Gujarat model' has been adopted nationally. The model entails an extensive role for the state, which has been conceptualised as 'New Developmentalism,' and emphasises state capacity through public sector banks and state-owned enterprises (SOEs). Using this approach, India's solar industrial policies have become part of broader political initiatives, such as 'Make in India' and 'Atmanirbhar Bharat' [Self-Reliant India], both of which emphasise economic independence.

Based in this political economy model, India's solar industrial policy has been relatively successful, and has certainly surpassed expectations: India is now the second-largest manufacturer and installer of solar panels worldwide (MNRE, 2025b). This progress is also impressive in relative terms, with India moving from being the ninth-largest solar power generator in 2015 to the second-largest in 2023 (Ember, 2025).

State-organised financing with limited fiscal expenditure

India's approach to financing green industrial policy can be summarised as 'state-organised financing with limited fiscal expenditure'. This approach distinguishes between spending from the state budget and other forms of government-organised financing: fiscal spending is kept at a minimal level, while other state-controlled tools are used to a much greater extent (see Table 1).

"Fiscal spending is kept at a minimal level, while other state-controlled tools are used to a much greater extent."

First, fiscal expenditure is narrow and strategically used for solar technologies. It is comprised primarily of direct transfers of funds, but also includes foregone revenue, predominantly in the form of tax breaks. The production-linked incentive (PLI) scheme lies at the core of fiscal policy. The long-term purpose of the PLI scheme is to create the entire solar panel manufacturing chain from polysilicon to finished panels within India (Rajshekar, 2024). Under the scheme, Indian solar equipment companies commit to creating a certain volume of manufacturing capacity and are then subsidised by sales for five years following the commissioning of the manufacturing plant.

Second, SOEs play a key role in investing in solar projects. They do so primarily by investing in solar generation and transmission to implement government mandates for scaling up solar power capacity. They also play a central role in organising renewable energy project tendering on behalf of the government.

Third, state-owned financial institutions provide adequate scale and advantageous terms for solar manufacturing and installation. The two central types are commercial banks and development finance institutions, providing US$3 billion and US$4.9 billion, respectively, in 2023, adding up to an annual total of US$7.9 billion that year.

Fourth, state-owned distribution companies (discoms) financially de-risk projects through stable and high offtake prices. As a consequence, the proportion of fiscal expenditure is exceedingly low and far lower than what is seen elsewhere. Given that distribution companies' financial de-risking is unquantifiable, it is not possible to put a meaningful number on the exact proportion. Discoms play a key role in subsidising solar power by providing long-term power purchase agreements. These discoms are tied

to dynamics around Indian politics and development, since the companies are used to subsidise politically-popular low electricity prices for end users, even though this means the discoms incur losses. While feed-in tariffs are the most common way to subsidise renewable power generation globally, in India, the price is set through reverse auctioning, and the project is then de-risked through a power purchase agreement. As the discoms commit to buying power at a certain price for up to 25 years, this works as financial de-risking for the project developer. Since the project developers bid at a price that allows them to make a profit, the power purchase agreement ensures that the revenue side of this profit calculation is certain. The alternative is fluctuating prices through the spot market mechanisms that dominate Western countries and discourage renewable investments (Christophers, 2024). With a so-called 'must run status', the power purchase agreements also include mandatory uptake of renewables by the discoms, a condition that is rarely applied to fossil fuel power generation.

Table 1. Overview of industrial policy state expenditure in India by category

Expenditure category	Most recent annual amount	Policy tool	Purpose
Fiscal expenditure	US$1.8 billion	Direct expenditure (PLI) and foregone revenue (tax incentives)	Subsidise domestic manufacturing to improve competitiveness
State-owned enterprises	US$1.5 billion	Investment in power generation	Increase demand and competitiveness through scale
State-owned financial institutions	US$10.1–14.6 billion	Concessional and commercial lending	Ensure adequate capital on terms profitable for debtors within manufacturing and power generation
Distribution company subsidies	Unquantifiable but significant	Renewable purchase obligations, power purchase agreements, distribution cost waivers	Improve the competitiveness of solar with other sources, while keeping electricity prices low

Source: Larsen (2025)

Box 1. Financing by source: the numbers for India

Combining several data sources presents an overview of how this solar boom has been financed. According to the International Energy Agency (2024), India's clean energy investment reached US$68 billion in 2023, which is an increase of 40% on the 2016–20 average. Though not explicit in the data, solar makes up the vast majority of this shift, since wind power has been stagnant for the last decade. According to the Climate Policy Initiative's data, about half of clean energy finance is from public sources (Khanna et al., 2022). While these data are for 2019–20, the split is likely not too dissimilar today, as both public and private financing have grown since then. According to the same data, the domestic component was 85%, which in the EMDE context is very low.

Nominally, though, foreign direct investment (FDI) in solar power is soaring. According to official statistics from the Indian Ministry of Finance (2023), total FDI in non-conventional (non-fossil) energy reached US$2.5 billion in 2022–23, up from an average of around US$1 billion in the preceding four years. These investments further increased to US$3.76 billion in 2023–24 (Joshi, 2024). This includes investments by many of the world's leading financial institutions and power companies, such as Goldman Sachs, Temasek and KKR, as well as Total, EDF and Shell (Buckley and Trivedi, 2021). These organisations' investments have been predominantly on the installation side, while a handful of Chinese companies have conducted small-scale investments in manufacturing. Although the cumulative scale of Chinese investments remains limited and research into them is scarce, it can be expected that they entail knowledge transfer since the investors are large, competitive Chinese companies (Bhambhani, 2024). Most foreign investments are conducted through local partners who know how to navigate local conditions (in contrast to the foreign investors).

In addition, multilateral development banks provided US$3.7 billion of climate finance (for both mitigation and adaptation) to India in 2022 (EIB, 2023). Bilateral development finance institutions do not disclose cumulative numbers, but the list of projects compiled by Buckley and Trivedi (2021) suggests it averages about US$100 million per year.

"India's financial and non-financial policies are designed with each other in mind and are cumulatively intended to create a conducive environment for the solar industry."

In addition to financial policies, several non-financial policies form part of India's overarching green industrial policy. India's financial and non-financial policies are designed with each other in mind and are cumulatively intended to create an environment conducive to growth for the solar industry. The two central policies are the Approved List of Models and Manufacturers (ALMM) and import tariffs on solar equipment imports. The ALMM ensures that solar power developers in India predominantly buy solar equipment from Indian rather than Chinese manufacturers (Rajshekar, 2024). It works as a non-tariff barrier that supports domestic solar manufacturing by requiring that solar modules used in projects with government involvement be manufactured in India. In tandem, tariffs on solar panel imports have been imposed to reduce the

competitiveness of Chinese-made alternatives. This includes a 40% import tax on solar panels and a 25% import tax on solar cells.

Lessons from India for other emerging markets and developing economies

India's industrial policy for solar power has been described as "the Indian equivalent of the USA's Inflation Reduction Act [IRA]" (Rajshekar, 2024). While their goals are similar, their approaches are different. Most centrally, while the IRA relies on the government budget, India's policy does not. The current consensus on how to conduct green industrial policy is that policies must draw to a great extent on fiscal resources. Recognising that fiscal resources may be limited in EMDEs, the extended argument is that financing needs to be sourced internationally. However, India relied on neither fiscal resources nor international capital. The country simply did not have the fiscal resources to make this an option and was not willing to rely on overseas capital inflows. Instead, India successfully developed the solar industry through financial institutions, enterprises and distribution companies all owned by the state.

That this approach was successful provides key lessons for other countries with such fiscal constraints, as it shows that there are ways to conduct green industrial policy without large expenditures from the state budget. Specifically, India's case suggests that it is possible to a greater extent than previously thought to conduct industrial policy without either large fiscal capacity or large financial inflows. While it is well known that non-fiscal items are important in industrial policy, it is not well known that industrial policy can be carried out almost entirely without fiscal expenditure.

In that regard, it is important to note that differences and similarities between India and other countries shape how this approach can be applied. A key difference from some countries is that India has a large enough domestic market for it to ensure demand for solar equipment, irrespective of global dynamics. While other countries could use the same policies as India, their weaker control of the demand side increases the risk of betting on a specific technology.

In terms of similarities that shape countries' ability to finance green industrial policy, EMDEs generally have smaller economies, lower levels of tax collection and larger informal sectors that significantly lower their capacity to use fiscal policy compared with advanced economies. For example, the unweighted average tax-to-GDP ratio in 2023 was 15.6% for 33 African countries, 19.8% for Asia and the Pacific, and 21.7% for Latin America and the Caribbean, whereas in the wealthy nations of the Organisation for Economic Co-operation and Development (OECD), this ratio was 34.1% (OECD, 2023). On the other hand, state ownership of companies is more predominant in EMDEs, where SOEs represent at least 50% of the top 10 firms in developing countries, compared with only 17% in France and 11% in Germany, for example (Kowalski and Perepechay, 2015). As SOEs are more common in EMDEs, this provides an opportunity for these countries to make use of the lessons from India on the role of SOEs.

"India's approach shows that there are ways to conduct green industrial policy without large expenditures from the state budget."

Conclusion

India's experience shows that an ambitious green industrial policy is possible even under severe fiscal constraints, offering important lessons for other countries. Rather than relying on large public budgets, India has mobilised investment through state-organised financing, using state-owned enterprises, public financial institutions and electricity distributors to de-risk projects and crowd in private capital. Direct fiscal spending has been tightly targeted, while demand creation and import barriers have strengthened investment incentives. For countries with large green investment needs but limited public resources, the key lesson from India is that governments can play a decisive role by strategically organising finance and markets, rather than primarily increasing budgetary expenditure.

"The key lesson from India is that governments can play a decisive role by strategically organising finance and markets."

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