

Renewable Energy in India

Solutions to the Financing Challenge



Gireesh SHRIMALI

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Executive Summary

India has committed to ambitious action on climate change, pledging that renewable energy will be 40% of the country's expected electricity generation capacity in 2030, which includes a wind power target of 60 GW and solar power target of 100 GW by 2022. This is a significant increase from capacities existing in 2015, which are 23 GW of wind power and 3.5 GW of solar power. Scaling up financing for renewable energy will be crucial as meeting these targets requires an investment of approximately USD 189 billion by 2022. However, our analysis at the Climate Policy Initiative (CPI) indicates that the actual realized investment could fall short of the requirement by 29% (USD 17 billion) for equity and 27% (USD 36 billion) for debt.

In order to fill this financing gap and boost the renewable energy sector, India has put in place several progressive policies, both at the federal and state level. Federal policy support has been in the form of accelerated depreciation, generation-based incentives and viability gap funding, while state-level policy support has typically been in the form of feed-in tariffs, net metering, and tax/duty exemptions.

Despite these supportive federal and state policies, financing challenges are bound to continue given the excessive reliance on commercial banks for debt finance. Overall, Indian renewables projects face higher financing costs than comparable projects in the US or Europe and this is a major obstacle to their deployment due to the high initial investment. Given the ambitious renewable energy targets, but limited government budgets, the cost-effectiveness of the support policies becomes an important criterion for policymakers.

To overcome these challenges, a combination of short and long-term policy solutions should be explored. We found that, in the short term, federal support policies such as an interest subsidy and accelerated depreciation are more cost-effective than other existing federal policies and state policies. An interest subsidy is an attractive policy in that it directly addresses the lack of availability of low-cost, long-term debt with a relatively low capital outlay by the government. Accelerated depreciation is one of the easiest policies to manage because it requires no cash disbursement by the government and the reduction in tax revenue can also be partly recovered in the later years. In the long term, it is possible to further lower the total cost of government

support by using policies that address a key barrier for renewable energy projects – the cost of debt. The government could provide reduced cost, extended tenor debt to project developers below the commercial rate of interest for longer than the usual commercial tenor. While reduced cost, extended tenor debt is much more cost-effective than accelerated depreciation over a project's life cycle, it would require a higher allocation of the budget in the initial years.

Given the constraints on government budgets and the large capital outlay required to achieve the renewable energy targets, both public and private capital needs to be mobilized in the long run. A number of less conventional financial instruments, such as credit and risk guarantees, innovative currency hedging facilities, government bonds, and instruments developed through the India Innovation Lab for Green Finance could help attract additional private capital and also lower the cost of debt in the range of 1.4-4.5 percentage points. While policy support can provide the essential thrust for the uptake of renewable energy, scaling up private investment through the introduction of innovative financial instruments will ensure that India can achieve its clean energy targets. Furthermore, these instruments could provide a useful basis for renewable energy financing in other markets, such as Africa, through entities such as the International Solar Alliance (ISA).

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Introduction

India's power generation capacity mix is dominated by fossil fuels, which account for 66.6% of the total installed power generation capacity of 329 GW by mid-2017.¹ The remaining installed capacity is contributed by large hydro (13.6%), nuclear (2.1%), and unconventional renewable energy (17.7%), which includes small hydro, wind, solar, and biomass power. India has committed to ambitious action on climate change, pledging that renewable energy will be 40% of the country's expected electricity generation capacity in 2030, along with a 35% reduction in carbon intensity by 2030 (from 2005 levels) as part of the Paris climate agreement.² In addition, driven by concerns over energy security in a rapidly growing (~5% per year) electricity demand scenario,³ the Indian government has set an ambitious target of achieving 175 GW of installed capacity of renewable energy (which includes a wind power target of 60 GW and solar power target of 100 GW) by 2022, a significant increase from capacities existing in 2015, which were 23 GW of wind power and 3.5 GW of solar power.

Scaling up finance for renewable energy will be crucial to meeting these targets. In its December 2016 report, *Reaching India's Renewable Energy Targets: The Role of Institutional Investors*,⁴ the Climate Policy Initiative (CPI) demonstrated that India will likely require an investment of approximately USD 189 billion (equity and debt) to meet the 2022 renewable energy targets. While the potential for investment from various classes of investors could exceed this demand (at ~USD 411 billion), the actual realized investment could fall short of the requirement by 29% (USD 17 billion) for equity and 27% (USD 36 billion) for debt. Despite having a strong potential for renewable energy production and relatively low labor

1. Ministry of Power, "Power Sector at a Glance – All India", Government of India, October 2017, <http://powermin.nic.in>.

2. The Agreement within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) established targets for greenhouse gas emissions mitigation, adaptation and finance starting in the year 2020. The agreement was negotiated by representatives of 195 countries at the 21st Conference of the Parties of the UNFCCC (COP21) in Paris and adopted on 12 December 2015.

3. Ministry of Power, *op. cit.*, and International Energy Agency, India Energy Outlook, Paris, 2015, www.iea.org.

4. V. Sen, K. Sharma and G. Shrimali, "Reaching India's Renewable Energy Targets: The Role of Institutional Investors", Climate Policy Initiative, December 2016, <https://climatepolicyinitiative.org>.

and construction costs, India may not be able to attract sufficient investment in renewable energy projects.

A strong public-private collaboration will be needed in order to fill this gap between the amount of investment required and the amount of investment expected. The right domestic policies will be key to facilitating a healthy investment environment, knowing that greatly scaling up investment from the private sector will be the only way to mobilize the full amount of capital needed to meet India's renewable energy targets.

Barriers to Financing Renewable Energy in India

Policies introduced to support renewable energy growth in India

Over the years (approximately since 1995 for wind power and 2009 for solar power), India has put in place several progressive policies, both at the federal and state level, to boost the renewable energy sector. Federal policy support has been in the form of accelerated depreciation, generation-based incentive, and viability gap funding, while state policy support has typically been in the form of feed-in tariffs, net metering, and tax/duty exemptions.

Historically, the growth of wind power in India has been primarily driven by state-level incentives in conjunction with the central government's accelerated depreciation and generation-based incentive. Although both of the latter measures were expired a few times in the past, they were reinstated at a later date to support the wind power industry.⁵ Many other state-level incentives of tax/duty exemptions and favorable transmission charges continue to support the industry; for example, Andhra Pradesh waived off wheeling charges for wind, solar, and mini hydro projects for the period 2015-2019⁶ and Madhya Pradesh waived off electricity duty on solar power projects for a period of 10 years from the date of commissioning of the project.⁷

Solar power growth has been driven by increasing price competitiveness and supported by government policies, such as viability gap funding and risk-reducing procurement mechanisms through solar parks and central government off-takers (buyers). In December 2015, the central government announced an INR 500 crore (USD 77 million) capital subsidy program for the rooftop solar segment, which could support the installation

5. *The Hindu*, “Removal of Incentives Brings Down Wind Power Generation”, 13 May 2013, www.thehindu.com, and *Business Standard*, “Accelerated Depreciation Scheme for Wind Energy Restored”, 18 July 2014, www.business-standard.com.

6. Andhra Pradesh Electricity Regulatory Commission, “Wheeling Tariffs for Distribution Business”, *AP Tariff Order*, May 2014, www.aperc.gov.in.

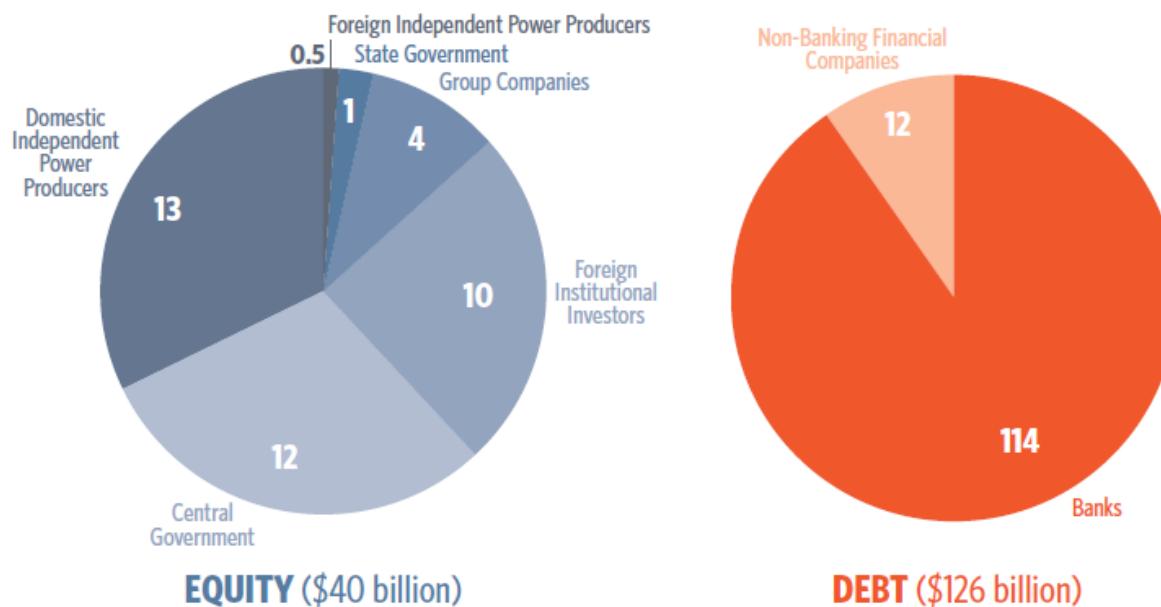
7. Madhya Pradesh Electricity Regulatory Commission, Tariff Order for Solar Energy Based Power Generation in Madhya Pradesh, *MP Tariff Order*, August 2016, www.mperc.nic.in.

of 4,200 MW of rooftop solar capacity during 2016-2020.⁸ This indicates that the central government is increasing its focus on the rooftop solar segment as grid-scale solar becomes competitive.

Expected investment may fall short of the required investment

Despite several supporting policies from the central and state governments, the Indian wind and solar power sectors will require continued support in raising finance to achieve the 60 GW and 100 GW targets for wind and solar capacity installation by 2022. As stated above, the Indian wind and solar power sectors could witness a shortfall of as much as USD 53 billion during 2016-2022.⁹ This is largely because of high reliance on banks for providing debt capital (Figure 1).

Figure 1: Expected equity and debt investments in Indian renewable energy, 2016-2022



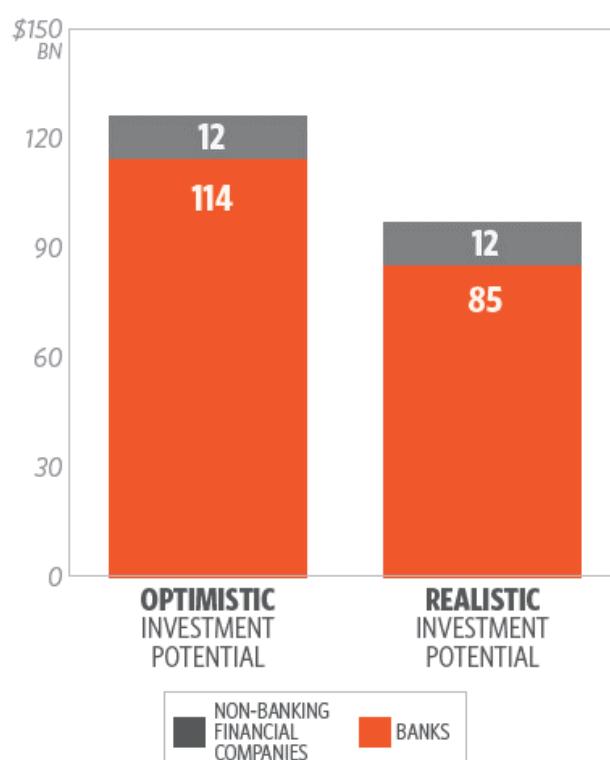
Source: V. Sen, K. Sharma and G. Shrimali, "Reaching India's Renewable Energy Targets: The Role of Institutional Investors", Climate Policy Initiative, December 2016, <https://climatepolicyinitiative.org>.

Public and private sector banks are the most significant source of expected debt investment, with approximately USD 114 billion, or 88% of

8. Cabinet Committee on Economic Affairs, "Cabinet Approves INR 500 Crore for Promotion of Solar Rooftops in the Country", Press Information Bureau, 30 December 2015, <http://pib.nic.in>.
 9. V. Sen, K. Sharma and G. Shrimali, "Reaching India's Renewable Energy Targets", op. cit.

total expected debt. Such a large share of bank-sourced investment could become problematic, because banks have exposure limits to lending to the infrastructure sector and, as they become overexposed, their expected ability to provide debt may decrease. In a realistic scenario, when banks draw close to lending limits, their expected ability to provide debt will likely reduce to approximately USD 85 billion or 64% of the total expected debt (Figure 2).

Figure 2: Amount of expected debt investment by banks, under optimistic and realistic scenarios, 2016-2022¹⁰



Source: V. Sen, K. Sharma and G. Shrimali, "Reaching India's Renewable Energy Targets", op. cit.

Unfavorable terms of finance increase the cost of renewable energy

In some important ways, India has a cost advantage in renewable energy. Labor and construction costs, for instance, are significantly lower in India than in countries like the U.S. or Germany. Furthermore, India is blessed with renewable resources like wind and sun that are comparable to good

10. We defined *Optimistic Scenario* as the one in which the market conditions will remain favorable for investors alongside government support for renewable energy. In *Realistic Scenario*, banks continue to be the main providers of debt capital and would reach the infrastructure sector exposure limits, thereby reducing their lending ability.

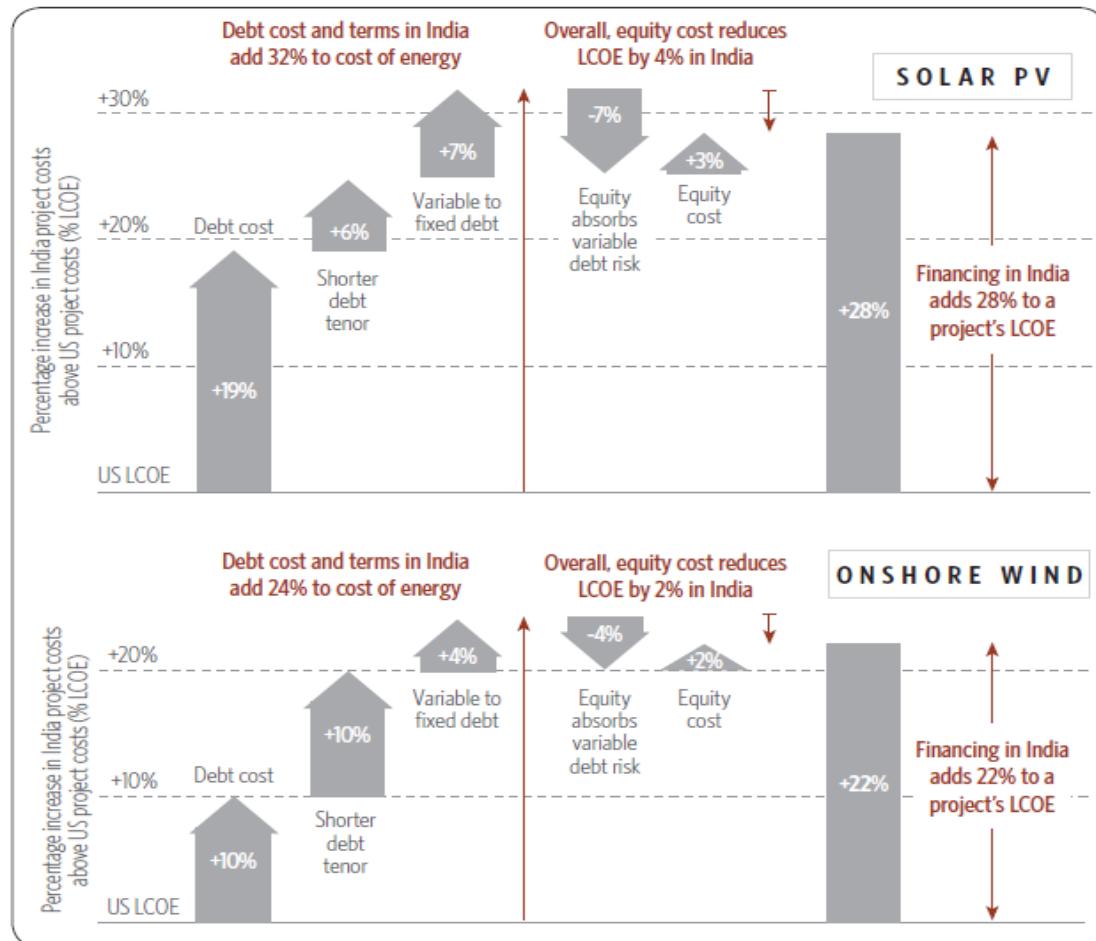
locations in other countries. Yet, despite these advantages, the cost of renewable energy can be as high in India as in the U.S., or even significantly higher. The difference is often due to financing costs.

In comparison to conventional power generation sources such as coal or gas, renewable energy is characterized by a relatively high initial investment, followed by low variable costs. Since a much greater share of the cost of energy is determined by the initial investment, higher financing costs have a disproportionate impact on renewable energy. This puts renewable energy at a relative disadvantage in India.

In Figure 3, we compare two typical large-scale installations in the U.S. against similar projects in India¹¹ to quantify the sources of differences in the levelized cost of electricity (LCOE), defined as the average cost of electricity over the life of a project factoring in the return required on investments.

11. The projects studied were First Wind's 204 MW wind power project and Greater Sandhill's 19 MW PV project in the U.S. (CPI, October, 2011) and Acciona's 56 MW Tuppadahalli wind power project and Reliance Power's 40 MW Dahanu Solar PV power project in India (D. Nelson *et al.*, *op. cit.*, December 2012). It should be mentioned that the solar project we studied in India used imported content. India's domestic manufacturing of solar modules is very limited and captures a minor share in the solar power market. Approximately 88% of all module requirement in India is met through imports.

Figure 3: The impact of debt and equity costs and terms in India on overall financing costs compared to a U.S. baseline



Source: D. Nelson, G. Shrimali, S. Goel, C. Konda and R. Kumar, "Meeting India's Renewable Energy Targets: The Financing Challenge", Climate Policy Initiative, December 2012, <https://climatepolicyinitiative.org>.

In the case of solar, capital costs in India were 25% lower than those in the U.S. However, most of this cost advantage was eliminated by the lower expected output per MW, which was likely the result of lower insolation and higher levels of dust in Rajasthan, where the Indian plant was built, or, possibly the use of less expensive, but less reliable equipment. With these two factors offsetting each other, the Indian solar PV facility was nevertheless 28% more expensive due entirely to the higher return requirements for investors in India, that is, the more expensive cost of financing the project.

The two wind projects depict a similar story, although the wind project in India is still cheaper, despite the higher financing costs. While these projects do not represent all U.S. or Indian renewable projects, and rapid changes to cost and performance lead to constantly changing figures,

the comparison itself is indicative of the substantial impact of financing costs on renewable energy in India.

When all of the adjustments are made to account for the differences in terms and tenors, equity ends up being less expensive than in the U.S. or Europe, despite the higher country risks. Meanwhile, the total impact of debt, including terms and costs, adds 24-32% to the cost of the project (Figure 3).

The key takeaway is that renewable projects in India could be much less expensive if costs of higher financing were lowered. As is, the costs and terms of debt in India can increase the cost of renewable energy by up to a third compared to similar projects in the U.S. and Europe. The high cost of capital and lack of adequate capital will continue to be a significant barrier to raising the amount of financing needed for India's renewable energy targets.

Policy Solutions

Cost-effective support mechanisms are needed at the central government level to complement state-level support

As noted above, policy support to the renewable energy sector is currently provided through a combination of state-level and central government incentives in the form of feed-in tariffs, tax exemptions, generation-based incentives, viability gap funding, and accelerated depreciation. Given the ambitious renewable energy targets, but limited government budgets, the cost-effectiveness of these policies becomes an important criterion for policymakers.

The federal government provides policy support through the Ministry of New and Renewable Energy (MNRE). The federal policies currently offered are: a generation-based incentive of INR 0.5/kWh (USD 0.008/kWh)¹² for grid-connected wind projects, viability gap funding up to 30% of project cost, and accelerated depreciation of 80% for solar projects under the National Solar Mission.¹³

The federal policies typically cover only some of the viability gap – that is, the difference between the cost of unsubsidized renewable energy and the average power purchase cost (APPC) of INR 3.5/kWh (USD 0.054/kWh). The rest is eventually supported by state governments entering Power Purchase Agreements with renewable energy developers, agreeing to pay feed-in tariffs for 20-25 years.

However, the high cost of debt and the resulting high cost of renewable energy limit the positive impact of policies such as feed-in tariffs, since financing cannot be optimized in response to policy changes. In 2014, CPI used project-level cash flow models to investigate the impact of various policies on wind and solar projects.¹⁴ We examined federally administered

12. All USD numbers in this report are derived at INR-USD 2017 average exchange rate (1 INR = USD 0.015361).

13. The Jawaharlal Nehru National Solar Mission was launched in January 2010, with a target to setup 20,000 MW of grid connected solar power by 2022. In 2015, the government of Prime Minister Modi raised the target by five times, to 100 GW by 2022.

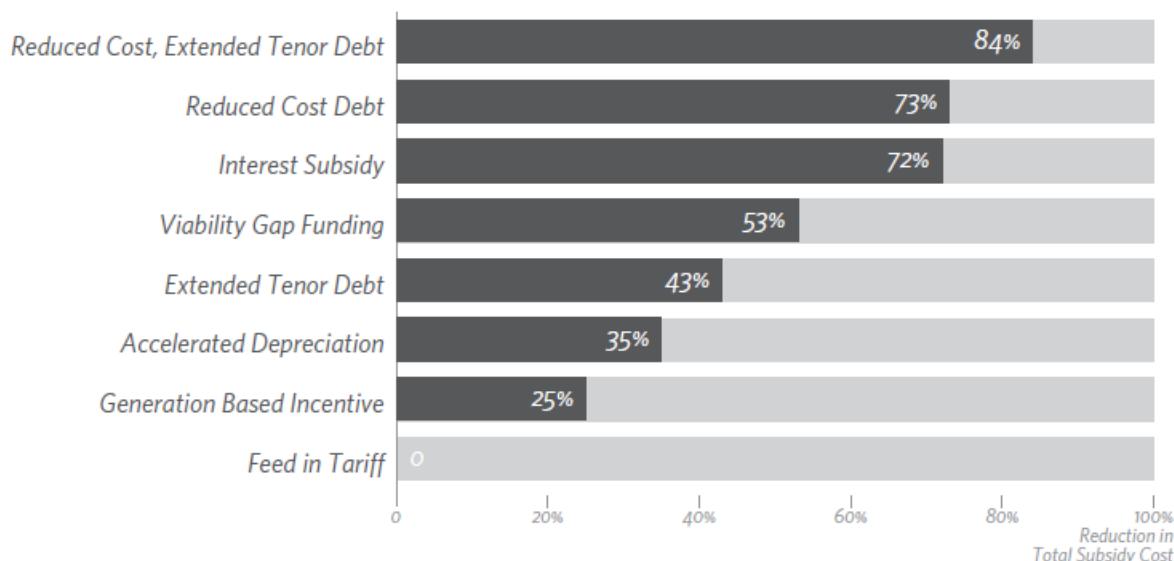
14. G. Shrimali, C. Konda, and S. Srinivasan, “Solving India’s Renewable Energy Financing Challenge: Instruments to Provide Low-cost, Long-term Debt”, Climate Policy Initiative, March 2014, <https://climatepolicyinitiative.org>.

debt-related policies that directly address the issues of high cost and short tenor of debt and compared them against existing federal policies – generation-based incentive, viability gap funding, and accelerated depreciation.

Our analysis shows that the absence of federal support – i.e., when all the support is via state-level feed-in tariffs – would be the least cost-effective federal-state policy combination and, therefore, we compare the cost-effectiveness potential of each federal policy to this as a reference case. Further, the value of any federal policy increases as it bridges more of the viability gap. Thus, each federal policy would achieve its maximum cost-effectiveness potential when it can reduce state-level support the most.

All federal policies are 25-84% more cost-effective than the reference case of absence of federal support due to the phenomenon of front-loading: a feed-in tariff is provided by the state government throughout the lifetime of the project, while the federal policies are front-loaded and disbursed in the first few years of the project, creating value for the government (Figure 4).

Figure 4: Cost-effectiveness potential of federal policies for wind energy



Source: G. Shrimali, S. Goel, S. Srinivasan and D. Nelson, "Solving India's Renewable Energy Financing Challenge: Which Federal Policies can be Most Effective?", Climate Policy Initiative, March 2014, <https://climatepolicyinitiative.org>.

In the short-term, an interest subsidy and accelerated depreciation are more cost-effective incentives

In the short-term, there are a number of alternative policy options for the federal government. In particular, an interest subsidy and accelerated depreciation are more attractive than the existing capped generation-based incentive at its current support level of INR 0.5/kWh for wind energy and the viability gap funding at its current support level of 30% for solar energy across most criteria.

Interest Subsidy:

- Wind: An interest subsidy outperforms the existing generation-based incentive at INR 0.5/kWh across all criteria. It is approximately 1.8 times as efficient in its use of capital, significantly more cost-effective, and has much higher viability gap coverage potential. For example, for the same state-level support, an interest subsidy of 3.4% is equivalent to the existing generation-based incentive of INR 0.5/kWh; and, compared to this generation-based incentive, would result in a total subsidy reduction of 11% and would support 83% more deployment.
- Solar: For the same state-level support, an interest subsidy of 10.2% is equivalent to a viability gap funding of 30%; and, compared to this viability gap funding, would result in a total subsidy reduction of 11% and would support 30% more deployment.

In general, an interest subsidy is an attractive policy since it directly addresses the lack of availability of low-cost, long-term debt with a relatively low capital outlay by the government. It has high potential for incentivizing production and moderate potential for viability gap coverage. The only potential drawback is that subsidy-recovery is not possible. However, since the capital outlay is not very large, especially compared to existing policies at current support levels, this may eventually not be a major issue.

Accelerated Depreciation:

- Wind: For the same state-level support, an accelerated depreciation of 38% – i.e., less than the typical 80% – is equivalent to a generation-based incentive of INR 0.5/kWh; and, compared to the existing generation-based incentive, would result in a total subsidy reduction of 17% and would support 87% more wind power.
- Solar: For the same state-level support, an accelerated depreciation of 80% is equivalent to a viability gap funding of 12.4%; and, compared to the viability gap funding, would result in a total subsidy reduction of 10%

and would support 44% more deployment. Though both of these are existing policies, the comparison is instructive given that it is not easy for independent power producers to avail of accelerated depreciation.

In the short-term, although accelerated depreciation is clearly the most cost-effective among the existing policies, it has been opposed as a policy mechanism because it encourages the setting up of a plant to yield tax benefits without incentivizing energy production. However, from the government's perspective, it is also one of the easiest policies to manage since it requires no cash disbursement. There is no direct capital invested by the government and the reduction in tax revenue is partly recovered in later years. Its advantages as a policy may eventually outweigh its drawbacks.

The only advantage that the existing generation-based incentive offers over an interest subsidy and accelerated depreciation is that it has the highest potential for incentivizing power-generation. However, if designed appropriately, all the proposed debt-related policies, which include an interest subsidy, show potential for incentivizing production.

In the case of accelerated depreciation, we recommend modifying the design of the policy or combining it with debt-related policies that could improve the incentive to produce through the pressure of debt-servicing. For example, for solar energy, for the same state-level support of INR 4.9/kWh (USD 0.075/kWh), the combination of 80% accelerated depreciation with reduced cost debt at 2% reduces total subsidies by 27% compared to the existing policy combination of 80% accelerated depreciation and 30% viability gap funding. Furthermore, the combination of accelerated depreciation with reduced cost debt would have a moderate potential for incentivizing production, enabling the policymaker to improve cost effectiveness without compromising on incentivizing production.

The advantage that viability gap funding offers over an interest subsidy and accelerated depreciation is that it has the highest potential for standalone support of renewable energy, without state-level support. However, it can be argued that, given that electricity concerns both the federal and the state governments, in the long-run, a sustainable policy would include both federal and state support; and, therefore, viability gap reduction up to a certain level – e.g., equivalent to an 80% accelerated depreciation, which has a viability gap coverage of 27% – is what should be required of federal policies.

To summarize, if policymakers' short-term priority is to identify a policy mechanism that ensures budget efficiency, an interest subsidy performs the best. However, if the government is interested in upfront cash disbursement

rather than a long-term commitment to subsidizing a project, accelerated depreciation is more cost-effective and more capital efficient.

In the long-term, current form of incentives can be replaced with debt incentives

It is possible to further lower the total cost of government support by using policies that address a key barrier for renewable energy projects – the cost of debt. As noted earlier, inferior terms of debt such as high cost, short tenor, and a variable interest rate add approximately 30% to the total cost of renewable energy in India compared to developed countries.¹⁵ Therefore, debt-related policies that address these challenges can significantly reduce the total cost of support.¹⁶

The government could provide a reduced cost, extended tenor debt to project developers below the commercial rate of interest for longer than the usual commercial tenor. If the government provides policy support through reduced cost, extended tenor debt instead of the existing federal policies, the total cost of support for solar energy can be reduced to an average of INR 0.10/W (USD 0.002/W) from INR 2.71/W (USD 0.042/W).

Under reduced cost, extended tenor debt, the annual cost of support for solar energy varies from INR 3.75/W (USD 0.058/W) in 2014 to a recovery (i.e., a profit) of INR 2.73/W (USD 0.042/W) by 2018 on account of loan repayments (Figure 5).¹⁷ Based on the earlier renewable energy targets, i.e., the 12th Five Year Plan (2012-17) deployment targets of 20 GW of solar and 50 GW of wind by 2022, the total cost of support would be INR 1.81 billion (~USD 28 million) under reduced cost, extended tenor debt, around 96% lower than under accelerated depreciation.¹⁸

This is because as a policy mechanism, reduced cost, extended tenor debt offers a number of advantages. The net cash outflow for the government is recovered over time since policy support is provided in the form of a loan rather than a grant. It also provides an opportunity for interest arbitrage: in

^{15.} D. Nelson, G. Shrimali, S. Goel, C. Konda and R. Kumar, “Meeting India’s Renewable Energy Targets: The Financing Challenge”, Climate Policy Initiative, December 2012, <https://climatepolicyinitiative.org>.

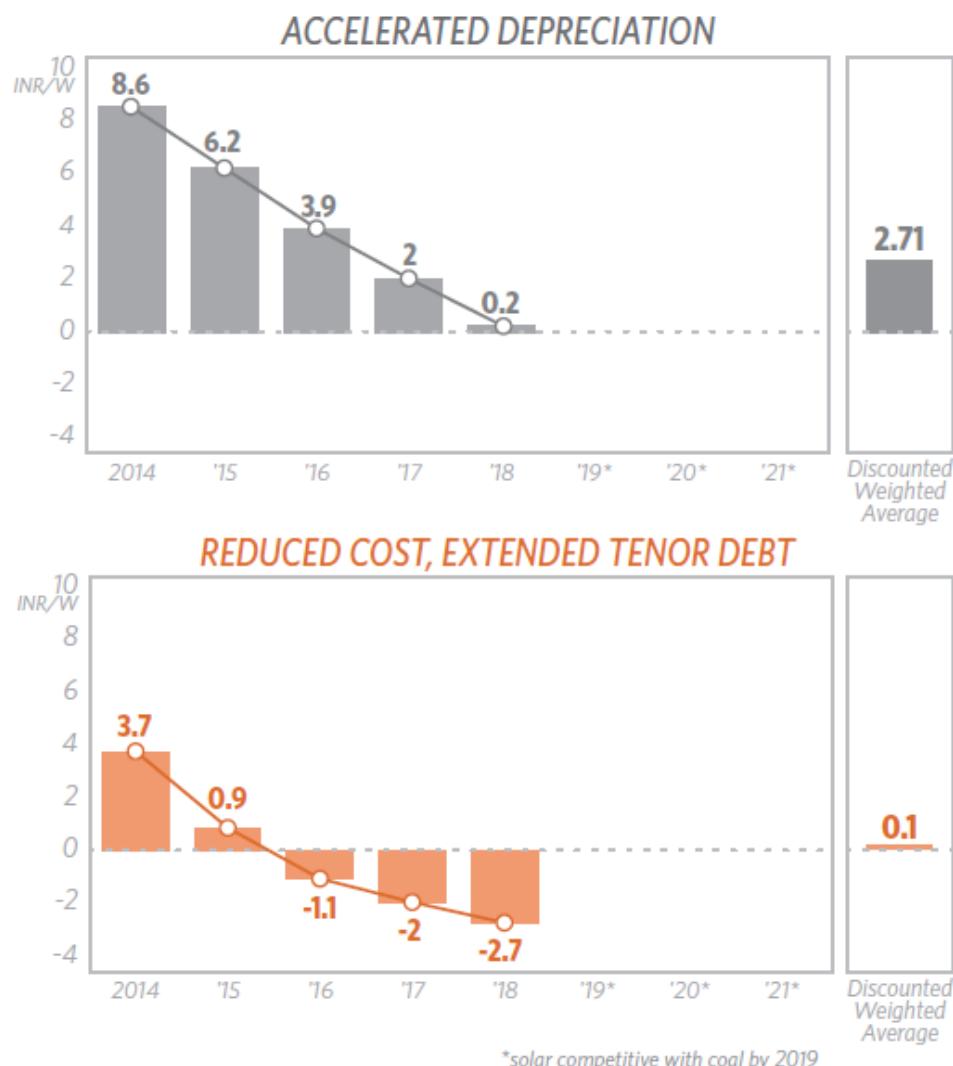
^{16.} G. Shrimali, S. Goel, S. Srinivasan and D. Nelson, “Solving India’s Renewable Energy Financing Challenge: Which Federal Policies can be Most Effective?”, Climate Policy Initiative, March 2014, <https://climatepolicyinitiative.org>.

^{17.} Since as per our estimates at the time of this research, solar energy was expected to become competitive in 2019, the cost of support was calculated for plants installed prior to 2019.

^{18.} We expect these benefits to be similar when extended to the current targets of 60 GW and 100 GW of wind and solar energy.

cases where the government lends at a higher rate of interest to the developer than its own cost of borrowing (7.8% on a 10-year government bond), the net cash flows for the government are positive. Lastly, when debt is cheaper, the developer can substitute equity with more debt in the project while meeting debt servicing conditions. By replacing expensive equity with cheaper debt, the overall cost of capital is reduced.

Figure 5: Annual cost of government support for solar energy (INR/W)

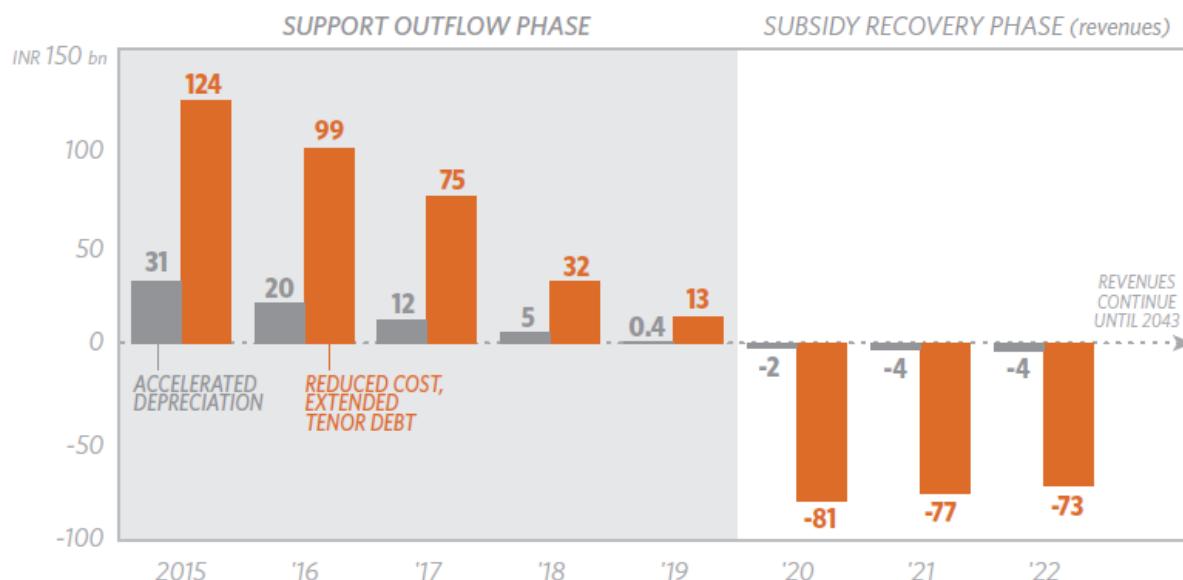


Source: G. Shrimali, S. Srinivasan, S. Goel, S. Trivedi and D. Nelson, "Reaching India's Renewable Energy Targets Cost-Effectively", Climate Policy Initiative, April 2015, <https://climatepolicyinitiative.org>

While reduced cost, extended tenor debt is much more cost-effective than accelerated depreciation over a project's life cycle, it would require a higher allocation of the budget in the initial years. In Figure 6, we present the nominal amount required from the government's budget under

accelerated depreciation, the most cost-effective among existing policies, and reduced cost, extended tenor debt, which is the most cost-effective among all policy options. While the net present value, or the total cost of support for reduced cost, extended tenor debt is significantly lower due to recovery of the subsidy amount invested by the government through loan repayments, the annual budget allocation, or nominal cost of support for reduced cost, extended tenor debt is much higher in the initial years. Indeed, the government needs to provide approximately 70% of the total project cost in the form of debt.

Figure 6: Nominal cost of support for solar energy



Source: G. Shrimali, S. Srinivasan, S. Goel, S. Trivedi, D. Nelson, "Reaching India's Renewable Energy Targets Cost-Effectively", op. cit.

For example, in 2015, based on the 12th Five Year Plan deployment targets of 20 GW of solar and 50 GW of wind by 2022, the total budget allocation for reduced cost, extended tenor debt would be INR 123.79 billion (~USD 2.06 billion). In contrast, the nominal cost of support in 2015 under accelerated depreciation is INR 31.2 billion (~USD 478 million).

However, after 2019, once solar power becomes competitive, there would be a net cash inflow for the government thereafter, since solar power would no longer require additional support, and the policy support provided in the form of debt would be repaid by the project developers. As shown in Figure 6, the subsidy recovery is approximately 25 times higher under reduced cost, extended tenor debt as compared to accelerated depreciation.

Therefore, although the government will need to make a budgetary commitment that is four times that of accelerated depreciation in the short

term, the net cash outflow in the long term will be 96% lower with reduced cost, extended tenor debt. In other words, in net present value terms, the total cost of support under accelerated depreciation is about 25 times higher than that of reduced cost, extended tenor debt.

Scaling Up Private Finance

Innovative financial instruments could attract private investment

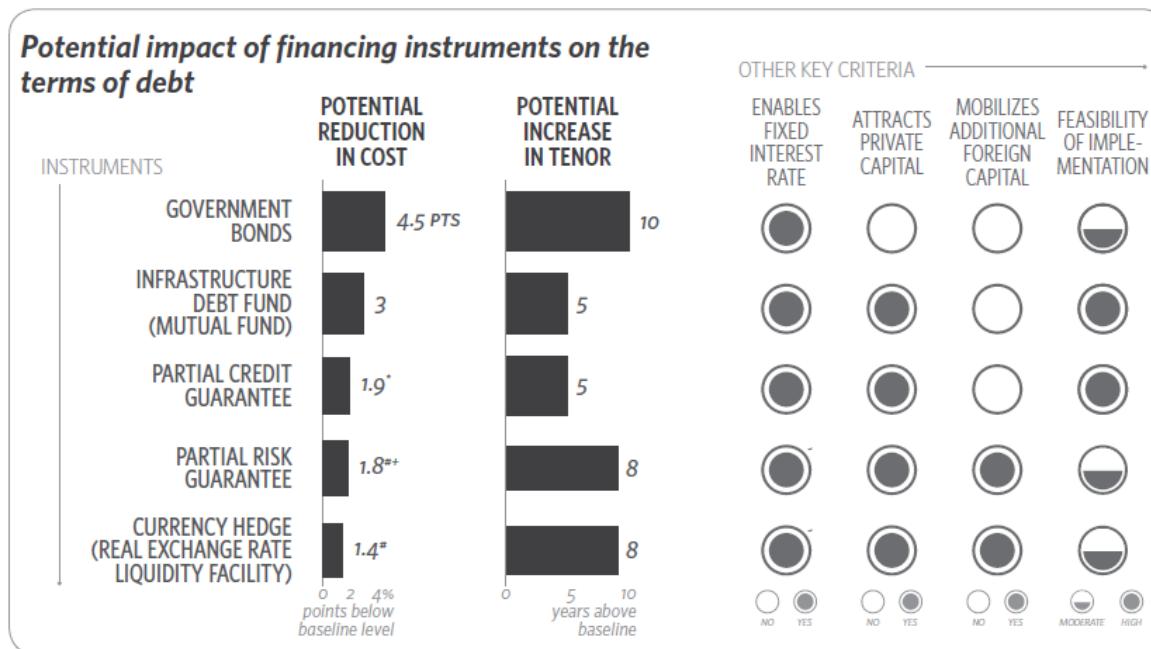
As noted above, debt-related federal policies that provide low-cost, long-term debt will be more cost-effective than the current set of federal policies. However, achieving high levels of renewable energy capacity installation, specifically a 5-time increase in solar power capacity from the earlier target of 20 GW to the current target of 100 GW, will require a large upfront budget allocation. Limited availability of finance thus requires collective effort from both the public and private sectors to mobilize the requisite amount of financing for renewable energy development in India.

In our preliminary research,¹⁹ we explored several financing instruments that were used in other regions or that were used in India in other contexts that have the potential to provide low-cost, long-term debt for renewable energy in India. We explored three categories of instruments used to finance renewable energy around the world: (a) instruments that provide access to previously untapped low-cost, long-term funds from domestic capital markets; (b) instruments that provide access to foreign debt; and (c) guarantee instruments that mitigate the risk associated with projects.

We found five financial instruments that have various levels of implementation feasibility with the potential to reduce the cost of debt in the range of 1.4-4.5 percentage points from their respective baseline cost (Figure 7). These instruments also have the potential to increase the tenor of debt by 5-10 years.

19. G. Shrimali, C. Konda, and S. Srinivasan, “Solving India’s Renewable Energy Financing Challenge: Instruments to Provide Low-Cost, Long-term Debt”, Climate Policy Initiative, March 2014, <https://climatepolicyinitiative.org>.

Figure 7: Potential impact of instruments on renewable energy financing



Source of graphic: G. Shrimali, C. Konda, and S. Srinivasan, "Solving India's Renewable Energy Financing Challenge", op. cit.

A foreign exchange hedging facility

In CPI,²⁰ we extended our research on innovative financing mechanisms to examine the possibility of a government-sponsored foreign exchange (FX) hedging facility. Foreign debt can increase debt available for renewable energy and can also provide a cheaper source of capital. However, when a renewable energy project is financed by a foreign loan, it requires a currency hedge to protect against the risk of devaluation. Market-based currency hedging in India is expensive, adding approximately seven percentage points to the cost of debt. This makes fully-hedged foreign debt nearly as expensive as domestic debt.

Reducing the cost of foreign debt by reducing the currency hedging cost can mobilize foreign capital and spur investments in renewable energy by reducing the cost of capital. This would then reduce the delivered cost of renewable energy, making renewable energy more competitive with

20. A. Farooquee, and G. Shrimali, "Reaching India's Renewable Targets Cost-effectively: A Foreign Exchange Hedging Facility", Climate Policy Initiative, June 2015, <http://climatepolicyinitiative.org>.

electricity generated from fossil fuels,²¹ as well as reduce the government cost of support.²²

The Indian government has shown interest in providing a government-sponsored exchange rate hedging facility. However, the design of the facility would be a large undertaking that has to be carefully considered, given that currency movements can be uncertain and volatile. In providing currency hedging for renewable energy projects, the government might consider the following questions: What are the expected costs and risks of providing such hedging? How can the government cover unexpected and extreme movements in foreign exchange rates?

We provided insights into these questions by examining a government-sponsored foreign exchange rate hedging facility. Under this facility, the government can provide project developers or off-takers a currency hedging solution through a standalone fund that covers debt payments for underlying USD loans.

Our analysis revealed that the expected cost of providing a 10-year currency hedge via the FX hedging facility is approximately 3.5 percentage points per year, 50% below market rates. At the current capital cost of solar energy, this amounts to 16% of the underlying loan amount.²³ The FX hedging facility would reduce the cost of renewable energy by reducing the cost of debt and, therefore, the cost of capital through a reduction in the cost of debt and an increase in the debt-to-equity ratio. This would then reduce the total cost of support – the total subsidies required – for renewable energy.²⁴

The implications for the cost of renewable energy as well as for the cost of support for the government are as follows: If the expected cost of the FX hedging facility is borne by the government, the cost of debt for the developer can be reduced by 7 percentage points, the cost of renewable energy by 19%, and the cost of government support by 54%. If the expected cost of the FX hedging facility is passed onto the developer, the cost of debt can be reduced by 3.5 percentage points, the cost of renewable energy by 9%, and the cost of government support by 33%.

²¹. D. Nelson, G. Shrimali, S. Goel, C. Konda and R. Kumar, “Meeting India’s Renewable Energy Targets”, *op. cit.*

²². G. Shrimali, S. Goel, S. Srinivasan and D. Nelson, “Solving India’s Renewable Energy Financing Challenge”, *op. cit.*

²³. *Ibid.*

²⁴. *Ibid.*, This includes: the feed-in tariff (FIT) premium embedded in a renewable energy power purchase agreement; other subsidies such as an interest subsidy; and changes in taxes.

However, the government should be aware of the risk exposure of the FX hedging facility. Our results show that there are ways for the government to manage the risks to which the FX hedging facility is exposed. One way to protect against the risk of unexpected and extreme movements in foreign exchange rates, and to ensure that the FX hedging facility does not default, is a capital buffer, or a reserve. Based on our statistical model, for example, for the FX hedging facility to achieve India's current sovereign rating of BBB, the cumulative capital buffer requirement for 10 years would be INR 14.26 million/MW (~USD 200K/MW), or almost 30% of the underlying loan amount.

A payment security mechanism

We also examined another financing instrument, a payment security mechanism that could lower off-taker risk and thereby the cost of renewable energy. An off-take agreement is a power purchase agreement between a producer and buyer (or off-taker) of power that guarantees that the buyer will purchase a certain amount of electricity. This makes it easier for the producer to secure financing. Off-taker risk is the risk that the buyer/off-taker will not fulfil its contractual obligations. Off-taker risk is a key contributor to the overall credit risk of a power project.

In India, public sector electricity distribution companies (DISCOMs) are the primary off-takers of electricity. However, DISCOMs are in a poor financial state, which is a major concern among foreign investors. State-level DISCOMs, with debt of INR 3.04 trillion (~USD 46.7 billion) and accumulated losses of INR 2.52 trillion (~USD 38.7 billion), are on the brink of financial collapse. Investors perceive DISCOMs to be at risk of failing to make payments on time. Delayed payments are still a major contributor to off-taker risk.

One solution to mitigate off-taker risk is a government-sponsored standalone fund, called a payment security mechanism, that would provide assurance that the payments under power purchase agreements are made on time. In India, there is precedent in the government providing financial support for payment security mechanisms to support power procurement, and a few payment security mechanisms already exist for the government's major solar power initiative, called the Jawaharlal Nehru National Solar Mission (JNNSM), by central public enterprises such as the NTPC Vidyut Vyapar Nigam as well as the Solar Energy Corporation of India.

However, despite these payment security mechanisms, there has not been much interest from foreign investors. This is likely due to two reasons. First, our analysis indicates that current payment security mechanisms

appear to be inadequate in covering the risk of delayed payments. But more importantly, and underlying the first reason, even an examination of the adequacy of these mechanisms is not easily possible, because the frameworks for these mechanisms are not publicly available. These two reasons--perception of inadequacy and lack of transparency--may have deterred investor interest.

In order to attract more interest from foreign investors, and therefore better use existing government funds, a more transparent framework for developing payment security mechanisms is required, which can demonstrate adequate risk coverage. As a starting point, CPI developed a potential framework²⁵ and applied it to an existing payment security mechanism in order to assess its adequacy in risk coverage.

We applied our framework to retrospectively estimate the size of an existing payment security mechanism involving a central solar power aggregator, which buys power from multiple generators and sells power to multiple off-takers deployed under JNNSM Phase 2, Batch 1.²⁶ For the supported capacity of this central aggregator, which was 750MW, we estimated the size of the payment security mechanism using our framework to be INR 4,160 million (~USD 63.8 million) or INR 5.55 million/MW (~USD 85K/MW). This is less than 10% of capital costs of the solar power deployed (750MW), but almost three times the size of the existing payment security mechanism for JNNSM Phase 2, Batch 1. That is, our preliminary results indicate that the existing payment security mechanism may not have been adequate in covering the risk of delayed payment from DISCOMs.

This demonstrates the need for the government to provide transparent frameworks for payment security mechanisms in order to enable assessment of the mechanisms' adequacy in covering the risk of delayed payments. Investors will be more attracted to payment security mechanisms that can demonstrate adequate risk coverage. The framework that CPI has developed could be a good starting point for the Indian government.

India Innovation Lab for Green Finance

The India Innovation Lab for Green Finance (India Lab), a public-private partnership for which CPI serves as the Secretariat, is also helping to develop innovative financing instruments for renewable energy.²⁷ The India Lab was

²⁵. A. Farooque and G. Shrimali, "Driving Foreign Investment in Renewable Energy in India: A Payment Security Mechanism", Climate Policy Initiative, April 2016, <http://climatepolicyinitiative.org>.

²⁶. For a detailed list of the projects commissioned under JNNSM phase 2, Batch 1, see: <http://seci.gov.in>.

²⁷. For more information, see: www.climatefinancelab.org.

launched in November 2015 to identify, develop, and launch privately-sponsored investment vehicles that can offer more attractive terms of financing, and are a better match with investors' needs, in order to scale up investment for renewable energy and other green infrastructure.

Each year, the India Lab crowdsources innovative ideas, develops the ideas, and facilitates implementation with the objective of scaling up the growth of green infrastructure in India. Innovative ideas that have transformative potential are sourced through an open Call-for-Ideas, through which innovators (idea proponents) could submit their ideas to the Lab. Once shortlisted by the Lab Members, the ideas are developed by the Lab Secretariat's (CPI) analysts through consultations with experts. CPI facilitates the implementation by helping the implementers/proponents raise finance for pilot projects.

The following ideas/instruments were launched in the India Lab's first cycle (2015-2016):

Loans4SME

India's banking system has traditionally relied on collateral and past track records as key factors in lending decisions. Small and medium enterprises (SMEs) in India often don't meet these requirements, and are thus challenged by limited options for lending sources. Loans4SME (Proponent: Aurus Lending Solutions) offers a solution that could expand the source of domestic debt capital for SMEs beyond banks, to include high-net-worth individuals, family investment offices and corporate treasuries. Loans4SME will launch a curated peer-to-peer lending marketplace that will connect SMEs with debt providers.

Figure 8: Loans4SME – a peer to peer lending platform



The platform will first assess each company via a credit scoring model to ensure that the companies only take on liabilities they can comfortably repay. Once the company lists its credit requirements on the platform, the implementer of Loans4SME will work with both the borrowers and the lenders to structure and close the transaction.

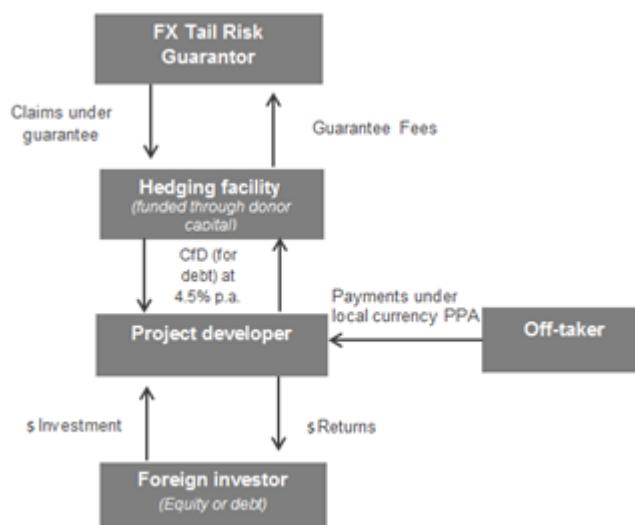
This could address a significant part of the debt finance requirement of USD 132 billion for renewable energy. We estimate that 40% of the Government of India's 40 GW rooftop solar energy target could be driven by the SME sector, which is about 16 GW by 2022. With a 5% market share, Loans4SMEs has the potential to finance the addition of 800 MW of solar rooftop capacity. The total potential for debt financing through Loans4SME is USD 2.2 billion including solar rooftop (USD 590 million), energy, procurement, and construction (EPC) financing (USD 141 million) and energy efficiency financing (USD 200 million).

Loans4SME has so far partnered with 50 lenders, including banks, Non-Banking Financial Companies (NBFCs), venture debt funds, and high-net-worth individuals. The platform has in total closed more than 20 transactions worth (total deal size) approximately INR 60 crores (~USD 9.3 million) by mid-2017. Loans4SME plans to further expand its operations to include innovative lending products. In the existing marketplace model, the lenders offer standard products, such as term loans and invoice discounting. More product innovation is required to meet the capital needs of the energy companies, particularly short term working capital required for companies with large order books and pay-as-you-go models beyond solar for sectors like energy efficiency, waste-to-energy, alternative heating and cooling solutions.

FX Hedging Facility

This facility aims to attract more, and cheaper foreign investment for renewable energy by managing a key barrier: currency risk. In financing a renewable energy project by foreign capital (in USD), the mismatch in the currency of obligations and currency of revenue exposes the investors/project to the risk of devaluation in the latter over time, resulting in reduced investments in the country due to the higher perception of risk – necessitating the use of a currency hedge to protect against these devaluations. The FX Hedging Facility (Proponent: Ravindra Rathee, JSW Group) is a customizable currency hedging product that lowers currency hedging costs by targeting a particular tranche of currency risk, thereby allowing allocation of risks to suitable parties and eliminating the credit risk premium otherwise charged in a commercial currency swap.

Figure 9: FX Hedging Facility



The Facility involves structuring of a foreign exchange (FX) tail risk guarantee, which has the potential to spur foreign equity investment to renewable energy in India. This in turn could reduce the cost of currency hedging by 22% and has the potential to mobilize USD 28 of foreign debt investment per dollar of donor grant. This process provides the following benefits in comparison with a commercial cross currency swap:

- Elimination of the counterparty credit risk premium: In a commercial swap, developers typically pay a premium due to their less-than-perfect credit risk. In this facility, the transaction structure and the upfront availability of the guarantee fee can eliminate counterparty credit risk and reduce the cost of hedging by up to 100 basis points (bps).

- Elimination of the liquidity risk premium: In a longer tenor commercial swap, developers typically pay a premium due to the market illiquidity. In our facility, the presence of donor capital eliminates liquidity risk and can reduce the cost of hedging by up to 60 bps.
- Targeted subsidy: The proposed hedging facility will be funded through donor capital (grants) contributed by either governments, development finance institutions, or private foundations. The cost of the subsidy, or the guarantee fee, to provide the FX Hedging Facility to a typical foreign debt service payment was calculated as 83 bps, which translates to a leverage of approximately USD 28 dollars for every dollar of public money. Breaking the currency risk into different components provides development financing institutions and donor agencies with an opportunity for targeted risk reduction instead of partially subsidizing the overall currency risk. This leads to a more efficient use of public grants as it covers only the targeted extreme currency depreciation. CPI along with the idea proponent is currently in discussions with relevant partners and potential implementers. There is interest from US Overseas Private Investment Corporation (OPIC) and the German government in this FX hedging facility, which could attract USD 500 million of foreign debt. This foreign debt mixed with domestic debt and equity could help set up solar capacity of approximately 1.8 GW in India.

Rooftop Solar Private Sector Financing Facility

In India, rooftop solar developers are facing two key financing challenges: availability and cost of debt. This is due to a banking system that is unsure of the credit quality of rooftop solar system deals, and is thus reluctant to lend. In addition, most rooftop solar systems are too small to attract significant investor attention.

The Rooftop Solar Private Sector Financing Facility, proposed by the International Finance Corporation (IFC), addresses these barriers by structuring a large number of small projects together so that the aggregate deal size is large enough and of sufficient credit quality to attract more attention from investors. In addition, the facility could demonstrate the commercial viability of the sector, enabling it to issue asset backed securities (ABS) to institutional investors. This securitization will help reduce the cost of capital compared to conventional financing and drive capital flows through the expansion of the investor base. The Facility has the potential to add around 500 MW of rooftop solar capacity by 2022. Currently, the proponent of this idea – IFC – is exploring partnerships to host the facility.

IFC is also exploring variations to support construction and/or blended finance.

The India Lab has developed a new set of promising ideas in the 2016-2017 cycle. They are:

- **The Matchmaker Service:** A platform to match qualified investors with a pipeline of climate-related investment opportunities for cities in India. Proposed by United Kingdom-based Carbon Disclosure Project and Climate KIC, a European public-private partnership.
- **Sustainable Energy Bonds:** Bonds to drive finance toward sustainable energy projects by attracting impact investors looking for debt exposure and offering them a set of instruments that provide a return as well as standardized impact measures. Proposed by cKers Finance, an Indian finance company launched in 2016.
- **Solar Investment Trust:** An investment trust to increase the availability of equity, possibly at a lower cost, to small-scale residential and industrial rooftop solar projects. Proposed by CleanMax Solar, one of India's largest rooftop solar power developers.

Implementation of ideas and instruments developed in the India Lab

The India Lab aims to facilitate the implementation of pilot projects for the ideas and instruments developed in the Lab. The pilot projects of the Lab-endorsed instruments are typically either implemented by the idea proponents themselves or other third-party implementers, such as private financing institutions, project developers, multilateral lending agencies, or governments. The Lab is also exploring working with countries that are interested in the implementation of Lab instruments for the growth of solar power in Africa through entities such as the International Solar Alliance (ISA). CPI, through the Lab would support, in collaboration with the implementation lead, piloting of one idea in the first year and 3-5 ideas in the next three years based on feasibility. Further, based on political and market interest, CPI will explore establishing a regional Lab program exclusively focused on Africa in the near future.

Conclusion

The right domestic policies can make a significant difference in managing investment barriers and ultimately facilitating more private investment for the renewable energy sector in India. Policymakers are often required to make decisions by balancing multiple objectives rather than comparing on a single metric. In particular, policymakers face a tradeoff between cost-effectiveness and the potential to incentivize production.

In the long-term, a combination of reduced cost debt and extended tenor debt is a very attractive policy for both wind and solar energy. For example, compared with the baseline of the unsubsidized levelized cost of electricity (LCOE), a reduction of 3% in the cost of debt and an increase in loan tenor of 10 years reduce the total subsidy burden by 29-61%. Since the government can mobilize funds at a lower cost compared with private developers due to its much higher credit (i.e., AAA) rating, it is possible to pass on the benefit of this borrowing capacity to renewable project developers at a relatively lower cost than the existing policy mechanisms.

In the short-term, since reduced cost, extended tenor debt may require a large outlay of capital, an interest subsidy in which a central government subsidy would reduce the interest payment on debt is a more attractive option than the existing policies. For example, for solar power, given the same state-level support, an interest subsidy of 10.2% is equivalent to a viability gap funding (a one-time grant) of 30%; and, compared with this viability gap funding, it would result in a total subsidy reduction of 11%.

However, as renewable energy targets have been revised to be more ambitious, government policies alone may not be enough to drive the growth of renewable energy in India. Innovative financial instruments that could address key risks, such as foreign currency risk and off-taker risk, could attract additional capital as well as lower the cost of financing.

India would need the participation of both the public and private sectors in order to meet its ambitious renewable energy targets and meet the international commitments made under the Paris Climate Agreement. While policy support can provide the essential thrust for the uptake of renewable energy, scaling up private investment through the introduction of innovative financial instruments will ensure that India can achieve its cleaner growth commitment.

