



REENERGIZING INDIA'S SOLAR ENERGY MARKET THROUGH FINANCING

PREPARED BY:
Council on Energy, Environment and Water
Natural Resources Defense Council

Solar Panels at a NSM
commissioned power plant
at Jaisalmer, Rajasthan



© Bhaskar Deol



ABOUT THIS REPORT

ABOUT THE COUNCIL ON ENERGY, ENVIRONMENT AND WATER

The Council on Energy, Environment and Water (CEEW) is an independent nonprofit policy research institution that works to promote dialogue and common understanding on energy, environment, and water issues in India and elsewhere through high-quality research, partnerships with public and private institutions, and engagement with and outreach to the wider public. (<http://ceew.in>).

ABOUT THE NATURAL RESOURCES DEFENSE COUNCIL

The Natural Resources Defense Council (NRDC) is an international non-profit environmental organization with more than 1.4 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC's India Initiative on Climate Change and Clean Energy, launched in 2009, works with partners in India to help build a low-carbon, sustainable economy. For more information, visit www.nrdc.org.

AUTHORS AND INVESTIGATORS

CEEW team: Arunabha Ghosh, Rajeev Palakshappa, Poulami Choudhury, Rishabh Jain, Shalu Aggarwal,

NRDC team: Anjali Jaiswal, Meredith Connolly, Bhaskar Deol, and Nehmat Kaur

ACKNOWLEDGMENTS

We thank government officials from India's Ministry of New and Renewable Energy (MNRE) and other Government of India agencies. We would also like to thank the following peer reviewers: Tobias Engelmeier, Ritesh Pothan, Dan Adler, Gireesh Shrimali, Doug Sims and Pierre Bull. We sincerely appreciate the valuable contributions by the following students and NRDC fellows and staff: Laura Sanchez, Yale University (Moran Fellow), Mia Diawara, Yale University (Summer MAP Fellow), Ariel Cooper, Gaurav Bansal and Nikhil Balasubramanian (Stanback Fellow). We also thank solar developers, financiers and other stakeholders for contributing to this report.

We would especially like to thank ClimateWorks Foundation, Shakti Sustainable Energy Foundation and our other supporting partners. This report is supported, in part, by Shakti Sustainable Energy Foundation (Foundation). The views expressed and analysis in this document do not necessarily reflect views of the Foundation. The Foundation does not guarantee the accuracy of any data included in this publication nor does it accept any responsibility for the consequences of its use.

TABLE OF CONTENTS

Executive Summary	5
Introduction: India's Current Solar Market and Financing Ecosystem	8
Snapshot of the Indian Solar Market.....	9
Scaling Up Solar Financing Solutions	9
Section 1	
Early Growth: Financing During Phase 1 of the National Solar Mission.....	10
Overview of Financing Barriers Encountered During NSM Phase 1	10
Solar Developer Perspectives: Barriers to Obtaining Financing.....	10
Bank Perspectives: Lender Barriers to Providing Financing.....	11
Financial Mechanisms Employed During Phase 1 of the NSM	11
Central Government Financing Mechanisms for the NSM	11
Other Financing Mechanisms.....	11
Key Financing Mechanisms Employed by States	12
Findings and Recommendations.....	12
Section 2	
Scaling Up in a Maturing Market: Phase 2 of the NSM: Phase 2, Batch 1: Boosting Support for a Struggling Solar Market	14
India's Solar Financing Ecosystem and Stakeholder Perspectives	17
Findings and Recommendations	19
Section 3	
Innovative Finance Programs and Best Practices	20
Unlocking Priority Sector Lending and Infrastructure Debt Funds for Solar Energy Access	20
Financial Mechanisms and Instruments Utilized Internationally.....	20
Framework to Analyze the Impact of Alternative Fiscal, Financial, and Policy Mechanisms	22
Findings and Recommendations	25
Conclusion	26

GLOSSARY OF TERMS

AD	Accelerated Depreciation
ADB	Asian Development Bank
BNDES	Brazilian National Bank for Economic and Social Development
CERC	Central Electricity Regulatory Commission
CUF	Capacity Utilization Factor
DCR	Domestic Content Requirement
FDI	Foreign Direct Investment
FiTs	Feed-in Tariffs
GBI	Generation Based Incentive
GW	Gigawatt
IDFs	Infrastructure Debt Funds
IFC	International Finance Corporation
IREDA	Indian Renewable Energy Development Agency
kWh	Kilowatt Hour
MLPs	Master Limited Partnerships
MNRE	Ministry of New and Renewable Energy
MW	Megawatt
NABARD	National Bank for Agriculture and Rural Development
NCEF	National Clean Energy Fund
NSM	Jawaharlal Nehru National Solar Mission
NVVN	NTPC Vidyut Vyapar Nigam
OPIC	United States Overseas Private Investment Corporation
PPAs	Power Purchase Agreements
RBI	Reserve Bank of India
REITs	Real Estate Investment Trusts
RECs	Renewable Energy Certificates
RPO	Renewable Purchase Obligation
SECI	Solar Energy Corporation of India
SERCs	State Electricity Regulatory Commissions
U.S.	United States
U.S. Exim	United States Export Import Bank

EXECUTIVE SUMMARY

The Indian solar industry has been maturing at a rapid clip, growing more than a hundredfold in four years to reach over 2.6 gigawatts (GW) of installed capacity in 2014. Coupled with successful state-level policies in Gujarat and Rajasthan, the Jawaharlal Nehru National Solar Mission (Mission or NSM) has played a pivotal role in making the industry successful. Abundant policy instruments, such as feed-in tariffs (FITs) and accelerated depreciation (AD), have been deployed at the state and national levels. These instruments have been vital to the rapid scale-up achieved by this industry so far and are now ready for adoption on a wider scale. Further, India's new government has announced nationwide targets to harness solar power and enable every Indian home to run at least one light bulb by the year 2019.

During the first phase of the NSM from 2010 to 2013, project proponents had to rely on self-financing to kick-start projects as they grappled with a lack of experience in financing solar technology on the part of domestic banks. International lenders, with greater exposure to solar technology, led the industry in supporting capacity addition. These lenders were also able to provide financing at rates lower than those offered by domestic banks. Coupled with the falling cost of solar modules, this low-cost financing strengthened the industry by contributing to an impressive drop in the cost of solar energy even as new capacity was added. The viability gap funding (VGF) mechanism employed in the first batch of NSM Phase 2 projects in 2014 allows developers to bid for additional upfront capital required to make the project financially viable at a tariff of Rs 5.45/kWh (~\$0.09/kWh), at which the produced solar power can be sold. Utilizing a reverse auction to select projects and bundling solar power with the sale of traditional power to lower prices—considered successful during Phase 1—have recently been proposed to be readopted for the second batch of Phase 2 projects.

Despite early success, India's solar industry will not be able to continue on its trajectory of growth unless domestic lenders step in and play a larger role. A persistently high cost of financing calls for continued innovation in policy and the introduction of financial mechanisms that can help bring down costs and attract the level of investment needed to build 20 GW of solar power by 2022. This paper evaluates mechanisms used in India and internationally, discussing their impact on capacity addition, risk mitigation, and reduction in the cost of finance while leveraging existing policies. The framework presents policymakers and industry leaders a set of tools to use while addressing a range of barriers to industry growth.

The analysis indicates that the renewable portfolio obligation (RPO) mechanism is the most significant missed opportunity to support Indian solar power. Weak compliance with RPOs fails to create a demand for solar energy that would otherwise exist, and needs to be addressed through stricter enforcement, something that is woefully missing at the moment. The report also discusses financial mechanisms successfully implemented in Indian states

and internationally. Some of these will become more viable as the Indian solar industry grows and matures. Green bonds and infrastructure debt funds (IDFs), vehicles that can act as conduits for debt to flow into solar projects under more favorable terms, are of particular interest among these mechanisms. Such funds have not been used for the renewable sector in India yet. Green banks for financing renewable energy projects with low-cost, long-term financing, such as the Brazil National Development Bank (BNDES), have also been successfully implemented internationally. Establishing a new institution of such scope is challenging, and further assessment is needed to understand the viability of such an initiative in the Indian context.

Obtaining financing for solar projects and reducing the cost of capital pose major obstacles to scaling solar in India. The question remains whether the solar energy market can be scaled eightfold in less than nine years to achieve the NSM's target to install 20 GW of grid-connected solar capacity by 2022. But the window of time to answer this question is quickly closing.

Well-designed government policies can clearly shape and influence market growth, as evidenced by the first phase of NSM from 2010 to 2012. Despite this early growth, stronger policies and mechanisms to finance solar energy are needed to achieve the goal of the Mission's second phase: reaching between 4 and 10 GW of installed solar power by 2017.

KEY FINDINGS

1. State programs supported two-thirds of India's solar installation during Phase 1 (2010–2013), with the NSM providing a foundation for the nascent solar market, particularly by driving down solar power prices through reverse auctioning. The innovative financing mechanisms under state programs have proved successful in the deployment of solar power and could provide useful lessons for the national program.
2. India must send clear demand signals to the market to allow solar companies to create pipelines of projects. The absence of RPO enforcement by state utilities has undermined a key signal for investors that could promote

solar capacity addition. Policies for solar-specific RPOs were primarily intended to create steady demand for grid-connected solar power; however, RPOs, along with renewable energy certificates (RECs)—tradable credits that are sold by solar power producers and bought by entities that need to fulfill RPOs—are ineffective because of minimal compliance.

3. Domestic banks must be encouraged to see solar as a mature business opportunity. Multilateral financing and self-financing provided the majority of financing during Phase 1, with domestic banks remaining reluctant to lend because of higher levels of perceived risk associated with solar. Despite increased familiarity and experience gained during Phase 1, many domestic banks continue to perceive significant risk in solar investments, in part due to information gaps and a continued lack of a successful track record. With international financing expected to decline, the burden on domestic banks will increase. Policies that aim at increasing domestic lending, such as the Indian Green Bank, are critical.
4. Trade disputes regarding solar equipment must be favorably resolved. Delays in government programs and frequent changes in proposed incentives complicated the policy environment, increasing uncertainty and perceived solar market risk. Nevertheless, interest in the solar market remains strong as demonstrated by the large number of bids received in the initial Phase 2 solar project allocations. Yet, the ongoing international trade dispute resulting from the domestic content requirement (DCR) and the announced anti-dumping duties on imported solar panels presents a major barrier to industry growth and prevents the creation of an environment that is conducive to investment.
5. According to financial institutions, top priorities to boost India's solar market are to: deploy VGF for Phase 2, Batch 1 projects within a year; strengthen the contractual link between SECI and the National Clean Energy Fund (NCEF) for these projects; disburse subsidies through lending agencies or banks; include renewable energy within priority sector lending; channel insurance and pension funds into the renewable sector; and explore refinancing options for the solar market. State incentive programs, including generation-based incentives (GBI), should be explored.
6. Infrastructure Debt Funds (IDF) can act as conduits for debt financing for solar energy projects. Even though the Reserve Bank of India (RBI) has issued guidelines for IDFs, they have not yet been used for renewable energy in India. Similarly, priority sector lending can further increase the renewable energy market's access to lower-cost capital.
7. Apart from systemic problems such as high interest rates, weak capital markets, and poor financial health of distribution companies, lack of access to cheap and long-term domestic debt financing poses challenges in India. Implementing financing instruments such as VGF, refinancing, and securitization (initiatives of the Indian

Renewable Energy Development Agency (IREDA)) has elicited a positive response from investors.

8. Over the course of Phase 1, lenders developed a level of comfort trading with the NTPC Vidyut Vyapar Nigam (NVVN), the nodal agency for signing of power purchase agreements (PPAs) to buy power directly from developers. For Batch 1 of Phase 2, SECI was appointed the new implementing agency that provides payment security for solar contracts. Some lenders expressed concerns about the organizational shift because they do not enjoy a similar level of confidence in SECI. MNRE responded to this feedback swiftly and proposed reappointing NVVN as the experienced and successful nodal agency for Phase 2's Batch 2 projects. Although a reverse auction and bundling scheme has been proposed to be reinstated for Phase 2, Batch 2 projects, stakeholders participating in Phase 2, Batch 1 have noted that while VGF ensures that projects deliver to capacity, a quicker payment of VGF would lower their risks during such experimental schemes and organizational changes.
9. Several mechanisms, such as green bonds, are effectively used in international markets to stimulate solar market growth. International mechanisms ranging from debt and tariff instruments to tax exemptions and direct financial transfers offer practices for funding India's solar market. Each mechanism has specific potential impacts and associated risks, which determine its desirability and utility in a given context.
10. Green banks offer low-cost capital for clean energy development at rates lower than what is available in private sector transactions, resulting in significant savings in delivering clean energy. However, establishing a new institution of such scope is challenging.

LOOKING AHEAD: FIVE FINANCING PRIORITIES

1. **Deploy VGF within the first year:** The central government must ensure effective implementation of the VGF for Phase 2, Batch 1 projects, with payment within the first year. It must also enhance finance programs at the national level and with states, giving serious consideration to GBIs and priority sector lending for utility-scale photovoltaic (PV) projects. The government should also work with financial stakeholders to modify policies in order to disburse subsidies through lending agencies or banks, channel insurance and pension funds into the renewables sector, and explore refinancing options for the solar market.
2. **Establish a contractual link between SECI and the NCEF and carve out a role for SECI moving forward:** Bringing back the more established NVVN for Phase 2, Batch 2 projects boosted investors' confidence as NVVN has proven its ability to provide payment security for solar contracts. However, strong government support of SECI and carving out a clear role for them moving forward in the Mission also important as the solar market scales up

and the organization matures. Establishing a contractual link between SECI and the NCEF is also necessary to enhance credibility of the Phase 2, Batch 1 VGF scheme and the overall solar market.

- 3. Establish priority sector lending provisions for solar power:** To increase affordable domestic financing, the RBI, along with leading agencies including the Ministries of Power, Coal, New and Renewable Energy, and Finance, should explore priority sector lending for large-scale solar projects in addition to off-grid energy projects. Although priority sector lending has its limitations, a quota for renewable energy separate from the existing power sector quota can act as a catalyst to boost low-cost financing for the solar sector in India.
- 4. Introduce infrastructure debt funds (IDFs) for investments in solar power:** For longer-term debt and lower interest rates, the RBI should encourage the application of IDFs to renewable energy investments. An appropriate project authority, for instance SECI or IREDA, backed by a strong balance sheet, is needed to provide guarantees for this tool to be effective.
- 5. Pilot a system of green bonds and establish a green bank:** Leading municipal governments with central government support could pilot both a green bank and green bond systems for solar energy and other clean energy sources. In order to inject new liquidity and reduce the cost of capital, the Ministry of Finance, IREDA, the National Bank for Agriculture and Rural Development (NABARD), and domestic banks should take concrete steps to establish a green bank and green bonds for low-cost financing for greater clean energy access and development.

LOOKING AHEAD: THREE POLICY PRIORITIES

- 1. Learn from successful state policies:** To grow investment in India's solar market, the central government should consider adopting innovative state programs, like Gujarat's AD policy, Andhra Pradesh's exemption from infrastructural charges for renewable energy projects,

and Rajasthan's Renewable Energy Infrastructure Development Fund, which finances transmission costs for solar projects. Close coordination and learning exchanges between state and central governments must be enhanced to craft strong policies.

- 2. Enforce RPO mandates:** In the absence of a well-functioning REC market, the solar industry is missing a key opportunity to attract additional investors. The Central Electricity Regulatory Commission (CERC) must work with MNRE, state regulators, and utilities to enforce RPO mandates and nurture the REC market.
- 3. Ensure timely program implementation of solar policies:** Both national and state programs must continue to advance market momentum through timely program implementation, with timelines for guidance, auctions, and payments. A comprehensive financing strategy with fewer—but effective—mechanisms and timely implementation of solar policy are needed to scale solar energy investments to meet the NSM's goals.

LOOKING AHEAD: TWO MARKET PRIORITIES

- 1. Establish an information sharing platform for lending institutions:** Leading financial institutions with experience in lending to solar markets require a platform from which to co-develop bank products that support solar energy. Institutions could work together to syndicate loans, share information, and conduct workshops where stakeholders across the solar ecosystem could exchange knowledge and experiences about solar investments. Organizations such as the Indian Banks' Association could play a pivotal role in making this happen.
- 2. Increase transparency of solar market information:** The central government, states, developers, and financiers as part of the solar market ecosystem must continue to increase transparency and provide information on the progress of solar projects. Transparency and immediate market information are vital in boosting investor confidence and reducing perceived risks in solar investments.



Solar panels at the Kiran Energy Solar Power Plant at Phalodi, Rajasthan

© Kiran Energy

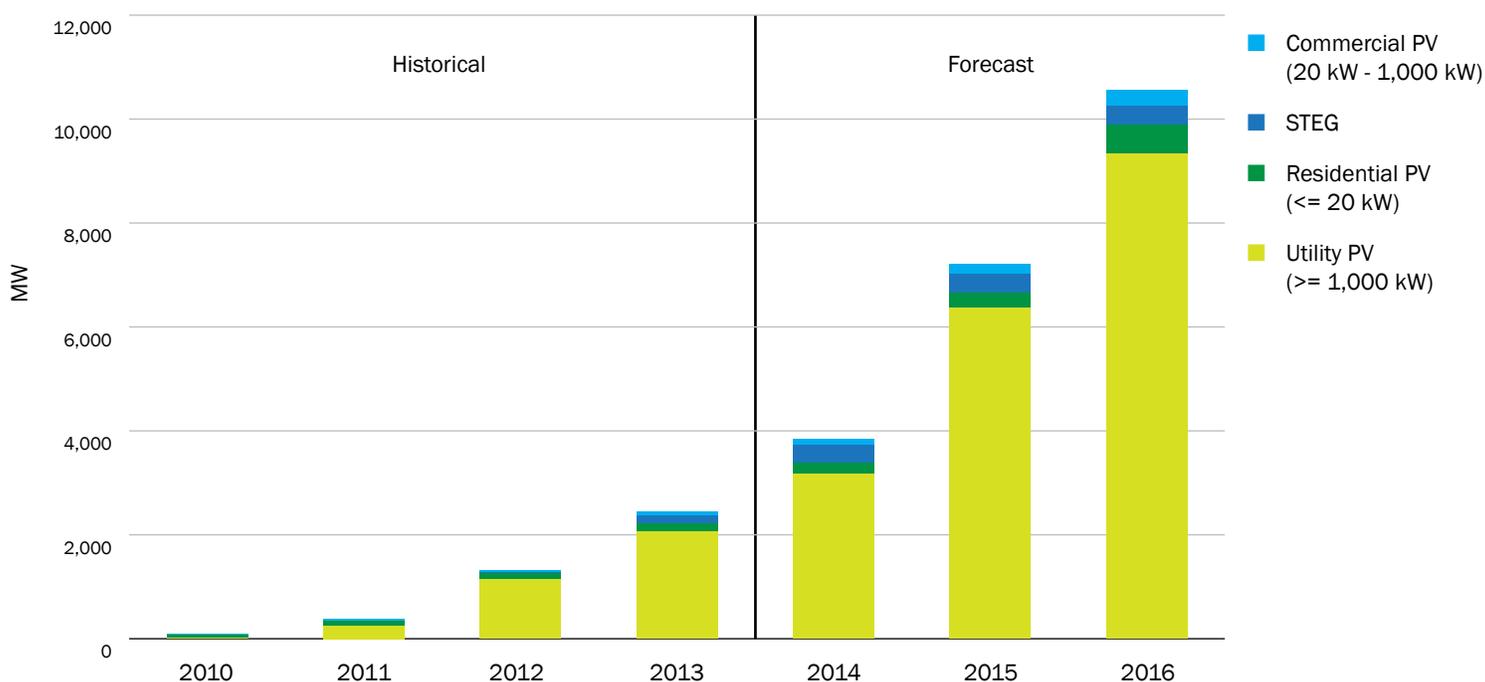
INTRODUCTION: INDIA'S CURRENT SOLAR MARKET AND FINANCING ECOSYSTEM

As domestic sources of fossil fuels continue to deplete, India is increasingly turning to imports to keep pace with rising energy demands. With more than two-thirds of India's electricity currently coming from coal, the National Solar Mission's success in increasing solar energy installations across the country can help fulfill domestic priorities and challenges, including: building a diversified energy portfolio, thereby increasing India's energy security; developing cleaner, more sustainable ways to meet rapidly growing energy demand; and addressing the global threat of climate change.

While prioritizing solar energy is a positive step for India, stronger policy support is needed to increase investor confidence and bolster growth in India's nascent solar market. Though installed solar capacity doubled in 2013 to more than 2.6 GW by March 2014, India's solar market growth is slowing.¹ Delays in the Mission's Phase 2 and in state solar auction allocations have chilled the market. International trade disputes and anti-dumping duties on United States (U.S.) and Chinese solar imports are also contributing to the slump.² As a result, financial investment in solar energy dipped to a three-year low in 2013. Clean energy investments that year totaled Rs 34,713 crore (~\$5.7 billion), the lowest since before 2010.³ Within the clean energy market, solar energy experienced the sharpest decline in investment, even though the decline can be attributed in part to significant cost reductions in photovoltaic systems.

Even with the delays, enthusiasm for the solar market continues. Prospective project developers submitted bids for projects totaling more than 2,100 MW of solar power for the 750 MW allocation for the Phase 2, Batch 1 auction in late 2013. On the heels of this keen market interest, MNRE announced that an additional 250 MW of solar PV power would be auctioned in 2014.⁴ Ambitious plans have also been announced for four mega solar plants totaling 15 GW, though state government concerns may stall these plans.⁵ The solar ecosystem created during the NSM's inaugural phase is continuing to incubate industry growth. Given the renewed momentum created by Phase 2's strong launch, now is the time for strong leadership to reenergize the domestic solar market.

Figure 1: Projected Growth of India's Installed Solar Generation Capacity Through 2015⁶



Source: Bloomberg New Energy Finance, *H1 2014 India Market Outlook*, 16 January 2014.

Snapshot of the Indian Solar Market

State solar programs directly supported two-thirds of the total 2,647 MW of solar capacity currently installed across India, according to recently released numbers from MNRE.⁷ Gujarat led states with 860 MW, 39 percent of the nation's installed PV capacity.⁸ Overall, central government programs, led by MNRE, supported 687 MW total in installed capacity. Direct projects, as part of the Mission's Phase 1 reverse auction, added 252.5 MW of solar capacity between 2010 and 2013.⁹

Competitive bids for NSM projects have rapidly driven down tariffs. Phase 1 bidding revealed prices as low as Rs 7.49 (~\$0.15) per kilowatt-hour (kWh) for PV projects, making it competitive with diesel-fired captive electricity generation.¹⁰ Phase 2 set even lower tariffs—Rs 5.45 (~\$ 0.09) per kWh with VGF, and Rs 4.75 (~\$0.08) per kWh with AD—while backup diesel generation prices increased.¹¹ The lower tariffs in Phase 1 raised lenders' confidence because, in the event of default by responsible distribution companies, the power can be sold to other entities.¹²

Developers proposed a total of 122 grid-connected PV projects for a total of 2,170 MW for the 750 MW tender offered under the first auction under Phase 2 of the Mission, making the solar auction three times oversubscribed.¹³ A total of 68 bids were received from 58 developers for the 122 projects in October 2013. The lowest bidding price for viability gap funding was Rs 17.5 lakh (~\$29,167) per MW. Another auction for 250 MW of solar PV projects is also expected during 2014.

The NSM's target for grid-connected solar projects was to reach 1,000 to 2,000 MW of solar power in Phase 1 (2010–2013). Going forward, the Phase 2 goal is to reach between 4,000 and 10,000 MW by 2017, and 20,000 MW by 2022 in Phase 3. The targets under each phase count total progress in installed capacity under both direct central government programs through the NSM and state programs.

The Modi government has also announced its plans to harness solar power to enable every Indian home to run at least one light bulb by the year 2019.

SCALING UP SOLAR FINANCING SOLUTIONS

High interest rates continue to be one of the biggest challenges in achieving India's solar energy objectives. Although not endemic to the solar market, the high up-front capital costs of solar energy mean that projects are burdened with high interest rates during initial development and construction. For example, India's commercial banks typically offer shorter-term loans (about 7 to 10 years) to renewable developers at high interest rates (about 12 percent), raising the cost of debt substantially.¹⁴

Solar financing policies alone cannot resolve the solar market's financing issues. The lower-cost debt offered by both self-financing and international funding sources during the first phase of the NSM proved to be attractive to many solar developers to get projects off the ground.¹⁵ Many of the multilateral financing groups that played a major role in Phase 1 are shifting their focus to other clean energy financing opportunities in developing economies and may play less of a role in Phase 2. The self-financing among larger industry players that was prevalent in NSM Phase 1 is now looking less realistic as projects scale up.

Several government policies that aim to increase financing for India's grid-connected solar energy market have been deployed since 2010. This report analyzes financial mechanisms and instruments used to stimulate market growth at the national and state levels, as well as successful foreign financing mechanisms that might be adapted to the Indian context. Diverse financial policies, some currently adopted by the central government and many that have proved successful on the state level or internationally, can still help fuel India's solar market.



SECTION 1

EARLY GROWTH: FINANCING DURING PHASE 1 OF THE NATIONAL SOLAR MISSION

The NSM's initial phase helped make India's renewable sector an attractive destination for new investments, mostly from multilateral sources. In 2011 alone, approximately Rs 51,000 crore (\$10.3 billion) was invested in the Indian renewable energy sector, more than one-third of it in solar projects.¹⁶ Effective government policies supported early market growth and proved the viability of the solar energy market in India—no easy feat for any government.

Anchored by the reverse-bidding auction process, the Indian government introduced many financing mechanisms to support early solar projects during the first phase of the NSM. To ease access to funds for nascent projects, Phase 1 utilized mechanisms including preferential tariffs, a payment security mechanism to protect investors from potential default by participating companies, and the bundling of solar power with unallocated coal. A track record of project commissioning, backed by increased performance information being provided by MNRE toward the end of Phase 1, has helped increase financiers' confidence in solar developers' ability to commission and operate projects efficiently. However, some stakeholders reported persisting asymmetry in access to information.¹⁷ During Phase 1, financiers said that the preferential tariffs combined with the bundling of solar power and the use of IREDA as the financial intermediary for payments from utilities, were effective mechanisms in attracting investment.¹⁸

The government also established RPOs, which require states and obligated entities to purchase a certain percentage of their electricity from renewable sources. Intended in part to attract investment, RPOs have been unsuccessful so far. Ineffective RPO enforcement due to the poor health of state electricity boards, have provided obligated entities with little incentive to purchase RECs.

Multilateral investors, including the International Financing Corporation (IFC), the Asian Development Bank (ADB), the U.S. Export-Import Bank (Ex-Im Bank), the U.S. Overseas Private Investment Corporation (OPIC), and KfW Development Bank of Germany, were key lenders for Phase 1 solar projects.¹⁹ Many Phase 1 projects were also funded through balance sheet or self-financing from larger parent companies testing the solar energy market. International funding and self-financing are showing a decline for Phase 2 projects, leaving a major financing gap for projects aiming to achieve the 4,000–10,000 MW Phase 2 goal of the NSM.

Domestic banks were extremely reluctant to invest in the first phase of the NSM, largely due to the perceived risks of a new market and technology.²⁰ A few Indian banks provided project financing loans at high average lending rates of 11 to 13 percent annually, according to developers, as compared with the 9 to 10 percent annual rates from multilateral institutions.²¹ Multilateral lenders also offered longer financing tenures, ranging from 15 to 18 years (as compared with approximately 7 to 10 years in India).²²

Looking ahead to Phase 2, Indian banks have more confidence in solar energy, given the growth in the solar market, especially PV technology. Yet lenders remain concerned about solar plant commissioning dates and performance, repayment rates, and supportive government policies. The question remains as to whether domestic lending institutions and mechanisms can be stepped up quickly enough to fill the gap from declining multilateral investment, meet the goals of the NSM, and provide greater clean energy access to meet India's increasing power demand.

OVERVIEW OF FINANCING BARRIERS ENCOUNTERED DURING NSM PHASE 1

SOLAR DEVELOPER PERSPECTIVES: BARRIERS TO OBTAINING FINANCING²³

Solar project developers experienced several barriers to accessing financing during the initial projects in the first phase of the NSM. Because the market is maturing, some of these barriers have been overcome, but others persist.

The chief barriers that remain are:

- high domestic interest rates resulting in high up-front capital costs;
- limited non-recourse loans; and
- shorter loan repayment terms offered by domestic banks, requiring bridge financing and resulting in increased debt burden.

The barriers for developers that have been ameliorated are:

- lack of market networks and information-sharing programs to disseminate irradiance data and project data;
- limited information dissemination regarding solar market progress within India's financial system of 170 banks and 80,000 branches; and
- lack of syndicate or group loans to spread risk, which are now emerging because of loan guarantees and other factors.²⁴

BANK PERSPECTIVES: LENDER BARRIERS TO PROVIDING FINANCING

Discussions with financial institutions indicate that lenders faced barriers in providing financing to the solar sector during Phase 1 of the NSM, and several still persist.

The main barriers that remain are:

- lending rates for solar projects that are grouped with the entire power sector, with no separate lending limits for the renewable sector. Since domestic banks are close to lending caps for the power sector because of their lending to conventional power plants, limited funds remain for renewable energy;
- uncertainty about the payment ability of financially distressed energy distribution companies; and
- lack of confidence in projects relying on RECs, given lack of compliance and enforcement.²⁵

Barriers that have been addressed for banks include:

- perceived high-risk investment in untested technology; and
- lack of comfort because of information gaps on project development, commissioning and performance benchmarks, and power delivery.

FINANCIAL MECHANISMS EMPLOYED DURING PHASE 1 OF THE NSM

CENTRAL GOVERNMENT FINANCING MECHANISMS FOR THE NSM

MNRE crafted a range of financial policy mechanisms during Phase 1 with mixed success. Some mechanisms, such as power bundling, that were considered most successful in Phase 1 were not included in Phase 2. The key mechanisms were:

Feed-in Tariffs (FiTs): Phase 1 of the NSM offered a preferential benchmark tariff for solar power sold to utilities by developers, known as the feed-in tariff. Phase 1 of the NSM employed a reverse bidding process that set record-low FiTs for selected projects. Outside of the NSM, the State Electricity Regulatory Commissions (SERCs) declare FiTs for projects allocated under state policies. FiTs have been continued in the Phase 2 guidelines.

Long-Term Power Purchase Agreements (PPAs): Under Phase 1 of the NSM, solar power developers received long-term (often 25-year) PPAs at preferential tariffs. The PPA structure provided a strong incentive for developers but was a

heavy burden for energy distribution companies, which were obligated to purchase power at the FiT rate but sell at much lower government-mandated retail rates.²⁶ The PPA structure has been retained in the Phase 2 guidelines.

Power Bundling: During Phase 1, NVVN sold solar power by bundling it with coal power generated under the unallocated quota—a small fraction of coal generation capacity that is not allocated to specific states. Bundling reduced the average purchase cost of energy for distribution companies to a rate between Rs 5.5 (~\$ 0.09) per kWh and Rs 6.0 (~\$0.10) per kWh.²⁷ Although considered a success during Phase 1, bundling solar was not continued in Phase 2, Batch 1 guidelines. Responding to stakeholder feedback, the Phase 2, Batch 2 draft guidelines propose bringing back bundling.

Renewable Purchase Obligations (RPOs): The creation of mandatory regulations specifying RPOs for SERCs was a primary policy intended to drive demand for grid-connected solar power. However, the failure of SERCs to enforce RPOs means many distribution utilities have not purchased the required amount of generated renewable energy (or RECs instead), nullifying a key incentive for solar production that could attract investors.²⁸ The RPO mechanism continues into Phase 2.

Renewable Energy Certificates (RECs): These market-based instruments, representing megawatts of renewable power that entities can purchase to meet their RPO obligations, have not been effective. Solar REC activity picked up in 2013, but the lack of long-term price signals and RPO enforcement maintains REC market uncertainty.²⁹ The REC mechanism continues into Phase 2.

OTHER FINANCING MECHANISMS

Multilateral and Bilateral Financing: Low-cost international financing, as discussed above, was a major funding source for Phase 1 projects, particularly from German-based KfW and the American entities Ex-Im Bank and OPIC. OPIC funding, for example, supports investment from U.S. companies in the Indian market by insuring up to \$250 million (Rs 1,505 crore) in total solar project value.³⁰ During Phase 1 of the NSM, involvement of foreign investors had the effect of increasing project credibility, and domestic banks looked upon international lenders for technical expertise and experience in due diligence for solar projects. With some international funding sources reaching country exposure limits or exploring other developing markets, domestic lenders will need to step in to provide the funding required to reach targets for the next phase of the NSM.

Table 1: Solar Project Investments in India by International Financing Institutions in 2012

International Financial Institution	Total Amount Invested in 2012 (\$)	Number of Projects Financed in 2012	Electricity Generation Capacity of Projects in 2012
Ex-Im Bank	\$ 216 million	5	215 MW
ADB	\$ 203 million	2	245 MW
IFC	\$ 77.2 million	4	50 MW
OPIC	\$ 4.3 million	1	5 MW

Sources: Export-Import Bank of the United States, Annual Report 2013; International Finance Corporation, IFC Annual Report 2013: The Power of Partnerships; Asian Development Bank, Annual Report 2012; Overseas Private Investment Corporation, 2012 Annual Report³⁴

Clean Development Mechanism (CDM): Grid-connected solar projects in India have registered under the CDM of the Kyoto Protocol, allowing developers to receive funding through carbon markets.³² At least 100 MW of projects have registered under the CDM, mostly in Gujarat, and India's largest solar energy project, in Rajasthan, has been approved for the CDM trading program.³³

Self-Financing: Self-financing by big industry players initially helped buoy many Phase 1 projects that could not access affordable financing from other sources. In most cases, once the project reached maturity, developers were able to get domestic financing due to the reduced implementation risk. Relying on company equity will not be enough for Phase 2 to achieve its scaled-up targets.

KEY FINANCING MECHANISMS EMPLOYED BY STATES

If India is to reach its total goal of 20 GW of installed solar energy, strong state programs will be critical to the effort. In developing policies that paralleled the NSM's policies, state programs supported two-thirds of the total 2,647 MW of solar capacity installed in India as of 2014.³⁴ The majority of these projects are in Gujarat and Rajasthan. The key financing mechanisms used by leading states are:

FiTs: SERCs designated statewide FiTs for solar power projects outside of the NSM. For example, Gujarat's preferential tariffs supported about two-thirds of the total solar photovoltaic systems in India by 2012.³⁵ Nearly a dozen states, including Tamil Nadu and Andhra Pradesh, have policies for preferential tariffs.

Accelerated Depreciation (AD): Inspired by India's wind energy policies, Gujarat employed an AD scheme, providing a tax benefit to project developers to offset profits of earlier tax periods. Under the Gujarat policy, project developers could depreciate 80 percent of their capital assets in the first year.³⁶ However, a shortcoming of AD is that power developers, as independent power producers, often have low or no taxable profits in the early years, which limits the tax benefit that can be claimed.³⁷ In mid-2014 MNRE announced plans to reintroduce higher AD percentages for wind generators given the drop in wind capacity in 2012–13.³⁸

Bank Guarantees: Some states require solar project developers to obtain bank guarantees in connection with their project financing. In Gujarat, the developer of a solar project must provide a bank guarantee of Rs 50 lakh (~\$85,382) per MW.³⁹ In Madhya Pradesh, the developer must provide a bank guarantee of Rs 5 lakh (~\$8,538/MW) per MW.⁴⁰

Renewable Energy Infrastructure Development Fund (REID): Rajasthan developed a REID fund that provides financing for transmission lines and other infrastructure related to renewable energy deployment. Some developers estimate that last-mile infrastructure can add 5 to 10 percent to total project costs.⁴¹ This fiscal support can increase the number of projects developed and accelerate commissioning.

Charge Exemptions: In Andhra Pradesh, solar power generators are exempt from wheeling and transmission charges on electricity sold within the state.⁴² Similarly, Tamil Nadu exempts solar power projects from wheeling and banking charges.⁴³ The exemption increases the project's viability by reducing operations and maintenance costs.

Subsidies: Chhattisgarh provides subsidies on interest and capital investment to solar energy developers as well as exemptions from electricity and stamp duties through March 2017.⁴⁴

FINDINGS

1. State programs supported two-thirds of India's solar installation during Phase 1 (2010–2013), with the NSM providing a foundation for the nascent solar market, particularly by driving down solar power prices through reverse auctioning. The innovative financing mechanisms under state programs have proved successful in the deployment of solar power and could provide useful lessons for the national program.
2. India must send clear demand signals to the market to allow solar companies to create pipelines of projects. The absence of RPO enforcement by state utilities has undermined a key signal for investors that could promote solar capacity addition. Policies for solar-specific RPOs were primarily intended to create steady demand for

grid-connected solar power; however, RPOs, along with renewable energy certificates (RECs)—tradable credits that are sold by solar power producers and bought by entities that need to fulfill RPOs—are ineffective because of minimal compliance.

3. Domestic banks must be encouraged to see solar as a mature business opportunity. Multilateral financing and self-financing provided the majority of financing during Phase 1, with domestic banks remaining reluctant to lend because of higher levels of perceived risk associated with solar. Despite increased familiarity and experience gained during Phase 1, many domestic banks continue to perceive significant risk in solar investments, in part due to information gaps and a continued lack of a successful track record. With international financing expected to decline, the burden on domestic banks will increase. Policies that aim at increasing domestic lending, such as the Indian Green Bank, are critical.

RECOMMENDATIONS

1. **Learn from successful state policies:** To grow investment in India's solar market, the central government should consider adopting innovative state programs, like Gujarat's AD policy, Andhra Pradesh's exemption from infrastructural charges for renewable energy projects, and Rajasthan's Renewable Energy Infrastructure Development Fund, which finances transmission costs for solar projects. Close coordination and learning exchanges between state and central governments must be enhanced to craft strong policies.
2. **Enforce RPO mandates:** In the absence of a well-functioning REC market, the solar industry is missing a key opportunity to attract additional investors. The Central Electricity Regulatory Commission (CERC) must work with MNRE, state regulators, and utilities to enforce RPO mandates and nurture the REC market.
3. **Establish an information sharing platform for lending institutions:** Leading financial institutions with experience in lending to solar markets require a platform from which to co-develop bank products that support solar energy. Institutions could work together to syndicate loans, share information, and conduct workshops where stakeholders across the solar ecosystem could exchange knowledge and experiences about solar investments. Organizations such as the Indian Banks' Association could play a pivotal role in making this happen.

Solar power plant in Jaisalmer, Rajasthan



© Bhaskar Deol

SECTION 2

SCALING UP IN A MATURING MARKET: PHASE 2 OF THE NATIONAL SOLAR MISSION

While reaching the first 2,000 MW of solar capacity by the end of 2013 was a notable feat, India cannot meet its NSM target of 4,000–10,000 MW by 2017 without ensuring continued government support and attractive returns for investors. A comprehensive financing strategy is the prerequisite for scaling up solar energy investments to meet the NSM's goals.

Interest rates remain high, and banks remain reluctant to invest in solar energy. Strong policies and leadership from India's financial sector now are important to ensure longevity and support for an expanding solar market to achieve the 20 GW target by 2022.

National Solar Mission Phase 2 Guidelines Highlights⁴⁵

Released in late 2013, the key guidelines in Phase 2 of the Mission are:

Size: Projects must be between 10 and 50 MW, with a maximum of five projects at different locations subject to a maximum aggregate capacity of 100 MW per company or bidder.

Implementing Agency: The SECI, a government-backed implementation and facilitation institution dedicated to the solar energy sector, is designated as the nodal agency of the NSM to achieve the Phase 2 targets, with support from NVVN, the implementing organization for Phase 1 projects. NVVN was then brought back on as the nodal agency for Phase 2, Batch 2 projects.

Allocation: Bid allocation is still conducted through open competitive reverse bidding, but in Phase 2, the developer bids for the lowest amount of VGF needed to support a project. In Phase 2, Batch 2, the traditional reverse auction and bundling scheme were reintroduced.

Minimum Equity: The developer must provide at least Rs 1.5 crore (~\$250,000) per MW of its own equity for the project. After the minimum equity and VGF are applied, the remaining balance can be raised as a loan from any source.

VGF: New in Phase 2, Batch 1, the VGF is a subsidy in the form of partial payment from the government to make the project financially viable. Determined for each project by reverse bidding, the funding is distributed in three tranches: 50 percent upon successful commissioning of the project, and then 10 percent per year for five years following the date of commissioning. The upper limit for VGF is 30 percent of the project cost or Rs 2.5 crore (~\$416,667) per MW, whichever is lower. Rs 1,875 crore (~\$302 million) was approved for VGF of the Mission's Phase 2, Batch 1 projects.

Tariff: The FiT is a set price as part of a long-term contract for the solar producer to provide compensation commensurate with the technology's cost and price certainty. The tariff for Phase 2, Batch 1 projects is set at Rs 5.45 (~\$0.09) per kWh for 25 years (or Rs 4.75 [~\$0.08] per kWh for projects taking the AD benefit).

DCR: Selected solar plants must use solar cells and modules manufactured in India for a total of 375 MW for any technology used (thin-film or crystalline silicon).

Excess generation: Any generation in excess of 10 percent of declared capacity utilization factor (CUF) will be purchased by SECI and NVVN at a tariff of Rs 3 (~\$0.05) per kWh.

Project Implementation Schedule: The deadline for accepting bids under Phase 2, Batch 1 was extended to January 2014. The deadline for signing of PPAs was April 2014, but some have been delayed. Finance arrangements are required to be in place 210 days from the signing of the PPA. With a 13-month commissioning timeline, this batch of projects should be online by mid-2015.

PHASE 2, BATCH 1: BOOSTING SUPPORT FOR A STRUGGLING SOLAR MARKET

The state of the Indian solar market was marred by unmet targets and delays releasing the NSM Phase 2, Batch 1 guidelines at the end of 2013. India fell from fourth to ninth place in Ernst & Young's Renewable Energy Country Attractiveness Index due to the poorly enforced REC trading scheme and the delay in the Phase 2 launch.⁴⁷ Yet, the Phase 2, Batch 1 tender for 750 MW of PV projects saw significant interest in February 2014.

The tender was three times oversubscribed, attracting bids totaling 2,170 MW from solar developers vying for projects.⁴⁸ SECI allocated projects to qualifying developers who required the least amount of VGF support to make their projects viable. VGF support sought by the selected bids ranged from Rs 17.5 lakh (~\$28,162) per MW and Rs 1.35 crore (~\$217,251) per MW under the "open category" (without the DCR). The range for selected bids adhering to the DCR was RS 1.35 crore (~\$217,251) per MW to 2.45 crore (\$394,271) per MW.⁴⁹

The NSM's successful bidding for the first batch of Phase 2 projects indicates that the nascent market may be approaching maturity. The recent announcements of a series of large-scale solar projects also point to a more robust pipeline of solar projects.⁵⁰ Yet, signals from financiers are not proportionally strong.

Table 2: Selected Viability Gap Funding (VGF) Bids for Phase 2, Batch 1's Tender⁵¹

	VGF Bid Amounts for "Open Category"	VGF Bid Amounts for "Domestic Content Requirement" Category
Lowest Bid	Rs 17.5 lakh (\$28,162) per MW <i>Gujarat Power Corporation Ltd.'s 10 MW PV project</i>	Rs 1.35 crore (\$217,251) per MW <i>Swelect Energy System Ltd's 10 MW PV project</i>
Highest Bid	Rs 1.35 crore (\$217,251) per MW <i>Sunil Hitech Engineer's 5 MW PV project</i>	Rs 2.45 crore (\$394,271) per MW <i>Welspun Renewables Energy Ltd's 5 MW PV project</i>
Weighted Average⁵²	Rs 1 crore (\$160,927) per MW	Rs 2.1 crore (\$337,947) per MW

PHASE 2 FINANCING MECHANISMS AND STRUCTURE ANALYSIS

The central government adopted four main financing mechanisms to scale solar energy during the first batch of Phase 2 projects with VGF, FiTs with AD, credit guarantees, and tax-free bonds. It also made key changes in the structure of the program, including appointing SECI, instead of NRVN as the implementing body for the NSM. These modifications in the program were intended to support market growth, yet stakeholder views of them are mixed. Responding

to this feedback, for the second batch of projects in the Mission's second phase, NRVN has been reappointed the implementing body selecting projects through traditional FiT reverse auctioning rather than the VGF scheme.⁵³

VGF: While generation-based incentives and bundling schemes were primarily utilized during Phase 1, the Phase 2, Batch 1 guidelines relied on VGF to subsidize the cost to make solar projects financially viable. Reverse auctions were held during Phase 2 to select the lowest VGF bids needed to fund potential Batch 1 projects. In the form of partial payment from the government, the VGF scheme was intended to support infrastructure investments through public-private partnerships.⁵⁴

The VGF mechanism allowed developers to seek financing for their projects upfront and allowed the government to provide more initial support instead of spreading it over the 25-year contract term (as in Phase 1). Since the VGF covers only a small part of the financing required for a project, developers theoretically need to generate power efficiently and consistently in order to achieve an acceptable return on investment from the project over its projected 25 years at the set tariff. The lenders felt that direct financial transfer through VGF mitigated viability risks for projects by reducing the purchase cost of solar power for distribution companies.⁵⁵ However, some stakeholders were concerned about the returns with the low VGF rates obtained through reverse bidding as well as the certainty of VGF subsidy disbursement over a five-year period. To increase confidence in the VGF mechanism for Phase 2, Batch 1 projects, bankers recommend establishing a formal contractual agreement between SECI and the NCEF for repayments in the event of defaults by distribution companies because SECI and NCEF are under different ministries.⁵⁶ The actual impact of VGF still remains to be seen, but the aggressive bids witnessed during the Batch 1 auction indicated a positive initial response from developers.

FiTs: As demonstrated during Phase 1, government support of tariffs has been critical to the success of solar power in India.⁵⁷ In Phase 2, Batch 1, the tariff was set at Rs 5.45 (~\$0.09) per kWh for 25 years, or Rs 4.75 (~\$0.07) per kWh with AD. Although this tariff is lower than what has been offered in the past, this standardized price certainty and longer-term contract structure may be helpful in attracting financing since the VGF is front-loaded to increase the project's viability early on, rather than over the life of the project. Moreover, the lower tariffs in Phase 2 have raised lenders' confidence, as the current FiTs are competitive with conventional power, and in the event of default by the responsible distribution company, the power can be purchased by other entities.⁵⁸ Solar power purchased by NRVN from Phase 2, Batch 2 projects will be bundled with traditional power again to minimize the tariff's impact on distribution companies, which proved successful during Phase 1.

Generation-Based Incentives

Generation-based incentives (GBIs) have been used to support grid-connected rooftop projects, where the central government pays state utilities a set tariff for power purchased from solar producers. With the focus on the VGF, Phase 2 does not currently offer a GBI for large-scale solar power projects. However, the long-term nature of GBI payments could help ensure revenue to the project developer and ease access to finance. A GBI could lock the central government into higher rate payments for longer periods of time, though it could also be structured to decrease over time, directly incentivizing improvements in efficiency or output for a project.

A GBI for wind producers was extended in late 2013, incentivizing greater generation and broadening the base of foreign direct investment sources.⁶⁵ A recent report by CEEW covering India's green industrial policies for wind and solar measured the net present value (NPV) of the total outlay while accounting for periodic subsidy (in GBI) and subsidy recovery (in the case of AD). The analysis indicated that in recent years, the fiscal outlay for AD (wind projects) was significantly higher than the outlay for GBI.⁶³

Power Bundling: During Phase 1, NRVN purchased solar power from Phase 1 developers and sold it at a reduced price after bundling it with an unallocated quota of coal-based power from traditional energy sources. This scheme was discontinued in Phase 2, Batch 1 due to limited unallocated power left for bundling, but is being reintroduced in Phase 2, Batch 2. A lower cost of solar reduces project risks perceived by financiers—such as the marketability of solar power and potential defaults by distribution companies—and therefore can reduce the cost of capital.⁶⁷

Domestic Content Requirement (DCR): The DCR clause has been revised under Phase 2 to make it technologically neutral, closing the loophole that resulted in an unintended bias toward thin-film technology in Phase 1. The DCR is applicable to 350 MW of the total 750 MW capacity being allocated under the current batch. Despite the inclusion of a source-neutral “open category” in Phase 2, DCR is a persisting cause of trade-related concerns raised by other countries, including the U.S. The DCR requirement may also hinder capacity addition due to lack of prompt equipment supply and may raise concerns related to after-sale service, equipment quality, and trade disputes.⁶⁸ It is expected that these concerns may be addressed if India drops the condition of local content in the next batch of solar power projects under the NSM, once penal duties are imposed on the import of solar panels.⁶⁹

Credit Guarantees: The Ministry of Finance approved a program that would provide a guarantee of up to 20 percent of the debt financing of projects in the power sector, including projects in renewable energy.⁵⁹ The guarantees allow projects to attain a higher credit rating, thus broadening the investor pool to include pension funds and insurance companies, and lower the rates.

Tax-free Bonds: IREDA, the public-sector, nonbank financing arm providing concessional financing for the NSM's solar projects, has started several new initiatives including co-financing, non-recourse financing, and securitization against future receivables. Starting in February 2014, IREDA began issuing 15-year tax-free bonds with an AAA credit rating.⁶⁰ These bonds offer attractive 8.8 percent rates and good returns to investors due to their tax-free nature and long tenure. IREDA has also started refinancing 30 percent of the debt after five years of commissioning at low interest rates (in the range of 2 to 5 percent).⁶¹ This will help to unlock developer equity for newer projects.

Project Size: The Phase 2 guidelines increase the minimum project size from 5 MW to 10 MW to ensure that serious and experienced developers will bid for projects, a concern raised by financiers during Phase 1 of the Mission. While financiers favor the increase in the project size threshold, they remain concerned about whether Phase 2's selected project developers can meet commissioning deadlines and loan repayments. Hence, the real impact of increased project size on bank lending practices remains to be seen.

Implementing Authority: SECI was designated as the implementing authority for Phase 2, as opposed to NRVN as in Phase 1. Although NRVN and SECI are ultimately both government-backed power trading companies, NRVN's considerably larger balance sheet (assuming it can offset losses in solar through other power trading investments) provided confidence to investors contemplating financing NSM projects. Stakeholders are now keenly watching to see how SECI discharges its role and responsibilities.

Payment Security Mechanism: To ensure timely payments to selected Phase 2 projects, MNRE directed SECI to establish and implement a “payment security mechanism” of approximately Rs 170 crore (\$27.64 million).⁶² Although SECI provides a letter of credit to backstop monthly bills as part of the PPA, concerns about SECI's financial strength to cover such defaults remains a significant issue for potential financiers.⁶³

INDIA'S SOLAR FINANCING ECOSYSTEM AND STAKEHOLDER PERSPECTIVES

India's solar financing ecosystem continues to grow and change as the market matures. It is made up of several strategic institutions and financial entities that, in varying

capacities, support the solar energy market and incentivize investments. Also in place are ancillary mechanisms that are essential to support market growth (see Figure 2).

Figure 2: India's Solar Financing Ecosystem

A range of private and public sector institutions play a role in enhancing bankability and overall solar market development

	INSTITUTIONAL EXAMPLES	ACTUAL/POTENTIAL ROLE
STRATEGIC LEVEL	Indian Public Sector (non-bank) Financial Intermediaries: Reserve Bank of India; IREDA; Life Insurance Corporation	Priority sector lending, Concessional loans, Long-term debt, Securitization
	Non-Financial Supporting Institutions: Solar Energy Corporation India, Indian Banks' Association, Solar Energy Centre, BEE, C-WET	Channeling funds, Information provision, Skills, R&D, Component certification
	Multilateral Funding Channels: International Finance Corporation, Asian Development Bank, World Bank, Clean Technology Fund, potentially Green Climate Fund	Payment guarantees, Capacity building (esp. due diligence), R&D
PROJECT LEVEL	Indian Banks: Axis Bank, Bank of Baroda, ICICI, IDBI, Indian Overseas Bank, State Bank of India, State Bank of Patiala, Union Bank of India, Vijaya Bank, Yes Bank	Debt financing, Non-recourse project finance, Innovative finance (e.g. IDFs)
	Non-Bank Financial Institutions: IDFC, Infrastructure Debt Funds (IIFC, L&T Infra), Rural Electrification Corporation Limited	Project finance, Support for market upscaling, Refinancing, Bridge financing
	International Financial Investors: Goldman Sachs, Apollo Management	Private Equity, Non-recourse finance
	Overseas Funding: Ex-Im Bank (U.S.), OPIC (U.S.), KfW (Germany), IFC, Multilateral Funding Channels	Concessional finance, Long-term debt, Bridge financing
	Other: Venture Capital, Private Equity (domestic and overseas), Corporate Debt, Public Markets, Other early-stage investors	Market entry support, Market upscaling, R&D
ANCILLARY MECHANISMS AND MEASURES	Fiscal support: SECI, NVVN/NTPC (bundling, short-term PPAs and PSAs), CERC (FiT), MNRE (Payment Guarantee Scheme)	Lowering costs, Incentivizing investment, Increasing market confidence
	Market Mechanisms: Carbon Markets (CDM and voluntary market), Renewable Energy Certificates	Additional revenue support to incentivize investment
	Infrastructural Support: Asian Development Bank, JICA, KfW, PFC	Evacuation Infrastructure, Grid Integration/stability (e.g. Green Corridor)
	Other: Bilateral Funding, Private Companies, Educational Institutions, National Skill Development Corporation, National Institute of Solar Energy (formerly SEC)	R&R&D, Skills development and training

Source: NRDC-CEEW survey, June 2014.

Since Phase 1, financial institutions have gained greater confidence that projects can successfully come online. Market information about the major players and project performance has also increased. The familiarity and experience gained during Phase 1 may enhance confidence and willingness among financial institutions to lend to Phase 2 developers, thereby increasing available capital.

Discussions and roundtables with financiers and key stakeholders revealed that many banks continue to perceive significant risk (Figure 3) in solar investments and have not yet embraced solar as a mainstream investment opportunity.

Concerns related to counterparty risk, lack of equity availability, lack of refinancing options, and lack of access to credible irradiance data still remain. A comprehensive financing strategy is a prerequisite for scaling up solar energy investments to meet the NSM's goals. Lenders perceive high interest rates, a weak capital market, and poor financial health of distribution companies as systemic problems that pose challenges to mobilizing of finance in India.⁷⁰ This problem is compounded by lack of access to cheap and long-term domestic debt financing.⁷¹

Figure 3: Financiers' Perspectives - Risks Perceived for Scaling Solar Energy⁷²

TECHNOLOGY SPECIFIC RISKS	POLICY RELATED RISKS	GENERAL RISKS
Lack of availability of credible solar irradiance data	Frequent changes in incentives structure	Delays in execution
Lack of availability of project and production data	Multiple mechanisms complicating the policy environment	Delays in revenues
Variation in cost of solar panels	Counterparty risk born out of lack of enforcement of RPOs	Evacuation risks
		Asset turning bad
		Economic slowdown

Financiers, developers, and most stakeholders view India's economic slowdown in 2013 and 2014 and the associated currency depreciation and inflation as reasons for reduced foreign direct investment (FDI) in India. The availability of low-cost financing from bilateral and multilateral sources under Phase 1 was considered key to the success of the initial phase. Although some international funding sources such as the World Bank express an eagerness to participate, other big players like OPIC have said they would not be participating as heavily in Phase 2 of the NSM as they did in Phase 1. Additionally, while self-financing might have helped to meet the relatively small scale of investment for Phase 1, this route cannot be a viable path to achieving the larger targets of Phase 2.

As seen in Phase 1, the RPO market is not being adequately enforced to give value to RECs and spur additional investment in large-scale solar projects. Although it is not clear that RPOs are enough to drive down the cost of capital, RPO enforcement by the central government is vital for the future of the renewable energy market in India. Poor enforcement of RPOs has led to low demand for—and therefore a decline in the value of—RECs, which were valued at their floor price for most of last year.⁷³

Top Priorities Listed by the Banking Community to Boost the Solar Market in India⁷⁴

- Deploy VGF within a year.
- Establish a contractual link between SECI and NCEF.
- Disburse subsidies through lending agencies or banks.
- Include renewable energy within priority sector lending.
- Channel insurance and pension funds into the renewable sector.
- Explore refinancing options for the solar market.

Recognizing these challenges at this critical scaling-up phase, MNRE introduced some innovative financing and policy mechanisms, such as VGF and AD, to support Phase 2's goal to achieve around 4,000–10,000 MW of total grid-connected solar installations by 2017. Although Phase 2 is still in its initial stages, stakeholders are forming early impressions regarding which changes from Phase 1 will help the NSM achieve widespread installation of solar power across India.

Green Energy Corridors

A lack of sufficient and timely power evacuation, the intermittent and variable nature of renewable energy, and grid integration challenges have delayed deployment of renewable energy projects, including solar, across India. These delays affect commissioning deadlines, profits, and investments.

In 2013, the Government of India announced plans to establish Green Energy Corridors worth Rs. 430 billion (\$6.9 billion) to facilitate evacuation of more than 30,000 MW of power generated from renewable energy sources into the national grid.⁷⁵ The central government, along with bilateral and multilateral agencies, is investing to upgrade the transmission infrastructure to improve grid stability and efficient transmission and enable the large-scale integration of renewable energy into India's power grid.

The project will integrate multiple grids into one large grid, and will allow electricity generated in areas with strong renewable energy sourcing to reach areas where renewable energy sourcing is limited. CERC and MNRE have identified eight potentially renewable-rich states as candidates for these Green Energy Corridors, and the ADB, JICA, and Germany's KfW are major financing partners.⁷⁶

FINDINGS

1. Trade disputes regarding solar equipment must be favorably resolved. Delays in government programs and frequent changes in proposed incentives complicated the policy environment, increasing uncertainty and perceived solar market risk. Nevertheless, interest in the solar market remains strong as demonstrated by the large number of bids received in the initial Phase 2 solar project allocations. Yet, the ongoing international trade dispute resulting from the domestic content requirement (DCR) and the announced anti-dumping duties on imported solar panels presents a major barrier to industry growth and prevents the creation of an environment that is conducive to investment.
2. According to financial institutions, top priorities to boost India's solar market are to: deploy VGF for Phase 2, Batch 1 projects within a year; strengthen the contractual link between SECI and the National Clean Energy Fund (NCEF) for these projects; disburse subsidies through lending agencies or banks; include renewable energy within priority sector lending; channel insurance and pension funds into the renewable sector; and explore refinancing options for the solar market. State incentive programs, including generation-based incentives (GBI), should be explored.
3. Apart from systemic problems such as high interest rates, weak capital markets, and poor financial health of distribution companies, lack of access to cheap and long-term domestic debt financing poses challenges in India. Implementing financing instruments such as VGF, refinancing, and securitization (initiatives of the Indian Renewable Energy Development Agency (IREDA)) has elicited a positive response from investors.
4. Over the course of Phase 1, lenders developed a level of comfort trading with the NTPC Vidyut Vyapar Nigam (NVVN), the nodal agency for signing of power purchase agreements (PPAs) to buy power directly from developers. For Batch 1 of Phase 2, SECI was appointed the new implementing agency that provides payment security for solar contracts. Some lenders expressed concerns about the organizational shift because they do not enjoy a similar level of confidence in SECI. MNRE responded to this feedback swiftly and reappointed NVVN as the experienced and successful nodal agency for Phase 2's Batch 2 projects. Although a reverse auction and bundling scheme has been proposed to be reinstated for Phase 2, Batch 2 projects, stakeholders participating in Phase 2, Batch 1 have noted that while VGF ensures that projects deliver to capacity, a quicker payment of VGF would lower their risks during such experimental schemes and organizational changes.

RECOMMENDATIONS

1. **Ensure timely program implementation of solar policies:** Both national and state programs must continue to advance market momentum through timely program implementation, with timelines for guidance, auctions, and payments. A comprehensive financing strategy with fewer—but effective—mechanisms and timely implementation of solar policy are needed to scale solar energy investments to meet the NSM's goals.
2. **Deploy VGF within the first year:** The central government must ensure effective implementation of the VGF for Phase 2, Batch 1 projects, with payment within the first year. It must also enhance finance programs at the national level and with states, giving serious consideration to GBIs and priority sector lending for utility-scale photovoltaic (PV) projects. The government should also work with financial stakeholders to modify policies in order to disburse subsidies through lending agencies or banks, channel insurance and pension funds into the renewables sector, and explore refinancing options for the solar market.
3. **Establish a contractual link between SECI and the NCEF and carve out a role for SECI moving forward:** Bringing back the more established NVVN for Phase 2, Batch 2 projects boosted investors' confidence as NVVN has proven its ability to provide payment security for solar contracts. However, strong government support of SECI and carving out a clear role for them moving forward in the Mission also important as the solar market scales up and the organization matures. Establishing a contractual link between SECI and the NCEF is also necessary to enhance credibility of the Phase 2, Batch 1 VGF scheme and the overall solar market.
4. **Increase transparency of solar market information:** The central government, states, developers, and financiers as part of the solar market ecosystem must continue to increase transparency and provide information on the progress of solar projects. Transparency and immediate market information are vital in boosting investor confidence and reducing perceived risks in solar investments.

SECTION 3

INNOVATIVE FINANCE PROGRAMS AND BEST PRACTICES

Several innovative financing mechanisms and government policies support accelerated market growth but have yet to be used for large-scale solar energy in India. Some policies have been considered or applied domestically in the Indian context for different sectors, while others have unlocked renewable financing in other countries. An overview of those alternatives can highlight new approaches to take in India to support the solar ecosystem during this critical scaling-up phase.

UNLOCKING PRIORITY SECTOR LENDING AND INFRASTRUCTURE DEBT FUNDS FOR SOLAR ENERGY ACCESS

While not currently deployed for grid-connected solar projects in India, priority sector lending and IDFs are examples of successful programs that could be applied to large-scale solar to increase available funding and lower the cost of capital. In discussions with financiers, project developers, government officials, and others, priority sector lending and IDFs rise to the top among financial mechanisms to unlock solar energy access.

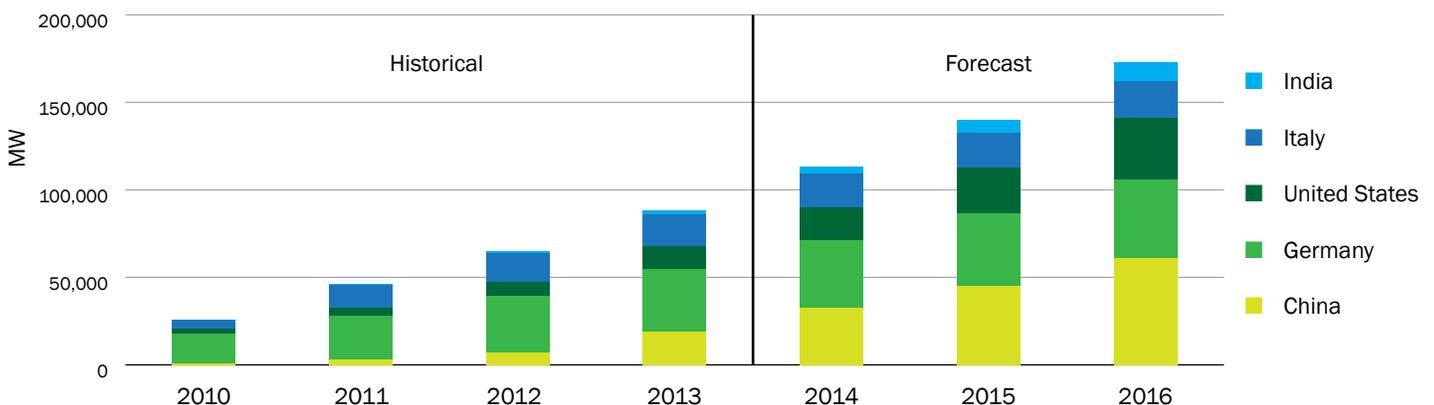
Priority Sector Lending: Recognizing the role banks can play in socioeconomic change, domestic commercial banks are required to give 40 percent of their credit to projects qualifying as “priority sectors”—economic sectors that might not otherwise get timely and adequate credit.⁷⁷ The recent priority given to off-grid solar by the RBI and to solar water heaters by several major bank-loan programs are a working example of this mechanism’s deployment to increase clean energy access.⁷⁸ Including larger-scale, grid-connected solar projects as a qualifying priority sector could allow banks to lend with lower interest rates and prevent funds for renewable energy from being crowded out due to power sector caps, as discussed in section 2. As recommended by financial institutions, even a 2 to 5 percent quota allocated for renewables could substantially increase the amount of funding available for solar power projects.⁷⁹

IDFs: As tradable instruments that are attractive to domestic and international long-term investors, IDFs can act as a conduit for debt financing into infrastructure projects with more favorable terms (lower interest rates and longer-term debt).⁸⁰ In 2011, the RBI issued guidelines for the operation of new IDFs, structured either as mutual funds or as companies, but they have not yet been used for renewable energy projects in India.⁸¹ For an IDF to buy out a debt, a project authority such as SECI would also have to provide guarantees, which requires credibility and financial strength.⁸² Although attractive as tradable instruments, lenders do not view SECI-backed IDFs with much hope because—due to SECI’s questionable financial strength—these mechanisms do not change the risk profile of a given project.⁸³ It remains to be seen how effective this tool will be at increasing the debt available for solar deals.

FINANCIAL MECHANISMS AND INSTRUMENTS UTILIZED INTERNATIONALLY

Solar markets in leading countries offer key insights into financial models that could be adapted to spur India’s solar industry and programs forward. The following successful programs utilized in other countries may offer best practices for India’s solar market.

Figure 4: Historic and Forecast Installed Solar Capacity (MW) in Four Leading Countries and India



Source: “H1 2014 India Market Outlook,” *Bloomberg New Energy Finance*, January 16, 2014.

China: China already gets more than 8 percent of its energy from non-fossil fuel sources, leads in wind installation, and is among the leading manufacturers of solar cells.⁸⁴ Renewable energy investment has risen considerably in the world's leading emerging market, and Chinese fiscal and governmental policies foster market development.

- **Renewable Energy Law:** China promotes renewable energy, including solar, through a legal framework consisting of mandated targets, market-based incentives, and direct subsidies.⁸⁵ Subsidies are administered through separate programs for building integrated PV applications, rural applications, and captive use.⁸⁶
- **Renewable Power Quotas:** Government agencies set and modify quotas annually for the proportion of power purchased that must come from renewable energy sources. This requirement is directed at power generating companies, grid companies, and provinces and encourages renewable energy investment.
- **FiTs:** Renewable electricity generators received a subsidy at market rates through set FiTs for electricity rates. China offers a national FiT at RMB 1 (\$0.164) per kWh with regional adjustments.⁸⁷
- **Priority Dispatch:** Government agencies require grid companies to give priority electricity dispatch to renewable energy generators over power plants fueled by coal or other high-emission plants.
- **Renewable Energy Development Fund:** Renewable energy surcharges are now allocated to a central Renewable Energy Development Fund. The central government manages the fund, instead of provincial grid companies, and this may spur further financial investment and development.

United States: As in India, solar energy in the U.S. is promoted through various state-level financing mechanisms in addition to national programs. The varied approaches used in the U.S. to finance solar projects offer success stories and cautionary tales for India's burgeoning market.

- **Loan guarantees:** For early projects without capital, loan guarantees were widely successful in lowering U.S. interest rates. However, the failure of one company invested in by the government (Solyndra) generated significant public relations backlash for the government, even though the portfolio of programs as a whole achieved a success rate over ninety five per cent, an incredible feat in technology risk management.
- **State-level Renewable Portfolio Standards (RPSs):** In California, for example, utilities procure solar energy to meet mandated renewable energy targets. In contrast to India's RPO program, the RPS has proved to be a very effective policy due to strong compliance and enforcement mechanisms.

- **Green Bonds:** Functioning like any other type of asset-backed bond, green bonds have the added requirement that the financing must be used for "green" projects such as renewable energy deployment. Issuers of green bonds may include governments (including state governments and export-import banks), intergovernmental organizations such as the World Bank or regional development banks, financial institutions, and other corporations. Green bonds enable refinancing of renewable energy projects, which increases liquidity and reduces the overall cost of the funds.⁸⁸ The advantages of green bonds in the Indian context could include access to domestic and foreign capital as well as relatively low interest rates, as discussed below in "International Trend: Unlocking Solar Finance Through Green Bonds."⁸⁹
- **Green Banks:** Clean energy banks are public-private financing institutions at the state level with the authority to raise capital through various means—including issuing bonds, selling equity, legislative appropriations, dedication of utility regulatory funds, or foundation grants—for the purpose of supporting clean energy and energy efficiency projects through financing tools such as loans and loan guarantees, often at below commercial rates. Green banks obtain low-cost capital and then use that cheap money to support clean energy projects at rates lower than for purely private sector transactions, resulting in significant savings in the cost of delivered clean energy (as much as 15 to 20 percent).⁹⁰
- **Master Limited Partnerships (MLPs) and Real Estate Investment Trusts (REITs):** MLPs and REITs can raise money on public exchanges but do not pay income tax at the corporate level (pass-through entities used to reduce the effect of double taxation), leading to a much lower cost of capital. Some MLPs structures can also improve the efficiency of a solar project by converting tax credits into actual capital. MLPs are allowed only for certain types of businesses at this time, and an act of Congress is required to include renewable energy. Solar REITs, on the other hand, require a ruling from the Internal Revenue Service (IRS) due to the tax ramifications of forming this type of investment trust.

Germany: The German renewable energy market is among the most expansive and innovative. A combination of national-level policies and investment protection has fostered tremendous growth since the German Renewable Energy Act (Erneuerbare-Energien-Gesetz, or EEG) was enacted in 2000. Climate protection targets, long-term strategies for future energy supply, and market-oriented innovation and cost reduction have allowed the expansion of renewable energy in Germany. However, lowered FiTs have lessened demand and led to a massive oversupply of solar panels in Germany, offering a lesson about the need for careful planning for the emerging solar market in India.⁹¹

International Trend: Unlocking Solar Finance Through Green Bonds

Developed in 2007 by Swedish investors, green bonds are proving to be effective in financing renewable energy market growth internationally. Several city and state governments internationally have deployed green bonds. For example, in April 2014 Paris issued its second bond, worth \$829 million for 12 years for renewable energy and energy efficiency.⁹⁶ The state of Massachusetts in the U.S. issued a green bond worth \$100 million (20-year bonds with interest rates between 3.20 and 3.85 percent) in June 2013, for projects to improve water and air quality and energy efficiency.⁹⁷ Recently, the city of Ontario in Canada announced plans for a \$500 million green bond in 2014.⁹⁸ A recent Bloomberg study noted that as of June 2014, more than \$16.6 billion worth of green bonds has been issued.⁹⁹ Standard & Poor's predicts that the green bond market could reach \$20 billion by the end of 2014, as compared with \$10.1 billion in 2013.¹⁰⁰ The Climate Bond Initiative predicts an even larger green bond market of \$40 billion for 2014.¹⁰¹

In India, the advantages of green bonds could include access to domestic and foreign capital as well as relatively low interest rates.¹⁰² Given its experience and role in the solar market, IREDA is well suited to be the issuing agency for green bonds.¹⁰³ A recent study indicates that India could reduce its clean energy cost by as much as 25 percent by issuing green bonds.¹⁰⁴ With green bonds, the government could offer funds that are one-third cheaper than commercial bank loans with double the tenure, given the government's higher domestic credit rating. However, several barriers exist for India, such as unfavorable market conditions for bonds, a smaller corporate debt market (14 percent of GDP, compared with 40 to 70 percent in developed countries).¹⁰⁵ Yet market conditions are improving, and some Indian states and municipalities may be interested in testing green bonds to grow local solar energy markets.

FRAMEWORK FOR ANALYZING THE IMPACT OF ALTERNATIVE FISCAL, FINANCIAL, AND POLICY MECHANISMS

The high upfront costs, information gaps, and other systemic challenges have limited solar market growth and widespread clean energy access in India. National, state, and local governments as well as financial institutions, as discussed above, have deployed mechanisms to support and stimulate clean energy markets. These mechanisms range from policy support and fiscal incentives to various financial instruments. India is at a critical juncture in its effort to scale the solar market to achieve 20 GW by 2022, and finance remains the key enabling element for the country to achieve this goal. The right policies leveraging the right financial mechanisms

- **Investment Protection Through FiTs:** In Germany, generated electricity from renewable energy facilities receives a fixed FiT rate. These rates are technology specific and guaranteed for 20 years. The long-term fixed price allows facilities, particularly small and medium-size enterprises, equal access to the energy production market and fuel rapid scaling of the renewable energy market. However, as widespread installations continue to increase, this FiT system becomes more costly. Additionally, the government makes guaranteed tariff payments regardless of demand—a problem when solar and wind installations oversupply the grid, an increasingly frequent issue.⁹² The excess power may be sold to foreign markets at reduced rates, but this situation is not profitable for German consumers or the government.
- **Remuneration Rates:** The price of fossil fuel-generated and renewable-generated electricity is passed on and paid for by the consumer, not by government-established subsidies, so that individuals who use more pay more. Thus, renewable energy market growth is spurred by consumption and generation, not by taxes on the German public.
- **Encouraging Innovation Through Lowered FiT Rates:** FiT prices are periodically lowered for new power plants. This creates an innovation incentive as firms conduct research and implement technologies that are more efficient and less costly.

Brazil: Brazil has demonstrated a vast potential for renewable energy growth and utilizes specialized tax regimes, national climate change targets, and public bidding through auctions to foster investment and market growth. With its similar growth and financing environment, including high interest rates, Brazil offers an intriguing example of an institution that could be implemented in India to address the renewables financing gap: the Brazil National Development Bank (BNDES). This is a major financier of clean energy projects, including wind energy, and supports renewable, transport, building, and industrial energy efficiency; waste-to-energy projects; prevention of desertification; and reduction of deforestation.⁹³ The BNDES provides low-cost, long-term financing at a large scale, cutting renewable energy costs by one-fifth while encouraging investment.⁹⁴ It acts as the main source of credit for both private and public companies across Brazil.⁹⁵

Norway: Norway has many national financial incentives to directly and indirectly encourage renewable energy. Green certificates are a primary subsidy for renewable energy, spanning Norwegian and Swedish markets. Companies that supply power to end consumers must purchase green certificates from renewable power plants, creating an additional cash flow to renewable energy sources. New and existing renewable generation sources that increase their production through construction are eligible to obtain green certificates.

will play a pivotal role in the industry's success. An inventory of available mechanisms that can potentially reenergize India's solar market can be a useful tool for policymakers and industry leaders to use to understand the relative advantages and disadvantages of each alternative.

CEEW and NRDC have prepared a framework that analyzes the impact of 30 mechanisms in making the solar ecosystem more vibrant and attractive to investors. The mechanisms have been assessed on the following points:

- Potential to stimulate capacity addition by attracting more investment, or potential to incentivize power production throughout the life of a project
- Potential to reduce the up-front costs or interest rates
- Potential to mitigate risks and raise investor confidence
- Potential to leverage existing government programs or market instruments that are being used in other sectors in India or in overseas markets

The potential impact of each available instrument can be evaluated with respect to its desirability and suitability in the Indian context. For instance, priority dispatch, a type of contract instrument that has been successfully deployed in Denmark and Germany, allows preference in access to the grid infrastructure. It can promote power production by leveraging generation capacity beyond the contracted amount, and it can also help lower capital costs by reducing expenditures on storage infrastructure. Similarly, IDFs give access to lower interest rates with longer tenures; these can promote capacity addition by making cheap funds available. Moreover, IDF is a well-known instrument that the Indian government is promoting to channel funds into infrastructure development and could be easily extended to solar energy with modifications.

In this manner, the policy framework below can help decision makers analyze various mechanisms, compare their utility, and then prioritize policy options based on the potential impacts and the risk profiles associated with each. Insights from this framework can help policymakers choose the best set of mechanisms with which to grow the solar energy market in India.

Framework for Analyzing the Impact of Alternative Fiscal, Financial, and Policy Mechanisms						
Type of instrument	Name of instrument	Duration/tenure	Capacity addition/Power production	Interest rates/Cost of capital	Risk mitigation	Leveraged in existing government programs or market instruments
Tariffs and contracts	Feed-in tariffs	10–25 years	Potential to drive solar capacity addition	No direct relation	Increases investor confidence due to investment protection and equal access to energy market	Globally: Standard practice in power sector. In E.U. nations and U.S.: being used for renewable energy.
	Power purchase agreements	Generally 25 years	Potential to drive solar capacity addition	No direct relation	Increases investor confidence due to assured revenue stream (assuming robust contracts)	In India: Exists in conventional power sector. In U.S. and U.K.: being used for renewable energy.
	Power bundling	As per policy	Potential to drive solar capacity addition	No direct relation	Reduces cost of renewable energy for customers	In India: Leverages existing unallocated capacity (successfully employed in Phase 1)
	Payment security mechanisms	As per policy	Potential to drive solar capacity addition	May reduce the cost of capital by reducing risk premium	Increases investor confidence by covering for defaults by distribution companies	No direct relation
	Generation based incentives	4–10 years	High potential to incentivize power production	Incentivizes easy access to finance	No direct relation	In India: Being used in wind and grid-connected rooftop solar sector
	Priority dispatch	As per policy	Can help leverage capacity beyond contracted amount	Can decrease capital costs by reducing storage costs	No direct relation	In Denmark and Germany: Given to renewable energy sector
	Remuneration rates	As per policy	Can foster growth of market as it allows passing costs to consumers	No direct relation	Increases opportunity to recoup investments	In Germany: Promotes growth of renewable sector on free market principles

Framework for Analyzing the Impact of Alternative Fiscal, Financial, and Policy Mechanisms

Type of instrument	Name of instrument	Duration/tenure	Capacity addition/Power production	Interest rates/Cost of capital	Risk mitigation	Leveraged in existing government programs or market instruments
Debt	Priority sector lending	As per policy	Intended to promote off-grid capacity addition	Increased availability of funds at lower cost (earmarked funds)	No direct relation	In India: Available for off-grid solar, SMEs, etc.
	Multilateral funds	Long-term (up to 18 years)	No direct relation	Lower interest rates (10.7 – 12%)	Builds capacity, strengthens market (e.g., R&D), enhances due diligence	Consortium lending
	Bilateral funds	Long-term (up to 18 years)	Tied support, which can increase capacity addition	Lower interest rates (10.7 – 12%)	Increases risks related to technology choice; enhanced due diligence	Consortium lending
	Credit guarantees	Up to loan duration	Limited impact	Does not reduce capital cost; adds to borrowing cost	Can increase investor confidence	In India: Used for small and medium-size industries, exports, etc.
	Infrastructure debt funds	Long-term	Can boost capacity addition by making cheap funds available	Lower interest rates	No direct relation	In India: IDF scheme; L&T Infra debt fund; tax-free infrastructure bonds (by IIFCL)
	Green bonds	Long-term	Can promote capacity addition by release of equity capital and refinance option	Increased access to capital pools; low cost of funds	No direct relation	Globally: Bonds by WB, IFC, ADB.
	Securitization	Not applicable	Can help in scaling up capacity through access to public market	Lower cost of capital and increased access to capital pools	Spreads risk widely and increases investor confidence	In India: General securities market including power sector. In California: SolarCity issued its first solar IPO
	Green banks	Long-term	Focused on renewable energy capacity addition	Low-cost finance (as it obtains low-cost capital)	Acts to reduce risk perception among investors	Being implemented at state level in U.S.
Direct financial transfers	Viability gap funding	Disbursal over 5 years (currently)	Alternative to power bundling mechanism; impact yet unknown	Reduced cost of capital due to up-front subsidy disbursal	No direct relation	In India: VGF scheme for PPP in infrastructure, new manufacturing policy
	Central development funds	Long-term	Central fund to spur renewable energy investment in China	No direct relation	Can be used for multiple purposes	In India: NCEF yet to gain major traction
Tax exemptions	Accelerated depreciation	As per policy	Attracted developers with large balance sheets to take advantage of tax benefits	No direct relation	No direct relation	In India: Offered to several industries and infrastructure sector
	Tradable tax certificates	As per policy	Can bring IPPs at par with captive investors and help raise additional financing	No direct relation	No direct relation	In India: Tradeable duty-free import credits. In U.S.: transferable tax credits in renewable energy
	Excise duty exemption	As per policy	Worked successfully in Phase 1 of NSM	Reduces cost of capital by reducing equipment costs	No direct relation	In India: Given across various sectors (manufacturing, export promotion, captive consumption, etc.)
	Master limited partnerships; real estate investment trusts	As per policy	Attracts investors by allowing IPPs to raise capital at public exchanges, monetize tax credits or AD, etc.	Lowers cost of capital	No direct relation	In U.S., Singapore, etc. for conventional power sector

Framework for Analyzing the Impact of Alternative Fiscal, Financial, and Policy Mechanisms						
Type of instrument	Name of instrument	Duration/tenure	Capacity addition/Power production	Interest rates/Cost of capital	Risk mitigation	Leveraged in existing government programs or market instruments
Regulation	Renewable purchase obligations/renewable portfolio standards	Permanent	Creates demand and attracts capacity addition	No direct relation	Risk reduction contingent on enforcement of RPOs	In China, California for renewable energy
	Renewable energy certificates/green certificates	730 days from date of issuance	Has attracted capacity addition, but market for RECs is declining; mechanism needs strengthening	No direct relation	No direct relation	In Norway: green certificates
	Carbon markets (cdm)	As per policy	Attracted investments initially, but plagued by regulatory and price uncertainties	No direct relation	No direct relation	No direct relation
Infrastructure support	Wheeling and transmission charges	Ongoing	No direct relation	Exemption reduces O&M and capital costs	No direct relation	In Andhra Pradesh and Tamil Nadu (Indian states): exemption to solar sector
	Renewable energy infrastructure development funds	As per policy	No direct relation	Reduces overall capital cost by reducing the burden of last-mile infrastructure costs	Reduces evacuation risks	In India: IDF scheme for infrastructure sector, Rajasthan's REID fund
Trade policy	Domestic content requirement	As per policy	May hinder capacity addition due to lack of prompt equipment supply	Increases overall capital cost of project	Creates risks related to after-sale service, equipment quality, and trade disputes	No direct relation
Other	Equity investment	Same as project	Low access to debt locks up equity in few projects	High share and cost of equity increases overall capital cost	Equity investor assumes larger risks	Globally: well-known instrument
	Risk insurance instruments	Same as project	Can attract risk-averse investors and help scale up solar	Cost of capital increases due to high premium for such products	Can cover risks related to technology, off-taker, PPA, and project development	In India: ADB and the World Bank have partial risk guarantee schemes available for RE projects; US, Japan: well developed market

Source: Adapted from Arunabha Ghosh et al., *Governing Clean Energy Subsidies: What, Why, and How Legal?* ICTSD Report, Geneva: International Centre for Trade and Sustainable Development, September 2012.

FINDINGS

1. Infrastructure Debt Funds (IDF) can act as conduits for debt financing for solar energy projects. Even though the Reserve Bank of India (RBI) has issued guidelines for IDFs, they have not yet been used for renewable energy in India. Similarly, priority sector lending can further increase the renewable energy market's access to lower-cost capital.
2. Several mechanisms, such as green bonds, are effectively used in international markets to stimulate solar market growth. International mechanisms ranging from debt and tariff instruments to tax exemptions and direct financial transfers offer practices for funding India's solar market. Each mechanism has specific potential impacts and associated risks, which determine its desirability and utility in a given context.
3. Green banks offer low-cost capital for clean energy development at rates lower than what is available in private sector transactions, resulting in significant savings in delivering clean energy. However, establishing a new institution of such scope is challenging.

RECOMMENDATIONS

- 1. Establish priority sector lending provisions for solar power:** To increase affordable domestic financing, the RBI, along with leading agencies including the Ministries of Power, Coal, New and Renewable Energy, and Finance, should explore priority sector lending for large-scale solar projects in addition to off-grid energy projects. Although priority sector lending has its limitations, a quota for renewable energy separate from the existing power sector quota can act as a catalyst to boost low-cost financing for the solar sector in India.
- 2. Introduce infrastructure debt funds (IDFs) for investments in solar power:** For longer-term debt and lower interest rates, the RBI should encourage the application of IDFs to renewable energy investments. An appropriate project authority, for instance SECI or IREDA, backed by a strong balance sheet, is needed to provide guarantees for this tool to be effective.
- 3. Pilot a system of green bonds and establish a green bank:** Leading municipal governments with central government support could pilot both a green bank and green bond systems for solar energy and other clean energy sources. In order to inject new liquidity and reduce the cost of capital, the Ministry of Finance, IREDA, the National Bank for Agriculture and Rural Development (NABARD), and domestic banks should take concrete steps to establish a green bank and green bonds for low-cost financing for greater clean energy access and development.

CONCLUSION

India is at a critical juncture in scaling solar energy to provide energy access to its growing cities and vast rural communities. The country added more than 1 GW of solar energy to its grid last year, nearly doubling the country's cumulative solar capacity to 2.6 GW as of the end of March 2014.¹⁰⁶ Growth in the industry since the launch of Phase 1 of the NSM in 2010, when installed solar capacity was only 17.8 megawatts (MW), shows that solar energy deployment is achievable and poised to scale up.¹⁰⁷ Successful state policies coupled with the first phase of the NSM demonstrated that strong government policies with active financial, business, and civil partners can successfully work together to create a solar energy ecosystem and give shape to a new clean energy market.

Financing remains the largest barrier to the expansion of India's solar energy market. Investments are expected to grow during the NSM's second phase, and yet, securing project financing is one of the greatest challenges for solar energy in India. The right policy settings and incentive structures must be adopted before solar investment will really take off in India. Diverse financial policies, some currently adopted by the central government and many that have proved successful on the state level or internationally, can help fuel India's solar market.

ENDNOTES

- 1 Government of India, MNRE, *Commissioning Status of Grid Connected Solar*, March 31, 2014, <http://mnre.gov.in/file-manager/User-Files/grid-connected-solar-power-project-installed-capacity-2013-14.pdf> (accessed August 8, 2014).
- 2 “H1 2014 India Market Outlook,” *Bloomberg New Energy Finance*, January 16, 2014.
- 3 Ibid.
- 4 Natalie Obiko Pearson, “India to Award 1 Gigawatt Solar Permits by 2015, Boosting Plan,” *Bloomberg Businessweek*, April 2, 2014, <http://www.businessweek.com/news/2014-04-02/india-to-award-1-gigawatt-solar-permits-by-2015-boosting-plan> (accessed April 9, 2014).
- 5 Rachna Singh, “Vasundhara Raje’s Green Concern a Black Spot on Solar Plant,” *Times of India*, February 10, 2014, <http://timesofindia.indiatimes.com/city/jaipur/Vasundhara-Rajes-green-concern-a-black-spot-on-solar-plant/articleshows/30134674.cms> (accessed April 9, 2014). See also Sharon Alle, “MNRE Plans to Develop 15GW Solar UMPPs in India,” *Solar Energy News*, November 15, 2013, <http://www.renewable-energy-technology.net/solar-energy-news/mnre-plans-develop-15gw-solar-umpps-india> (accessed June 2, 2014).
- 6 “H1 2014 India Market Outlook.”
- 7 Shreya Jai, “National Solar Mission Generated 252.5 MW Against the Target of 1100 MW in 2010-13,” *The Economic Times*, March 21, 2014, http://articles.economictimes.indiatimes.com/2014-03-21/news/48438336_1_capacity-addition-solar-mission-1-lakh-mw (accessed April 2, 2014). *Ministry of New and Renewable Energy: Achievements*, <http://mnre.gov.in/mission-and-vision-2/achievements/> (accessed June 2, 2014).
- 8 “India Solar: State Programs Responsible for Over Half of Installed Capacity,” *Solar Server*, February 24, 2014, <http://www.solarserver.com/solar-magazine/solar-news/current/2014/kw09/india-solar-state-programs-responsible-for-over-half-of-installed-capacity.html> (accessed April 2, 2014).
- 9 Ibid.
- 10 Raj Prabhu, *India: It’s Time for Results*, Mercom Capital, Q4 2011, <http://www.mercomcapital.com/india-its-time-for-results> (accessed April 2, 2014).
- 11 G. Balachandrar, “Solar Capacity in India crosses 2,500 MW,” *The Hindu*, April 5, 2014, <http://www.thehindu.com/business/Industry/solar-capacity-in-india-crosses-2500-mw/article5876808.ece> (accessed April 9, 2014). See also *Detailed Report on India’s National Solar Mission Phase II Batch I*, Spark Network, November 5, 2013, <http://www.renewableenergyworld.com/rea/blog/post/2013/11/detailed-report-on-indias-national-solar-mission-phase-ii-batch-i> (accessed April 2, 2014).
- 12 Natural Resources Defense Council (hereafter NRDC) and Council on Energy, Environment and Water (hereafter CEEW) roundtable discussions with financiers on solar finance, April 22, 2014, Mumbai.
- 13 Lucy Woods, “India Solar Auction Three Times Oversubscribed,” *PV Tech*, January 20, 2014, http://www.pv-tech.org/news/india_jnnsmpd_auction_flooded_with_proposals (accessed March 28, 2014).
- 14 G. Shrimali et al., *Solving India’s Renewable Energy Financing Challenge: Which Federal Policies Can Be Most Effective?* Indian School of Business and Climate Policy Initiative, March 2014, <http://climatepolicyinitiative.org/wp-content/uploads/2014/03/Which-Federal-Policies-can-be-Most-Effective.pdf> (accessed March 28, 2014). See also David Nelson et al., *Meeting India’s Renewable Energy Targets: The Financing Challenge*, Indian School of Business and Climate Policy Initiative, 2012, <http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Meeting-Indias-Renewable-Targets-The-Financing-Challenge.pdf> (accessed March 21, 2014). See also Natalie Obiko Pearson, “Green Bonds Could Cut India Clean Energy Cost by 25%: Report,” *Bloomberg*, April 23, 2014, <http://www.bloomberg.com/news/2014-04-24/green-bonds-could-cut-india-clean-energy-cost-25-report.html> (accessed June 3, 2014).
- 15 For example, OPIC and Ex-Im Bank offer lower interest rates and favorable financing terms for developers who buy U.S.-made products for their solar projects.
- 16 “2011 Worldwide Renewable Investments Set Record,” *Today’s Energy Solutions*, January 25, 2012, onlinetes.com/worldwide-renewable-energy-investments-tes-012512.aspx (accessed April 2, 2012).
- 17 From interviews of stakeholders participating in the 2013 Intersolar Conference, Mumbai.
- 18 NRDC, CEEW, *Laying the Foundation for a Bright Future: Assessing Progress Under Phase 1 of India’s National Solar Mission*, April 2012, <http://www.nrdc.org/international/india/national-solar-mission-ph1.asp> (accessed March 21, 2014).
- 19 Ibid., endnote 23.
- 20 Discussions with stakeholders, November to December 2011; interviews with MNRE officials, March 2012. See also NRDC, CEEW, *Laying the Foundation*.
- 21 Solarcon India 2011 presentation by Ex-IM Bank, November 10, 2011. This number includes the average baseline lending rate in India of around 9 percent as consolidated with bank margins. See also NRDC, CEEW, *Laying the Foundation*. This number includes lines of credit averaging around 3.5 percent combined with interest rate and currency hedging costs. For instance, Ex-Im has provided direct loans at 3.18 percent for an 18-year term.
- 22 NRDC, CEEW, *Laying the Foundation*. See also Solarcon India 2011 presentation by the Indian Renewable Energy Development Agency, November 10, 2011.
- 23 CEEW-NRDC roundtable discussions with financiers on solar finance. NRDC, CEEW, *Laying the Foundation*.
- 24 Solar Radiation Resource Assessment (SRRA) stations set up by C-WET, http://cwet.res.in/web/html/departments_sr-ra.html (accessed April 30, 2014).
- 25 Bridge to India, *Bankability and Debt Financing for Solar Projects in India*, <http://www.bridgetoindia.com/our-reports/indian-solar-decision-briefs/> (accessed April 30, 2014).
- 26 PACE-D Technical Assistance Program, *Financing Renewable Energy in India*, October 2013, <http://www.pace-d.com/wp-content/uploads/2013/10/RE-Finance-Report.pdf>.
- 27 MNRE, *Jawaharlal Nehru National Solar Mission Phase 2 Policy Document*, <http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf> (accessed March 29, 2014).
- 28 World Bank and Energy Sector Management Assistance Program (hereafter ESMAP), *Paving the Way for a Transformational Future: Lessons from JNNSM Phase 1*, <http://www.esmap.org/sites/esmap.org/files/ESMAP-World%20Bank%20Publication%20-%20Paving%20the%20Way%20for%20a%20Transformational%20Future%20-%20Lessons%20from%20JNNSM%20Phase%20I.pdf> (accessed March 29, 2014).
- 29 “H1 2014 India Market Outlook.”
- 30 Capital Markets Climate Initiative, “Scaling Up Solar in India Through Public-Private Action,” https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48271/4174-scaling-up-solar-india.pdf.
- 31 Sources: Export-Import Bank of the United States, Annual Report 2013, www.exim.gov/about/library/reports/annualreports/2013/annual-report-2013.pdf; Overseas Private Investment Corporation, 2012 Annual Report, www.opic.gov/sites/default/files/files/OPIC_2012_Final.pdf; Gujarat Energy Development Corporation, *Solar PV Plants Commissioned in Gujarat (as on 31.03.2013)*, geda.gujarat.gov.in/news_single.php?news=45; International Finance Corporation, IFC Annual Report 2013: *The Power of Partnerships*, www.ifc.org/wps/wcm/connect/d020aa004112357a8975fffe5679ec46/AR2013_Full_Report.pdf?MOD=AJPERES; Asian Development Bank, Annual Report 2012, www.adb.org/sites/default/files/adb-annual-report-2012.pdf.

- 32 Certified emission reduction (CER) is a unit of greenhouse gas emission reductions issued pursuant to the Clean Development Mechanism of the Kyoto Protocol, measured in metric tons of carbon dioxide equivalent.
- 33 “India’s Largest Solar Energy Project Registers for CDM,” *Energy Next*, July 23, 2013, <http://www.energynext.in/indias-largest-solar-projects-registered-for-cdm/> (accessed June 20, 2014). “Indian Solar PV Capacity Registered Under CDM Crosses 100 MW, Gujarat Dominates,” *Climate Connect*, <http://www.climate-connect.co.uk/Home/?q=India%20solar%20PV%20capacity%20registered%20under%20CDM%20Gujarat%20JNNSM%20> (accessed June 20, 2014).
- 34 “Time to Tap Solar Power on a Priority Basis,” *New Indian Express*, April 11, 2014, <http://www.newindianexpress.com/editorials/Time-to-Tap-Solar-Power-on-a-Priority-Basis/2014/04/11/article2161170.ece> (accessed June 3, 2014).
- 35 David Nelson et al., *Meeting India’s Renewable Energy Targets*.
- 36 D.S. Arora et al., *Indian Renewable Energy Status Report*, National Renewable Energy Laboratory, German Technical Cooperation, Renewable Energy Policy Network for the 21st Century Secretariat in France, and Integrated Research and Action for Development in India, 2010, <http://www.nrel.gov/docs/fy11osti/48948.pdf>.
- 37 USAID India, *Renewable Energy Finance in India*, Partnership to Advance Clean Energy—Deployment (PACE-D) Technical Assistance Program, April 16, 2013, <http://www.pace-d.com/wp-content/uploads/2013/04/RE-Finance-Presentation-EVI.pdf>.
- 38 Remya Nair and Utpal Bhaskar, “India Seeks to Revive Interest in Wind Sector,” *Live Mint*, July 25, 2013, <http://www.livemint.com/Industry/HzQ1NGtt9kX7MqsJcJPcmO/India-seeks-to-revive-interest-in-wind-sector.html>.
- 39 MNRE, *Salient Features: Solar Policies*, 2013, http://mnre.gov.in/file-manager/UserFiles/guidelines_sbd_tariff_gridconnected_res/salient_features_for_State-wise_solar_policies.pdf (accessed May 20, 2014).
- 40 Ibid.
- 41 NRDC, CEEW, *Laying the Foundation*.
- 42 MNRE, *Salient Features: Solar Policies*.
- 43 Ibid.
- 44 Ibid.
- 45 MNRE, *Reference Draft Guidelines for Setting Up of 750 MW Grid Solar PV Power Projects with Viability Gap Funding Under JNNSM, Ph-2, B-1*, http://mnre.gov.in/file-manager/UserFiles/final-VGF_750MW_Guidelines_for-grid-solar-power-projects.pdf (accessed March 21, 2014).
- 46 Headway Solar, *Project Allocations Under the National Solar Mission Phase II, Batch I: An Overview*, March 2014, <http://headwaysolar.com/JNNSM-National-Solar-Mission-Phase-II-Batch-I-Result-analysis.pdf> (accessed August 8, 2014).
- 47 Ernst & Young, *Renewable Energy Country Attractiveness Index*, Issue 40, February 2014, http://indianpowersector.com/home/wp-content/uploads/2014/02/EY-Renewable-Attractiveness_Feb-2014.pdf (accessed March 29, 2014).
- 48 The 375 MW in the “open category” of Phase 2, Batch 1 was three times oversubscribed, while the 375 MW in the category requiring compliance with the domestic content requirement was two times oversubscribed. Solar Energy Corporation of India (hereafter SECI), *Notification Regarding Selected Projects of 750 MW Grid Connected Solar PV Projects Under JNNSM Phase-II, Batch-I*, February 25, 2014, http://seci.gov.in/upload/uploadfiles/files/Final%20allocation%20list_750%20MW%281%29.pdf (accessed March 29, 2014). See also Lucy Woods, “India Solar Auction.”
- 49 SECI, *Notification Regarding Selected Projects*.
- 50 See, for example, M. Chadha, “India to Set Up Ultra Mega Solar Power Plant—4,000 MW Capacity,” *CleanTechnica*, September 24, 2013, <http://cleantechnica.com/2013/09/24/india-set-ultra-mega-solar-power-plant-4000-mw-capacity/> (accessed April 2, 2014).
- 51 SECI, *Notification Regarding Selected Projects*.
- 52 Headway Solar, *Project Allocations Under the National Solar Mission Phase II, Batch I: An Overview*, March 2014, <http://headwaysolar.com/JNNSM-National-Solar-Mission-Phase-II-Batch-I-Result-analysis.pdf> (accessed August 8, 2014).
- 53 Government of India, MNRE, “Draft Guidelines for Phase 2, Batch II projects,” July 16, 2014, http://mnre.gov.in/file-manager/UserFiles/Draft-Guidelines-for-1500%20MW%20NSM-Ph_II-%20Batch_II.pdf (accessed August 8, 2014).
- 54 The VGF targets capital grants to facilitate certain infrastructure projects that the government has determined are necessary but not commercially viable without government intervention to “meet the funding gap,” including NSM projects. MNRE, *Jawaharlal Nehru National Solar Mission Phase 2 Policy Document*.
- 55 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 56 Ibid.
- 57 David Nelson et al., *Meeting India’s Renewable Energy Targets*.
- 58 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 59 Remya Nair, “IFCL, PFC Tie-up Likely; Will Help Reduce Loan Rates for Power Firms,” *Live Mint*, July 25, 2013, <http://www.livemint.com/Industry/RjIPOS9eK8AU7NI6gjTxiL/IFCL-PFC-tieup-likely-will-help-reduce-loan-rates-for-po.html>.
- 60 Radhika Merwin, “This Time, Go for 15-year Tax-free Bonds,” *The Hindu Business Line*, February 16, 2014, <http://www.thehindubusinessline.com/features/investment-world/beyond-stocks/this-time-go-for-15year-taxfree-bonds/article5696223.ece> (accessed April 30, 2014).
- 61 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 62 SECI, *JNNSM Phase-II, Batch-I: Clarity on Payment Security Mechanism*, http://seci.gov.in/content/news_update/jnnsmpd-ii-batch-i-clarity-on-payment-security-mechanism.php (accessed March 29, 2014).
- 63 SECI, *Draft Standard Power Purchase Agreement for Procurement of Solar Power on Long-Term Basis Under JNNSM Phase II, Batch I Scheme*, August 1, 2013, http://seci.gov.in/upload/uploadfiles/files/Standard%20Power%20Purchase%20Agreement-JNNSM%20Phase%20II%20Batch%20I-V02_08012014.pdf (accessed April 1, 2014).
- 64 MNRE, *Working Draft: JNNSM Phase 1—Policy Document*, December 2012, <http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf> (accessed March 29, 2014).
- 65 Debjoy Sengupta, “Government Extends Generation Based Incentive Scheme for Wind Power,” *The Economic Times*, September 5, 2013, http://articles.economictimes.indiatimes.com/2013-09-05/news/41802395_1_wind-power-generation-based-incentive-merchant-power-plants (accessed March 29, 2014).
- 66 K. Ganesan et al., *Assessing Green Industrial Policy: The India Experience*, CEEW, March 2014, http://ceew.in/pdf/India-Green-Industrial-Policy_APRIL17.pdf (accessed June 20, 2014).
- 67 World Bank and ESMAP, *Paving the Way for a Transformational Future*.
- 68 Lucy Woods, “SunEdison Drops Domestic Content Project in India,” *PV Tech*, April 7, 2014, http://www.pv-tech.org/news/sunedison_drops_domestic_content_project_in_india (accessed June 2, 2014).
- 69 Amiti Sen, “Local Sourcing Clause May Go for Solar Projects,” *The Hindu Business Line*, May 21, 2014, <http://www.thehindubusinessline.com/economy/local-sourcing-clause-may-go-for-solar-projects/article6034192.ece> (accessed May 26 2014).
- 70 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 71 Ibid.
- 72 Ibid.

- 73 "REC Trading Report—March 2014," *Open-Access*, Team REConnect blog, March 26, 2014, <http://reconnectenergy.com/blog/2014/03/rec-trade-report-march-2014/> (accessed April 8, 2014).
- 74 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 75 "Government Plans to Roll Out Rs 430 Billion 'Green Energy Corridor' Project," *Panchabuta*, August 15, 2013, <http://panchabuta.com/2013/08/15/govt-plans-to-roll-out-rs-430-billion-green-energy-corridor-project/> (accessed April 9, 2014). See also Press Information Bureau, *Government of India, Power Minister Leads High-level Delegation to Germany*, press release, May 15, 2013, pib.nic.in/newsite/erelease.aspx?relid=95990 (accessed April 11, 2014).
- 76 Ministry of Power, Power Grid Corporation of India, "Green Energy Corridors" Report Released by Hon'ble Union Minister of Power, http://www.powergridindia.com/_layouts/PowerGrid/User/PressRelease.aspx?PRId=2&LangID=&PId=277 (accessed April 9, 2014). See also T. Ramakrishnan, "German Bank to Fund Green Energy Corridors Project," *The Hindu*, February 16, 2014, <http://www.thehindu.com/news/national/tamil-nadu/german-bank-to-fund-green-energy-corridors-project/article5694235.ece> (accessed April 9, 2014).
- 77 Sectors include agriculture, micro credit, educational loans, and village industry. Reserve Bank of India, *Priority Sector Lending: Targets & Classifications*, February 1, 2014, <http://www.rbi.org.in/scripts/FAQView.aspx?id=87> (accessed April 2, 2014).
- 78 M. Ramesh, "Priority Lending for Off-grid Solar Products Will Boost Solar Industry Growth: Ashden Founder," *The Hindu Business Line*, October 13, 2012, <http://www.thehindubusinessline.com/industry-and-economy/priority-lending-for-offgrid-solar-products-will-boost-solar-industry-growth-ashden-founder/article3994622.ece>. Baerbel Epp, *India: Commercial Banks Give Priority to Solar Water Heater Loans*, Global Solar Thermal Energy Council, October 6, 2013, <http://solarthermalworld.org/content/india-commercial-banks-give-priority-solar-water-heater-loans>.
- 79 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 80 PACE-D Technical Assistance Program, *Financing Renewable Energy in India*.
- 81 PACE-D Technical Assistance Program, *Financing Renewable Energy in India*. Reserve Bank of India, *Infrastructure Debt Funds (IDFs)*, November 21, 2011, <http://rbi.org.in/scripts/NotificationUser.aspx?id=6830&Mode=0> (accessed April 2, 2014).
- 82 PACE-D Technical Assistance Program, *Financing Renewable Energy in India*.
- 83 CEEW-NRDC roundtable discussions with financiers on solar finance.
- 84 Jonathan Moch, *China FAQs: Renewable Energy in China*, Network for Energy and Climate Information, July 16, 2013, <http://www.chinafaqs.org/library/chinafaqs-renewable-energy-china-overview-0> (accessed April 2, 2014).
- 85 People's Republic of China, *Renewable Energy Law of the People's Republic of China*, English translation, 2007, http://www.npc.gov.cn/englishnpc/Law/2007-12/13/content_1384096.htm (accessed April 2, 2014). See also Jonathan Moch, *China FAQs*.
- 86 Nitin Kumar, *Asia Solar: On Firmer Ground*, Nomura Equity Research, November 2013. See also, Asia Europe Clean Energy Advisory Co. (AECEA), *March 2012 Briefing Paper: China Solar Development*, March 2012, http://www.frankhaugwitz.info/mediapool/134/1345433/data/2012_03_China_Briefing_Paper_Solar_Market_Development_Frank_Haugwitz_AECEA.pdf, (accessed April 2, 2014).
- 87 Nitin Kumar, *Asia Solar*.
- 88 Farah Khaliq, "Green Bonds Win New Fans and Investors," *Financial News*, June 18, 2013, <http://www.efinancialnews.com/story/2013-06-18/green-bonds-win-fans-investors> (accessed April 2, 2014). Vibhash Garg, "Solar Mission Financing," *Power Today*, January 9, 2011, <http://www.constructionupdate.com/asapp/magazineuser/ViewTopic.asp?conts=21155> (accessed April 9, 2014).
- 89 USAID India, *Renewable Energy Finance in India*.
- 90 K. Berlin et al., *State Clean Energy Finance Banks*, Brookings-Rockefeller Project on State and Metropolitan Innovation, September 2012, <http://www.brookings.edu/~media/research/files/papers/2012/9/12%20state%20energy%20investment%20muro/12%20state%20energy%20investment%20muro> (accessed March 21, 2014).
- 91 Bentham Paulos, "Are the Legacy Costs of Germany's Solar Feed-in Tariff Fixable?" *Green Tech Media*, June 4, 2014, <http://www.greentechmedia.com/articles/read/germany-moves-to-reform-its-renewable-energy-law> (accessed August 8, 2014).
- 92 Jeffrey Michel, "Can Germany Survive the *Energiewende*?" *Energy Post*, March 13, 2014, <http://www.energypost.eu/energiewende-doomed/> (accessed April 2, 2014).
- 93 PACE-D Technical Assistance Program, *Financing Renewable Energy in India*.
- 94 David Nelson et al., *Meeting India's Renewable Energy Targets*.
- 95 Ibid.
- 96 Sean Kidney, *Île-de-France issues EUR600m (\$830m), 12yr, AA+ Green Muni*, Climate Bonds Initiative, April 15, 2014, <http://www.climatebonds.net/2014/05/%C3%AEile-de-france-issues-eur600m-830m-12yr-aa-green-muni-they-had-so-many-orders-one-hour>.
- 97 Mike Cherney, "Massachusetts Goes 'Green,'" *The Wall Street Journal*, June 4, 2013, <http://online.wsj.com/news/articles/SB10001424127887324563004578525762271478512>.
- 98 Cecile Gutscher, "Ontario to Issue Green Bonds Within Months, Finance Chief Says," *Bloomberg*, May 1, 2014, <http://www.bloomberg.com/news/2014-05-01/ontario-to-issue-green-bonds-within-months-finance-chief-says.html>.
- 99 Ehren Goossens, "Green Bonds Seen Tripling to \$40 Billion on New Entrants," *Bloomberg*, June 3, 2014, <http://www.bloomberg.com/news/2014-06-03/green-bonds-seen-tripling-to-40-billion-on-new-entrants.html>.
- 100 Marc Roca, "Green Bonds from Companies Seen Doubling to 20 Billion," *Bloomberg*, May 20, 2014, <http://www.bloomberg.com/news/2014-05-20/green-bonds-from-companies-seen-doubling-to-20-billion.html> (accessed August 8, 2014).
- 101 Ibid.
- 102 USAID India, *Renewable Energy Finance in India*.
- 103 Vibhash Garg, "Solar Mission Financing."
- 104 Natalie Obiko Pearson, "Green Bonds Could Cut India Clean Energy Costs 25%: Report," *Bloomberg*, April 23, 2014, <http://www.bloomberg.com/news/2014-04-24/green-bonds-could-cut-india-clean-energy-cost-25-report.html> (accessed June 15, 2014).
- 105 M Allirajan, "Franklin Templeton to Launch Banking and PSU Debt Fund," *The Times of India*, April 1, 2014, <http://timesofindia.indiatimes.com/business/india-business/Franklin-Templeton-to-launch-banking-and-PSU-debt-fund/articleshow/33078308.cms> (accessed June 15, 2014).
- 106 Ministry of New and Renewable Energy (hereafter MNRE), *Commissioning Status of Grid Connected Solar Power Projects Under JNNSM, 2013-2014*, <http://mnre.gov.in/file-manager/UserFiles/grid-connected-solar-power-project-installed-capacity-2013-14.pdf> (accessed April 9, 2014).
- 107 SolarServer, "India Installs More Than 1 GW of Grid-Tied Solar PV, CSP in 2013," *OFWeek*, January 18, 2014, <http://global.ofweek.com/news/India-installs-more-than-1-GW-of-grid-tied-solar-PV-and-CSP-in-2013-6606> (accessed August 8, 2014).



Natural Resources Defense Council

40 West 20th Street
New York, NY 10011
212 727-2700
Fax 212 727-1773

www.nrdc.org



Council on Energy, Environment and Water

Thapar House
124 Janpath
New Delhi 110001
+91 11 40733300
Fax: +91 11 40733399

www.ceew.in

Copyright © 2014 Council on Energy,
Environment and Water and Natural
Resources Defense Council

All rights reserved. No part of this
publication may be reproduced, stored
in a retrieval system or transmitted, in
any form or by any means, electronic,
mechanical, photocopying, recording or
otherwise, without prior permission.