

THE BOTTOM LINE

India's national- and state-level experience with auctions of solar energy products both large and small attests to the flexibility and adaptability of auction mechanisms. Under the National Solar Mission, auctions have been implemented with good results in a variety of settings. Lessons include the importance of clear ideas about key goals and objectives—and about areas where sacrifices can be made. Experience in several states has also underlined the importance of regulatory stability.



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Promoting Renewable Energy through Auctions: The Case of India

Why is this case interesting?

India's National Solar Mission led to concurrent implementations of renewable auction schemes

Although India is the fifth-largest electricity consumer of the world, with an installed capacity of 211 GW as of the end of 2011, the country's energy sector still has immense potential for growth. A quarter of the country's population lack access to electricity, and yearly electricity consumption per capita stands at just 684 kWh, less than a third of Brazil's and around a fifth of China's. Solving India's significant supply-side problems would open major opportunities for load growth, and renewable generation could be an important part of such a scenario.

Renewable energy—notably wind and solar—has played an important role as a complement to India's coal-based electricity generation mix. Attractive fiscal and financial incentives introduced in the 1990s favored the growth of the Indian wind energy sector, to the point that by the end of 2012 the country ranked fifth in the world in installed wind power capacity (19 GW). When India decided to launch its Jawaharlal Nehru National Solar Mission (NSM) in January 2010, policy makers aimed to do for solar power what the previous policies had done for wind, enabling the Indian solar power sector to become an important international player. However, solar energy was not as close to competitiveness in the Indian context as was wind power, requiring greater efforts from policy makers to reach the expansion target.

Under the NSM, the central government initially organized energy auctions to procure new solar capacity. For the longer term,

much of the capacity expansion was to be decentralized to the state level. Motivated to design their own solar policies and targets, many of the state governments adopted auction mechanisms as a central scheme to achieve their goals, inspired largely by the central government's initiatives. Because the Indian experience was varied, with implementation tailored to local circumstances, it is a valuable case study for the use of auctions to promote renewable energy.

What was the major challenge?

Auction designs had to take into account local peculiarities as well as national objectives

Auctions were to play a central role in the early stages of development of the NSM. In the NSM mission statement (MNRE 2012), competitive bidding schemes were singled out as important supporting mechanisms specifically for research and development initiatives, ensuring adequate price discovery in contracting for pilot and demonstration projects. In Phase 1, encompassing the years 2010 to 2013, the NSM aimed to build between 1,000 and 2,000 MW of grid-connected solar power. Of that amount, 1,000 MW (that is, between 50 percent and 100 percent of the target) was to be contracted through centralized auctions.

Increasingly, the NSM scheme has relied on decentralized implementations. The NSM mission document states that the keys to promoting solar power over the longer term (culminating in 20 GW of installed capacity by 2022) should be a renewable purchase obligation (RPO) scheme and state-level initiatives. In a policy document produced for NSM's Phase 2 (2013–17) (GERC 2012), the

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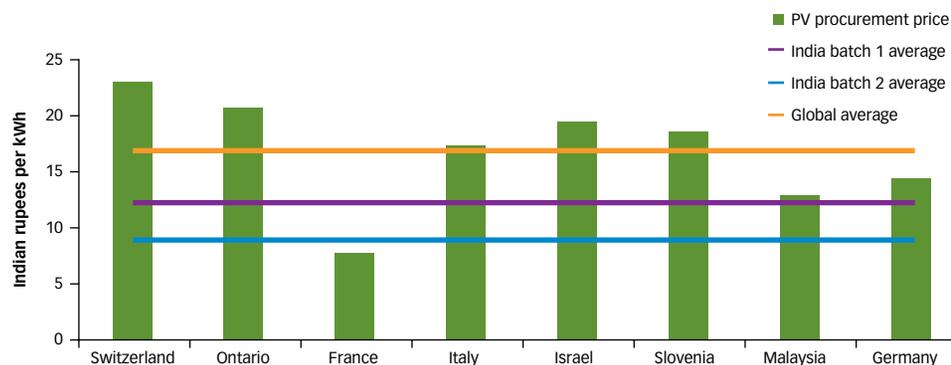
government estimated that state policies would be responsible for 60 percent of solar capacity additions during these years. States were given a large degree of autonomy to set and implement local policies, and many have chosen auction schemes to ensure solar capacity expansion at minimum cost. The greater involvement of the states during Phase 2 has posed new challenges of coordination, harmonization of policies, and sharing of best practices among states.

Reducing the impact of renewable energy development on electricity tariffs has been a major concern of both the central and state governments. In general, the higher costs of solar power must ultimately be passed through to final consumers. Auction schemes are useful in this sense, because they tend to minimize costs to consumers (Bridge to India 2012–14), and the NSM has taken further steps to dilute the tariff impact of contracting more expensive solar power. In Phase 1 of the NSM, a so-called “bundling” scheme was used to dilute these costs in a cheaper generation portfolio, whereas in Phase 2 a mechanism known as viability gap funding (VGF) was used to dilute solar costs over time. In a VGF scheme, the government pays a part of the plant’s capital cost up front and ensures a fixed payment per unit of energy delivered for the contract’s duration. Introduction of the VGF scheme in Phase 2 was made necessary by the nonavailability of a cheaper pool of thermal generation for bundling, and made possible by the National Clean Energy Fund’s approval of VGF as a funding source.

India also set the goal of achieving a global leadership role in solar manufacturing. This objective was very prominent in the NSM documents, which discussed the financial and fiscal benefits to be gained, the development of human capital, and other underlying infrastructure and ecosystem enablers. Policy design mechanisms were chosen with these concerns in mind. It was expected that demand for solar equipment stimulated by the NSM would spur the Indian solar manufacturing sector.

The technological routes to the NSM targets were left open, with the NSM aiming to maintain neutrality with respect to technology

Figure 1. Procurement prices for solar PV projects worldwide



Source: Deloitte.

choices. That said, the implicit focus of central and state policies has changed over the years. In Phase 1, the government placed equal emphasis on large-scale concentrated solar power (CSP) and solar photovoltaics (PV); whereas more recent implementations have emphasized the PV technology for its shorter construction period, lower prices, and greater success in most early implementations. Another shift in focus has been the more recent development of mechanisms aimed at smaller-scale rooftop implementations, following the successful commissioning of the first large-scale PV plants.

What results were achieved?

Both national- and state-level auctions have led to successful projects

The Indian central government’s experience with auction implementations can be split into three main segments.

Phase 1 auctions. The first centralized auctions for procuring utility-scale solar plants were carried out in August 2010 and August 2011. Extremely important in breaking new ground, these auctions resulted in impressive price discounts that made India one of the cheapest places for solar power in the world (figure 1). The auction demand was split into 500 MW of PV and 500 MW of CSP implementations. CSP plants, which usually involve larger capacities and longer construction times, were seen at the time as an attractive alternative to PV, which had historically been more common worldwide. At least

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five of the seven CSP projects that were commissioned, however, suffered serious delays. As a result, more recent policies have focused on PV implementations. Among PV plants, delays have been relatively manageable: 125 MW out of the 140 MW sold in the August 2010 auction were operational in March 2012; and the entire 310 MW sold in the August 2011 auction was operational in May 2013.

Prices and quantities of the most important national- and state-level auctions for solar PV are summarized in figure 2.

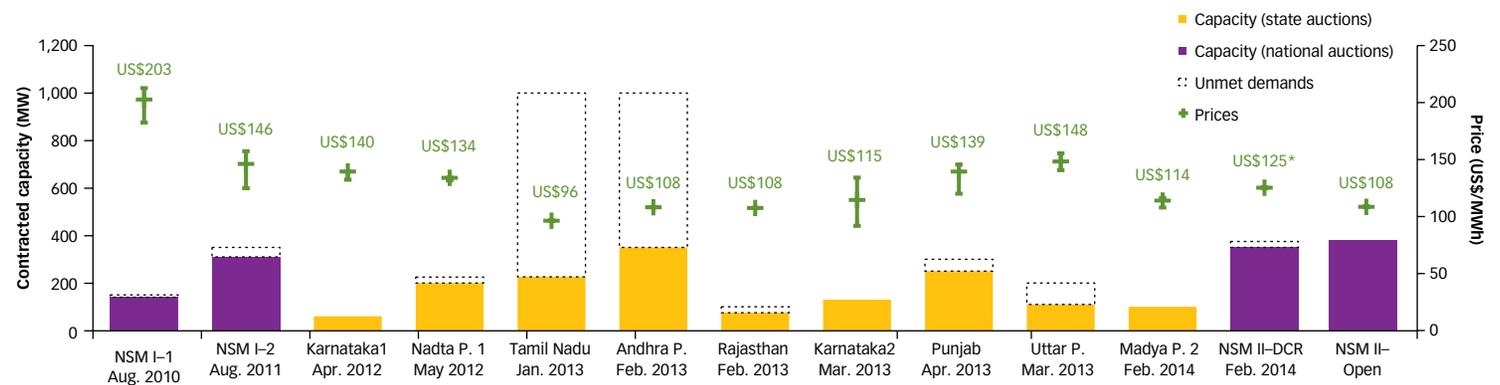
The rooftop auctions. In April, July, and December 2013, the central government conducted auctions for rooftop solar generation in specific cities. The product awarded in these auctions involves a capital subsidy for part of the plant’s investment cost. The generator is entitled to sell the electricity in the market. While the awarded capacities have been small (a total of 25.5 MW in the three auctions combined), the use of bidding processes to procure smaller-scale projects is an interesting departure.

The Phase 2 auction. No centralized auctions for large-scale solar generation were conducted in 2012 or 2013, leaving state policies to fill this gap, as discussed below. The first centralized auction under Phase 2 was held in February 2014. The main innovations of the new bidding process applied in Phase 2 were (i) the

absence of CSP technology, as the auction called only for 750 MW of PV projects; (ii) the application of the VGF scheme as a substitute for bundling; and (iii) the separation of demand into a “domestic content requirement” (DCR) portion and an “open” portion (375 MW each). The issue of DCR had been a major point of contention in the previous two years, as the United States filed an official complaint with the World Trade Organization against India’s DCR. At the same time, the Indian government had been disappointed by the fact that a large fraction of the Phase 1 auction’s demand was met by thin-film solar cells, which were exempt from DCR obligations (since this type of cell is not manufactured in India). The DCR subauction received half as many bids as its open counterpart (700 MW vs. 1470 MW) and resulted in significantly higher bids.

Regarding state-level implementations, the state of Gujarat stands out both as being the first state to develop a solar policy (even earlier than the NSM) and as the most prominent state to implement a feed-in tariff (FIT) mechanism, as opposed to an auction mechanism, for the development of solar power. Gujarat’s state policy has been responsible for the development of nearly 850 MW of installed solar capacity as of April 2014 (Bridge to India 2012–14), and the state’s FIT has tailed the price reductions coming out of NSM

Figure 2. Schematic overview of some of the most important solar PV auctions in India, 2010–14



Source: Authors.

Notes: Prices are calculated assuming an exchange rate of 60 INR/US\$. The Tamil Nadu data depict the state’s “L1” auction results rather than the results obtained after the state’s “workable tariff” was disclosed. For the NSM Phase 2 auction, an “equivalent” nominal levelized tariff has been computed from the VGF (viability gap funding) amount. The subsequent fixed payments are based on an assumed discount rate of 13 percent and a plant capacity factor of 18 percent. Auctions of less than 50 MW of demand (which includes rooftop auction schemes and auctions from the state of Odisha) have been omitted.

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auctions. Gujarat’s success in promoting capacity additions relative to most other states can be attributed both to earlier implementation and relatively higher prices paid for solar power.

Among the states adopting auction-based mechanisms, most have had some amount of success, despite a few setbacks. Madhya Pradesh currently has the most successful state-level auction scheme, with 175 MW already operational (Bridge to India 2012–14).

Several states have had trouble attracting the desired number of bidders. The auctions carried out by the states of Tamil Nadu, Punjab, and Uttar Pradesh have all been undersubscribed, meaning that they were unable to meet the desired capacity additions even by contracting the entire amount of solar power bid. One important reason for this result is the low bankability of distribution companies in these states, with high perceived risk dampening the private sector’s interest. (In the national-level auctions, the financial situation of the contract counterparty was much more stable.) Rajasthan has been able to avoid this issue for the most part by changing the contract counterparty to the state’s nodal agency (RRECL) rather than the distribution company.

Some state governments have introduced the “L1” lowest-bid pricing scheme. Under this scheme, adopted in Rajasthan, Tamil Nadu, and Andhra Pradesh, developers must meet the lowest offer of all the auction’s participants in order to be awarded the power purchase agreement. The economic rationale for the scheme is questionable: It could be successful in depressing prices if most bidders were behaving strategically, but in a competitive market it would simply result in most bidders refusing the power purchase agreement (PPA). Out of 180 MW bid for in the Rajasthan auction, winners of only 75 MW (less than the state’s target of 100 MW) accepted the L1 tariff. Similarly, in Tamil Nadu supply was reduced from 499 MW to 226 MW. Here again auctions have allocated less than the targeted capacities. On the other hand, states implementing L1 auctions have indeed been able to achieve lower prices.

Regulatory and policy instability has undermined state programs in Tamil Nadu and Andhra Pradesh. While these two states declared the most ambitious auctions-based policies in India, with each aiming to contract 1,000 MW of new solar capacity, expectations for both states are now very low, as unclear policies and multiple changes

have muddied the waters. In Tamil Nadu, the state regulatory commission has contested the “workable” tariff that was determined (outside any bidding process) by the state’s Energy Development Agency. No PPAs are active right now, and there are no indications of how the stalemate might be resolved. In Andhra Pradesh, the government decided to apply a “traditional” L1 bidding scheme to all auctioned projects, even though it had originally promised that it would allow price differences between different substations (to account for different irradiation levels and land costs). The state subsequently reduced its capacity target from 1000 MW to 350 MW.

Leniency with project delays has been the norm. According to announced schedules, the capacity contracted in the state auctions in Karnataka, Madhya Pradesh, and Rajasthan should be fully operational by now, yet delays of up to a year have occurred. All three states seem to have accepted the delays, extending deadlines with no penalties or requiring only minor justifications from the developers. Such practices set bad precedents, giving investors an extra incentive to be unrealistically aggressive on their planned schedules.

What are the key lessons?

Auctions should be part of a coherent strategy that meets clear policy objectives

Auctions have been implemented in a variety of settings, with good results. The Indian experience with auctions, from the CSP segment to procuring rooftop solar power, attests to the flexibility and adaptability of auctions. While India’s CSP implementations are far from trouble-free, the program can be described as a qualified success, given the many obstacles encountered (Stadelmann, Frisari, and Konda 2014). India’s rooftop auction scheme is so new that plants have not yet been commissioned, but expectations are high.

The right policies can further the nation’s long-term goals. It is sometimes unclear whether India’s strategic policy goals are being met. The L1 schemes used in some state auctions, for example, seem overly focused on short-term price reductions, rather than on ensuring continued capacity additions and investors’ participation in future auctions. Likewise, leniency with PPAs that

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are delayed or ultimately cancelled can negatively affect bidders' incentives.

The country's core goals for renewable energy should be made clear. Because most policy implementations involve trade-offs, it is important to have clear ideas about key goals and objectives and about areas where sacrifices can be made. One interesting topic in this regard relates to local manufacturing and job creation, both of which require a careful analysis of the country's comparative advantage in specific solar technologies. Establishing a clear set of priorities for the NSM would help to ensure a coherent long-term plan and elucidate whether the higher cost paid for domestic content in the NSM Phase 2 auctions has been a good investment.

Regulatory stability and trustworthiness are crucial. Several instances of erratic behavior on the part of the Indian national and state governments and regulators have likely hurt the country in the long run by reducing investors' confidence. Last-minute policy revisions in Tamil Nadu and Andhra Pradesh are the most prominent examples, although the successive delays that were observed in the implementation of the NSM Phase 2 auction have likely also had negative results. Investors need to feel secure before they will establish a strong manufacturing or developer base.

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