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THE BOTTOM LINE

Expensive diesel-fired generators operated by two state-owned utilities keep the lights on in Maldives, an archipelago of 200 inhabited islands spread over 900 kilometers of the Indian Ocean. But with the advent of affordable solar technology, the islands' abundant sunshine can be harnessed for clean generation through private rooftop solar systems. With World Bank support, an innovative guarantee structure has been designed to attract private developers. The program is expected to produce savings of $28 to $84 million for 20 MW of installations and to mobilize about $42 million in private investment.

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Rooftop Solar in Maldives: A World Bank Guarantee and SREP Facilitate Private Investment in Clean and Affordable Energy

How do you power an archipelago?

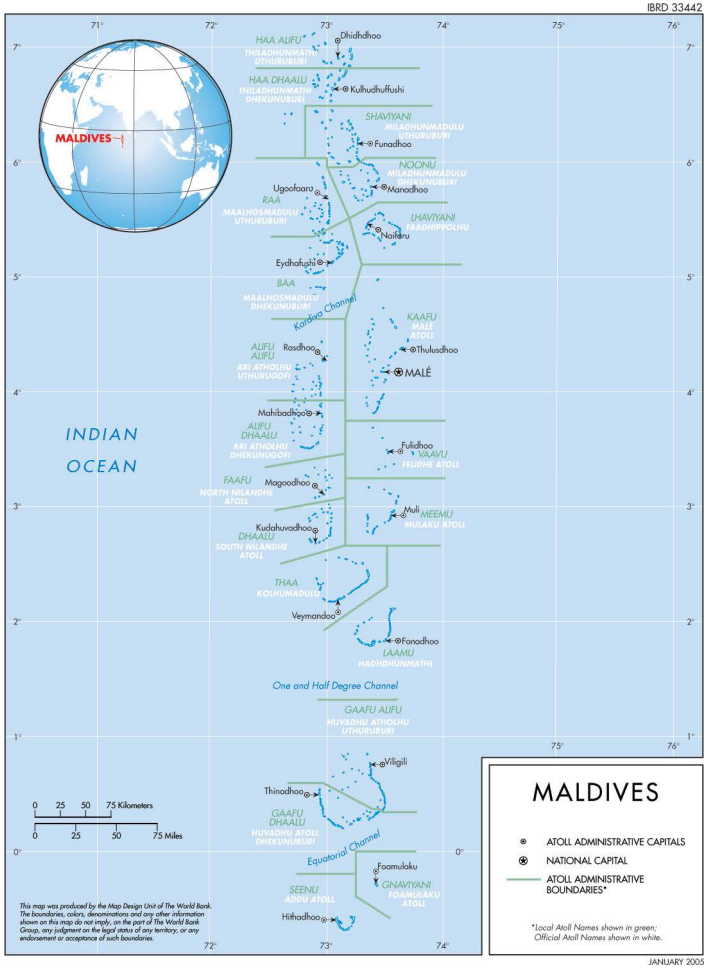
Maldives is betting that electricity from rooftop solar can lower its reliance on imported diesel fuel

Access to electricity in Maldives is nearly universal. But because the archipelago (figure 1) lacks indigenous conventional energy sources, power generation is based almost exclusively on imported diesel fuel. Installed capacity on the 194 inhabited islands, home to 350,000 people, is about 140 megawatts (MW), while an additional 100 resort islands have a generation capacity of about 105 MW, operated independently. Maldives is a middle-income country that remains highly dependent on imported goods and is increasingly vulnerable to the effects of climate change.

As a result of its dispersed geography, the fuel cost for electricity generation alone ranges from 20–30 U.S. cents per kilowatt-hour (kWh) in the larger and more efficient island grids. It is even higher on smaller and more remote islands. Despite significant subsidies (averaging 5 U.S. cents per kWh), the end-user tariff remains high (20 to 56 U.S. cents per kWh with fuel surcharge), constituting about 9 percent of spending in the poorest households.

Providing around-the-clock energy to the dispersed population is a large undertaking and a burden on public expenditure (1.4 percent of GDP in 2012). In response, national policies, including Maldives Vision 2020 and the 2010 National Energy Policy and Strategy, have focused on creating a reliable, resilient, and sustainable energy sector. Use of renewable energy, such as rooftop solar power, is a central element of the nation's strategies. Other countries have shown the promise of rooftop solar; India's experience is described in box 1.

Figure 1. Map of Maldives



"ASPIRE's goal is to scale up solar PV generation from the present level of ~1.5 MW to between 20–40 MW over the next five years by creating a bankable project structure attractive to the private sector."

Box 1. Successful rooftop solar power in India

Recent experience in India shows the potential of rooftop solar photovoltaic power. In three years, the country has developed about 300 MW of solar rooftop capacity.

In 2012, the government of the state of Gujarat, with support from the International Finance Corporation, launched a project to build a 5 MW grid-connected rooftop solar generation facility in Gandhinagar to be operated by an independent power producer. The project included two lots of 2.5 MW, with government-owned roofs producing 80 percent of the power and privately owned roofs accounting for the remaining 20 percent. The bidding generated wide interest—38 firms submitted expressions of interest. The winning bidders offered tariffs of Rs 11.21/kWh and Rs 11.79/kWh (about 18 U.S. cents per kWh). One of the winning bidders is a special-purpose vehicle formed by SunEdison, a large international solar developer.

Building on this success, the Gujarat Electricity Regulatory Commission determined a rooftop solar benchmark tariff. In 2015, the city of Vadodara awarded another 5MW project. The tariff obtained from the bidding was even lower (Rs 10.76/kWh; about 17 U.S. cents per kWh) despite higher risk stemming from the requirement that the developer secure most of the roofs from private owners.

Who will build the needed solar capacity?

Maldives created a project structure to attract the private sector

The Maldives Ministry of Environment and Energy, with support from the World Bank and from the Scaling Up Renewable Energy Program (SREP), a funding window of the Climate Investment Fund, has designed a program centered on solar photovoltaic (PV) rooftop installations to take advantage of the nation's high insolation while also coping with the scarcity of land. The "daily average global horizontal irradiation" in Maldives is 5.4–6.4 KWh/m2, with 280–300 sunny days per year.

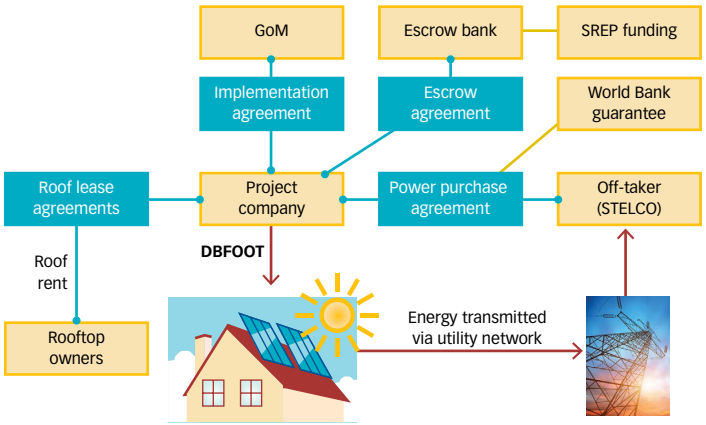
Known as ASPIRE (Accelerating Sustainable Private Investments in Renewable Energy), the program is funded with $11.7 million in SREP funds, the equivalent of $16 million in IDA guarantees, and support from the Asia Sustainable and Alternative Energy Program.

ASPIRE's goal is to scale up solar PV generation from the present level of ~1.5 MW to between 20–40 MW over the next five years by creating a bankable project structure attractive to the private sector. For 20 MW of installations, the estimated savings over an approach based on the status quo would be $28 to $84 million over a 20-year period.[1]

The first phase of ASPIRE is building 4 MW of solar PV systems on public buildings in Malé, the capital, and Hulhumalé, a large residential island nearby. The key features of this program are as follows:

- A private firm ("the Seller") designs, finances, builds, owns, operates, and transfers (or decommissions) the solar rooftop project (DFBOOT model) (figure 2).
- The Seller is selected through an international competitive process, with selection based on the lowest offered tariff. Bidders must prequalify by meeting minimum technical and financial requirements.
- The Seller supplies power to the utility (in this case, STELCO, a state-owned utility serving Malé and adjacent islands) at a fixed tariff denominated in U.S. dollars and payable in Maldivian rufiyaa under a 20-year power purchase agreement.

Figure 2. Structure of the ASPIRE project



DBFOOT = design, finance, build, own, operate, and transfer.

1. The estimates assume an off-take power price for PV of 21 U.S. cents per kWh, fuel consumption of 0.29 liters of diesel per kWh, and a diesel price of 71 to 104 U.S. cents per liter (based on prices observed during the second half of 2015). For reference, Maldives' GDP in 2014 was about $3 billion.

- The Seller and the government enter into an implementation agreement defining the obligations of the government vis-à-vis the Seller.
- The Seller also enters into lease agreements with roof owners for PV installations.
- The Seller, STELCO, the government, and a selected escrow bank enter into an escrow agreement.

What have been the challenges?

A mix of features common to developing markets—plus some unique to Maldives—required creative solutions

"To make the contracts bankable, the government, its advisors, and the World Bank worked to ensure a fair and attractive allocation of risk."

The project has been designed to overcome numerous obstacles—among them investor concerns about the risk of nonpayment by the publicly owned utility, political risk, currency convertibility issues, and the utility's unfamiliarity with public-private partnerships. The small size of the market, the lack of a national grid, the remoteness of most islands, and the scarcity of land and rooftop space have complicated the process of aggregating investments. Project documents meeting international financing standards, including the power purchase agreement, also had to be developed.

To mitigate the utility's payment risk, the government is funding a six-month escrow account using an SREP grant. The Seller is empowered to draw on the account if a payment is delayed, thus mitigating liquidity risk for the investor. STELCO and the government then have an obligation to replenish the account during a "cure period," failing which a guarantee from the International Development Association, the concessional lending arm of the World Bank Group, will partially cover the government's termination obligations. In this manner risk is shared between the private investor and the government.

To make the contracts bankable, the government, its advisors, and the World Bank worked to ensure a fair and attractive allocation of risk—in particular regarding deemed generation, force majeure, events of default, and termination clauses. The government also gave bidders the option to bid with or without requiring currency-convertibility protection from the government; bidders not seeking this risk-hedging facility benefited from an advantage in the evaluation.

Because the Maldives government had limited experience with independent power producers, financial, technical, and legal advisors were engaged with support from the World Bank to develop standardized project documents that met international standards. Two investor conferences—one before the bidding and another at its announcement—were held to solicit investor interest. The conferences ensured wide outreach to solar developers and generated useful feedback.

To cope with the size and remoteness of the market, ASPIRE has a phased strategy, one that will unfold to 20–40 MW of solar PV over five years from the present ~1.5 MW, effectively enlarging the market for potential developers. Aggregating investments in large enough bids and focusing on developing local expertise is a part of this strategy. Finally, part of the SREP grant will be used to buy down the tariff in remote islands, where more extensive PV penetration will likely require additional storage capacity.

Is ASPIRE working?

Progress has been challenging, but early returns are promising, and much has been learned

The turnout for the first 4 MW bid package was good, considering the risks and market size. About 25 firms, mostly international, purchased the bid documents; four bids were received. (Two additional bids were disqualified for late submission.) The package was split in two—1.5 MW in Hulhumalé and 2.5MW in Malé. In the latter segment, bidders did not meet all technical criteria, so another round of bidding will be held. The Hulhumalé segment was awarded to a Chinese–Swiss consortium (China Machinery Engineering Corporation in association with Grass Solartek Schweiz) that signed the power purchase agreement and implementation agreement on October 15, 2015. The tariff is 21 U.S. cents per kWh—which seems reasonable considering that a recent winning bid in a much larger and more developed market in India came in at 18 U.S. cents per kWh (see box 1).

Applying the experience gained thus far, the government will launch the second round in the coming months and then move to the outer islands, working toward its policy goal of a reliable, resilient, and sustainable energy sector. In December 2015, the government

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Live Wire 2015/50. "Implementing Rooftop Solar Projects: Public-Private Partnerships in India," by Pankaj Sinha and Shaina Sethi.

enacted a net metering regulation that should boost the participation of local entrepreneurs and residents in roof-top based PV generation.

World Bank support provided important benefits. In addition to adding credibility to the entire transaction, the Bank's experts began working with the government far upstream of the bidding, identifying problems, tailoring solutions to the country's circumstances, classifying the islands, and piloting a solar project in Thinadhoo. The Bank assisted ministry staff in contracting reputable advisors and providing advice for developing project documents, risk allocation, and procurement processes, all in conformity with international standards.

Help in mitigating payment risk (through the SREP-funded escrow account and the IDA guarantee for termination) was critical. Historically, projects with IDA's involvement rarely encounter defaults, but it was important to ensure that payment delays did not trigger immediate recourse to the guarantee. The SREP-funded escrow facility provides that buffer, giving comfort to both the investor and the government.

The major lessons learned to date are these:

- Governments and utilities having limited experience with public-private partnerships need a clear governmental commitment, motivated staff, and strong technical, financial, and legal support to prepare transactions. It can take considerable time to build understanding of the issues and to devise solutions, such as a fair and attractive allocation of risk and a workable approach to currency convertibility. Small-scale pilots can reduce technology risk and build confidence among stakeholders.
- Fostering competition is critical. The confidence of private firms is gained through investor conferences, timely answers to questions, modification of the transaction structure as the need arises, and a fair allocation of risk.
- Finalizing the documents during the bid period allows for fast closing following the award. In the Maldives' case, bidders were invited to propose changes during the bid period, and the government responded to all queries and made some changes. The documents then became final, with no material changes made after the award.
- Teams can build on existing experience. For example, existing templates for rooftop solar power purchase agreements, implementation agreements, and roof lease agreements can be used for similar projects.

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