



# FROM CARBON TO COMPETITION: CAMBODIA'S TRANSITION TO A CLEAN ENERGY DEVELOPMENT PATHWAY

CASE STUDY SUMMARY - JUNE 2020

## DEVELOPMENT CONTEXT

*Cambodia is a country of 16 million people, with a GDP per capita of US\$ 1,510 (Lower-Middle Income), and CO<sub>2</sub> emissions of 0.44 metric tons per capita (tCO<sub>2</sub>e)<sup>1</sup>. In the face of recent burgeoning economic growth, power demand in Cambodia has also surged, rising from 742 GWh in 2004 to 6,229 GWh in 2016, a combined annual growth rate of 20%<sup>2</sup>. As of 2017, Cambodia had a shortage of electric power—nearly 5 million Cambodians lacked access to electricity, with only 82 percent of villages and 69 percent of households connected to the national power supply. About 18 percent of the country's total electricity supply was imported fossil-fuel energy from Thailand and Vietnam, and high tariffs of US\$0.14 to US\$0.17 per kWh, well above those of regional counterparts, constrained economic competitiveness.*

## THE INTERVENTION

This case study takes a deep dive into Cambodia's multidimensional energy sector transition, a joint effort by the government of Cambodia and the Asian Development Bank (ADB) to reformulate how the nation approaches power generation: from thermal and large hydro to scalable, low-cost renewables; from bilaterally negotiated power purchase agreements to competitive international tendering; and from binary public or private operating and ownership structures to complex blended risk-sharing modalities.

In 2017, coal and hydro were Cambodia's two primary sources of power, together accounting for 81 percent of installed capacity. Thermal generation, however, was vulnerable to shifting global coal prices, while hydro was proving unreliable in the face of climate volatility. In the face of an increasing and urgent supply shortfall, solar offered the brightest light: an abundantly available, vastly untapped and increasingly price-competitive resource, Cambodia's year-round irradiation presents a mammoth potential of 30,090 GWh per year<sup>3</sup>. With an aim to incentivize

an entry into solar, the Climate Investment Fund's (CIF) Scaling Up Renewable Energy Program in Low Income Countries (SREP) drafted an Investment Plan for Cambodia in June 2016, introducing concessional and grant financing

## ELECTRIFICATION VIA CLEAN AND AFFORDABLE ENERGY GENERATION

### ESTIMATED PROJECT COST

US\$26.71 million

### PARTNER ORGANIZATIONS

Climate Investment Funds' (CIF) Scaling Up Renewable Energy Program in Low-Income Countries (SREP) and the Asian Development Bank (ADB)

### PROJECT DURATION

23 May 2019–December 2021

### COUNTRY

Cambodia

1 World Bank Data, 2018

2 Cambodia Solar Master Plan Study, 2018

3 Cambodia Solar Master Plan Study, 2018

facilities that could trigger pilot projects in a sector with, at the time, no installed capacity. In 2017, in consort with the Asian Development Bank (ADB), the CIF revised its Investment Plan, adding provisions for a National Solar Park Program.

## DELIVERY CHALLENGES AND SOLUTIONS

While the objectives of the government, CIF and ADB aligned on introducing more renewable sources into the energy mix, transitioning from traditional forms of production to more privately generated, solar-based energy posed two major delivery challenges.

### CHALLENGE 1: BUILDING CONSENSUS: GRID STABILITY, EFFICIENCY CONCERNS AND THE NATIONAL UTILITY.

The Government of Cambodia had to deliver more energy capacity, quickly, while ensuring reliability and affordability of supply. The state utility, Electricite du Cambodge (EDC), had well-founded **concerns regarding the stability of the national grid in the face of rapid, large-scale variable renewable energy (VRE) integration**. Since solar is an intermittent energy supply source, generated only during the day and dependent on the weather, integration required measures to predict and manage a smooth changeover to alternate sources in times of low generation, preventing a discontinuity in supply. **Managing time constraints and technical capacity** needs posed another concern. Since a large-scale project would require private investment, and because, per the ADB's recommendation, securing low prices required an international competition that would drive down prices, realizing the proposed project hinged on executing an open tender. This then required significant groundwork and know-how in regulatory, financial and procedural structuring and management, a process that the government deemed as having too large a lead time, and too great a dependency on international investor appetite that was hard to gauge and had thus far seemed inadequate.

### → SOLUTIONS

**Across-the-board cost-to-benefit and scenario analyses of VRE integration** were conducted, providing the government with robust information and tools to make informed decisions best suited to Cambodia's grid infrastructure. ADB's public sector energy team prepared the National Solar PV Masterplan and Road Map, commissioned a grid integration study, predicted the extent of solar penetration in the medium term (2018–2030), and provided a detailed feasibility study and analyses of low, medium, and high solar uptake scenarios. The ADB then proposed **an unconventional, phased solar park model, in lieu of a single plant,**

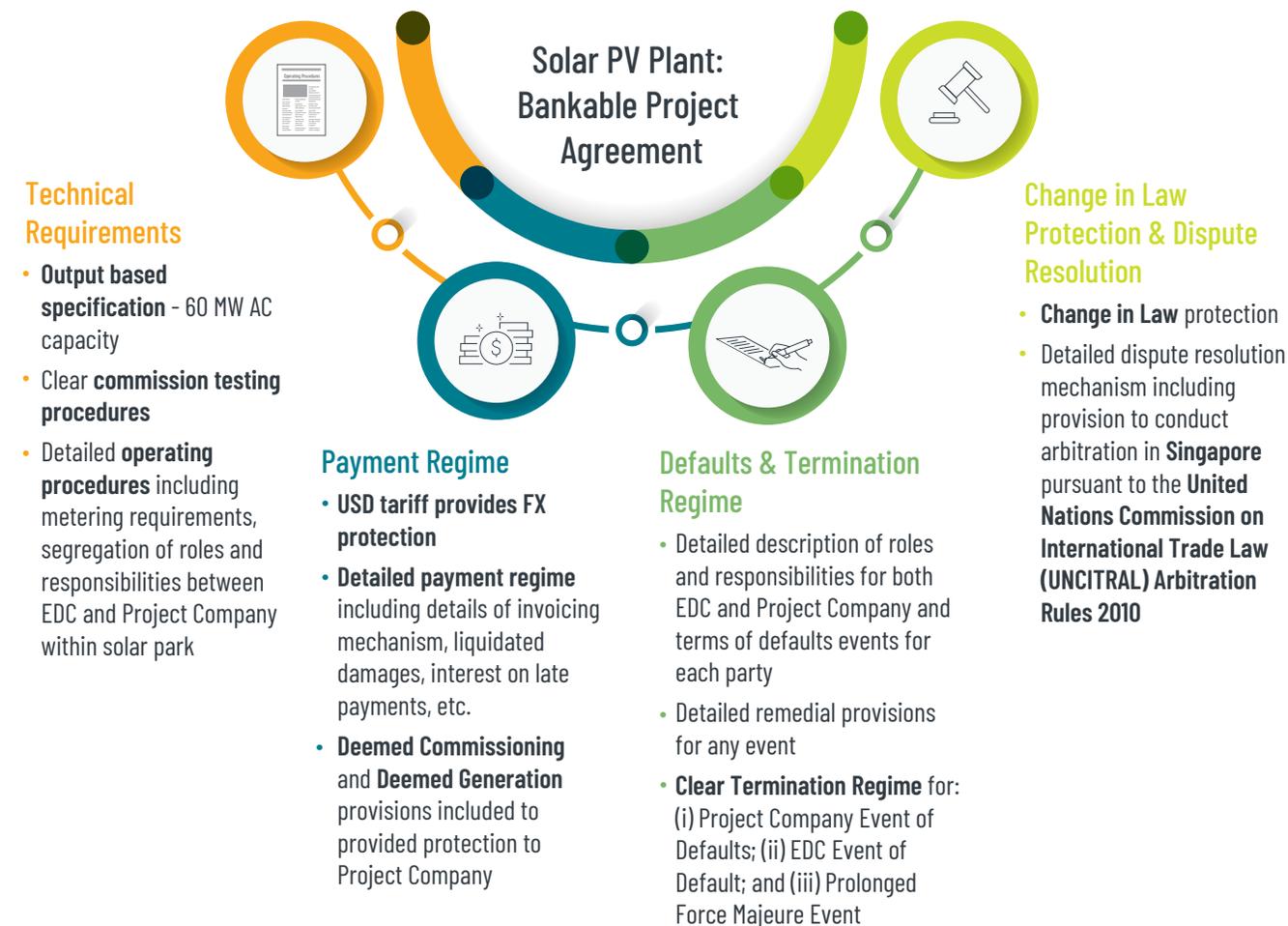
allowing for piecemeal, step-wise additions of generation capacity in line with increases in both consumer demand and EDC's familiarity with the technology. To bridge capacity and efficiency gaps, ADB's Office of Public-Private Partnerships were engaged to provide transaction advisory services, **designing the financial and regulatory architecture of an auction,** alongside **technical capacity development,** thereby addressing concerns regarding geographic placement and land availability relative to the primary energy demand centers; considerations of including battery storage capacities in the project design, and the related cost implications; accommodating and balancing EDC payment risks for the private sector, particularly vis-à-vis the lack of a government guarantee; coordinating with and between different ministries and their approval processes; negotiating power purchase agreements with the successful bidder; and overall considerations of the cost- and time-efficiencies of bilateral processes versus competitive tenders.

### CHALLENGE 2: FORMULATING AN ENABLING BUSINESS ENVIRONMENT: TRANSPARENCY, RISK, PRICING AND THE PRIVATE SECTOR.

For the private sector, and particularly for international investors, Cambodia presented a nascent energy market with **limited demonstration of the capacity to execute transparent, open-door tendering practices,** and in a region where procurement costs were high. There were also reservations about **balancing costs and pricing versus risk:** for the state, renewable energy was seen as an expensive power source at entry—cost-intensive if not at adequate scale, needing significant upfront investment volume, and requiring a multitude of auxiliary processes to manage forecasting and grid-stabilization. In sum, the gains from solar pricing were not seen as sufficient to offset overall costs. For private bidders, the project carried a high risk profile due to several factors: firstly, while the national utility, EDC, a state-owned enterprise, was considered financially sound, the country's sovereign credit rating—the first threshold through which to bring in investors—was less than favorable. The government also did not offer sovereign guarantees, often a mechanism to reduce exposure to losses from political volatility, legal changes, debt serviceability, economic and currency fluctuations, etc. Second, with many international bidders new to the country, unpredictable and lengthy procedures for land acquisition posed a challenge, skewing competition towards potential local bidders with geographic familiarity and bargaining advantages. The harder it was for international players to be competitive, the weaker the competitive tensions that would drive down price.

Figure 1.

WHAT MADE THE PROJECT BANKABLE?



→ SOLUTIONS

**Standardized, open, and best-practice procurement processes** were instituted, **establishing a climate of transparency** around the technical and financial architecture of the project, and allowing participants to assess and price bids with confidence. The Power Purchase Agreement (PPA) was designed such that it minimised risks of incongruence in expectation or delivery, and set transparency and predictability as cornerstones of the related arrangements. Figure 1 maps the entire array of instruments put into place to appropriately allocate risks and responsibilities such that the project was both commercially viable and attractive.

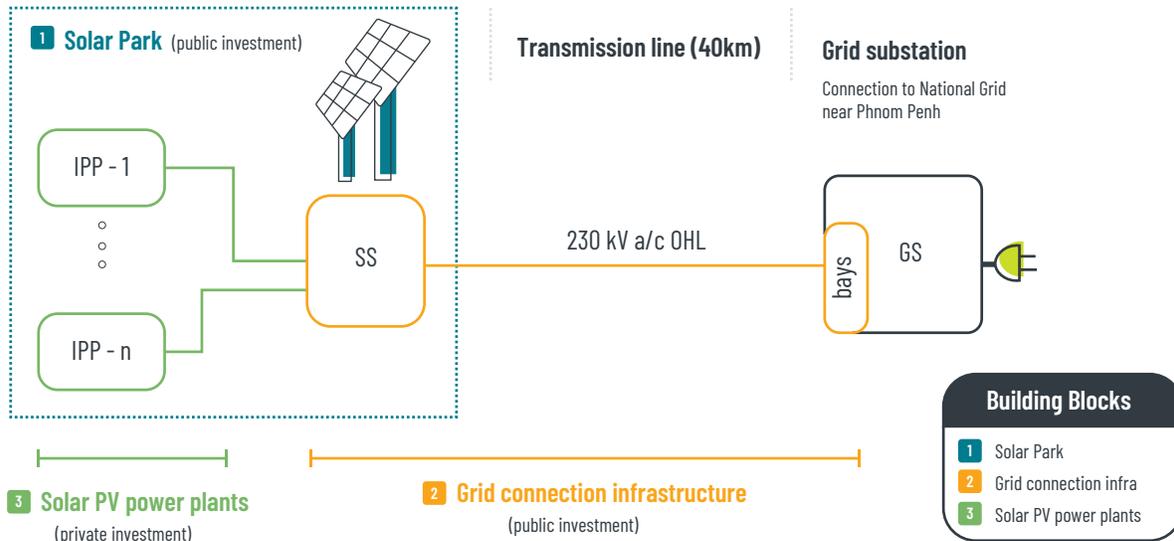
**ADB then deployed the phased PPP solar park model (figure 2), where the government carried country-specific risks that would otherwise deter new investors but were in fact manageable commitments for the state,** with risk-taking buttressed by the availability of concessional and grant financing. In tandem, the ADB worked closely with the government to **implement a highly effective two-step reverse-auction process.**

Efforts to ignite international investor interest were met with success: over 150 firms attended a bidders' conference convened in Phnom Penh in early 2019, 148 purchased the bid documents, and 26 from 11 countries submitted expressions of interest and later, final bids. The end result: with 3 years of concerted and foundational work, **the country's first National Solar Park of 100MW has now been established, with the first competitively auctioned 60MW plant securing a record low tariff in the South-East Asian region—US\$0.039/kWh, nearly a third of what the nation was previously paying.**

**SPILOVER EFFECTS AND THE FUTURE**

**National level: enhanced interest and agency in integrating solar capacity and enabling technologies.** The project's impact in Cambodia alone is markedly catalytic: the country is now proceeding to Phase II of the project, auctioning the remainder of the Park's solar capacity; is deliberating the deployment of the same solar park model, even without the support of concessional finance; is deploying competitive infrastructure tendering in sectors even outside of solar;

Figure 2.  
SOLAR PARK OVERVIEW



and has a new **Power Development Plan, approved in early 2020, that calls for up to 1.8 GW of solar in Cambodia by 2030<sup>4</sup>**. Where previously cautious about integrating solar, the Cambodian government has maximised the project's potential as a market-sounding and technical-testing exercise, and is now exploring yet more frontier integration technologies, including new-to-the-market energy storage options. Early this year, the EDC agreed to host a pilot battery energy storage system within the National Solar Park substation, also to be partly financed by an SREP grant and executed by the ADB. The project team hopes that this will pave the way for a larger, nation-wide battery energy storage systems program in 2022–2023.

**Regional level: demonstration effects.** The project has had above-par knock-on effects, triggering other regional

counterparts to approach the ADB for similar competitive international solar auctions, **a brave new frontier for renewable energy transitions in the ASEAN**. The last months have seen Vietnam sign a mandate for ADB support in developing a 200 MW floating solar auction, and similar discussions have kicked off with Indonesia, Myanmar and Timor-Leste. In efforts to maximize the demonstrative power of these successes and discussions, the ADB is initiating a new regional program—the ASEAN Scaling up Renewables Plus Storage Initiative (ASSURE). It will work with ASEAN countries to deploy renewables and energy storage on a large scale by supporting project development and facilitating private sector participation, thereby making way for an exponential green energy transition in the region. **In sum, the project has demonstrated the immense potential of concessional climate finance, and of efforts of dedicated climate champions, to realise emerging economies' and regions' ambitions for greener and more sustainable low-carbon development trajectories.**

<sup>4</sup> This plan was developed by Chugoku, a Japanese organization advising the Government of Cambodia.

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