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URJA NEPAL

# TARIFF BASED COMPETITIVE PROCUREMENT OF SOLAR POWER IN NEPAL

## For Nepal Electricity Authority

June 2022

# CONTENTS

# 1. INTRODUCTION

## 1.1 NEPAL POWER SECTOR OVERVIEW

Electricity generation in Nepal relies primarily on run-of-river (RoR) hydropower projects (HPPs), which depend heavily on the monsoons that fall in summer months during the country's "wet season". During the "dry months" of winter when water levels are at their lowest, Nepal, then in energy deficit, must import power from India.

Approximately 86% of Nepal's population has access to grid electricity, while another 10% rely on off-grid distributed generation which comes principally from renewables.[1] Between 2018 and May 2022, Nepal nearly doubled its installed capacity – from 1,069 MW to 2,100 MW.[2] It is a widely held belief that in the near-term electricity deficits will be a relic of the past and that continuing capacity growth can be used to feed long pent up domestic demand, as a substitute for imported fossil fuels, and for export to the South Asian region.

In the last decade, Nepal's peak power demand has grown at a Compounded Annual Growth Rate (CAGR) of approximately 5.3% -- from 885 Megawatts (MW) in 2010[3] to ~1,643 MW[4] in 2022. Although Nepal is expanding and upgrading its networks to enhance per capita electricity consumption to 700 KWh by FY2022/23,[5] the current consumption is still near the bottom of South Asia's league tables.[6]

Of Nepal's 2,100 MW installed capacity, approximately 30% is generated by the Nepal Electricity Authority (NEA), Nepal's vertically integrated, state-owned utility, while the balance of 70% is produced by the private sector, Nepal's Independent Power Producers (IPPs). The Government of Nepal (GoN) estimates that the country has 43 gigawatts (GW) of hydropower generation potential, of which only about 5% (2.1 GW) has been developed. Owing to these vast hydropower resources Nepal's generation mix is quite lopsided, with hydropower contributing 95%, with the balance coming from solar, bagasse, and thermal resources.

Although Nepal's climate can support a significant amount of solar power, Nepal's energy scales will always be tipped toward hydropower development. It is also true however, that the GoN has not completely overlooked the benefits of renewable energy (RE). In fact, in the recent past it has taken steps to exploit its solar resources to increase Nepal's energy security and to help meet the nation's climate change goals. In recent years the GoN has introduced numerous programs and policies to promote the integration of multiple types of RE into the grid. In 2016, in its '*National Energy Crisis Prevention and Electricity Development Decade*' policy paper, the GoN announced a plan to incorporate RE in amounts as high as 5-10% of the generation mix by 2026. That plan also advanced the notion of NEA conducting tariff-based bidding for solar plants at various locations throughout Nepal. Other

1 Solar Generation for Energy Security in Nepal, Vidyut Magazine, NEA (Year 32, Issue 1, 2078 Bhadra) accessed through https://www.nea.org.np/admin/assets/uploads/annual_publications/Bidhut_2020.pdf
[2] List of completed projects, NEA Power Trade Department
[3] Nepal Electricity Authority (NEA) Annual Report FY2009/10
[4] https://english.khabarhub.com/2022/02/255473/
[5] Nepal Electricity Authority (NEA) Annual Report FY2020/21, p. 76
[6] https://nepal.gov.np:8443/NationalPortal/view-page?id=92

GoN policies geared towards the RE sector include the *'Grid Connected Alternative Energy Procedure 2021'* and the bill for an act on Renewable Energy (development and promotion) Act, in the same year. As a result of such policies, legislation, and incentives, Nepal has recently begun to consider the development of large, grid-scale RE projects. Recent examples include NEA's 2016 call for bids for tariff-based procurement of solar projects for 64 MW in 22 locations and in 2018 for 62 MW in 22 locations. More recently, NEA announced plans to procure solar projects only through competition, fixing the base tariff rate at Nepalese Rupees (NPR) 5.94. However, to successfully move forward in this space, Nepal will require a robust framework that includes carefully designed policy, regulatory, institutional, financing, and commercial incentives.

NEA, the state utility, is legally obligated to provide generation, transmission, and distribution services. Because Nepal's electricity sector is based on the single buyer model, NEA currently provides the only access to the network by domestic power producers. Like all electricity generators, RE producers are also required to sign either a power purchase agreement (PPA) or a net-metering agreement with NEA to connect to the national grid. Finally, inconsistent messaging from policy makers with respect to the legal, regulatory, and pricing methodologies required to promote RE has so far, left many private sector developers disappointed and discouraged. The GoN will need to tackle these problems if it is to make the power sector receptive to RE development.

This report will focus primarily on one such problem - the challenges of solar power procurement. It will explore deeply the practice of tariff-based competitive bidding to award solar power projects. In doing so, the report will analyze the current practice in Nepal and compare it with leading practices in other parts of the world to form a gap-analysis on how Nepal needs to improve its solar licensing regime. We believe that tariff-based bidding will provide GoN with the most transparent and efficient way to determine the bid with the best value-for-money. Moreover, such auctions will provide the GoN with the advantages of flexibility and real-price discovery while protecting the interest of all stakeholders involved in the process through clearly articulated commitments and penalties.

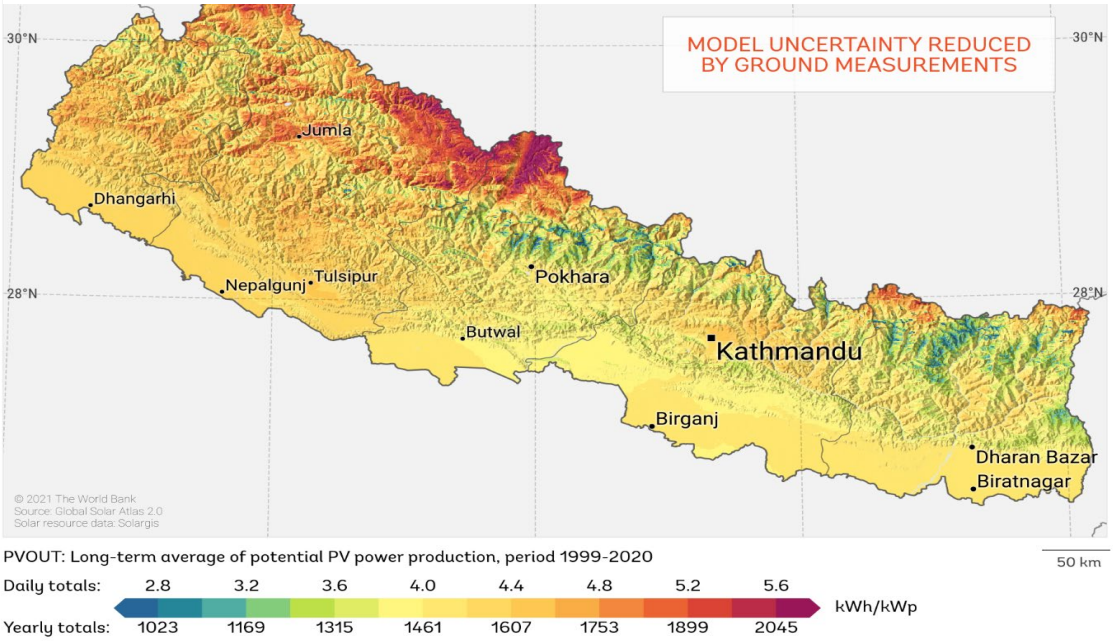
## 1.2 POTENTIAL OF SOLAR PV BASED POWER GENERATION IN NEPAL

Each year on average, Nepal enjoys more than 300 days of sunlight. It has relatively high insolation of an average of ~17 megajoules per m2 per day (1.7 TWh per km2 per year) and the national average sunshine hours of 6.8 per day. This makes Nepal a country with moderately high solar potential.[7]

The solar photovoltaic (PV) output potential for Nepal's multiple regions are set out in Figure 1.

7 100% Renewable Energy with Pumped-hydro-energy storage in Nepal, https://academic.oup.com/ce/article/5/2/243/6275217

*Figure 1: Solar PV Potential in Various Regions of Nepal*




*Source: Global Solar Atlas (https://globalsolaratlas.info/download/nepal)*

In addition, a study was carried out by Nepal's Alternative Energy Promotion Center (AEPC) with the support of United Nations Environment Program and Global Environment Facility (UNEP/GEF) to assess the solar and wind energy potential in Nepal. The study report, *'Solar and Wind Energy Resource Assessment in Nepal (SWERA)'* submitted by AEPC in 2008, highlights the potential for Solar PV technologies as follows:

> *Grid Connected Integrated PV: 2,167 sq. km of urban areas with population density greater than 3,500 per sq km and average annual radiation of 5.28 kWh/m2/day were considered for analysis. Assuming 2% of the land is suitable and power generation of 50 MW per sq.km of land, yield for grid-connected integrated PV was estimated to be 2,100 MW.*

## 1.3 ROLE OF SOLAR PV IN NEPAL'S ELECTRICITY DEMAND

Nepal's electrification rate is one of the fastest growing in the world, as evidenced by the increase in population with access to electricity to 93% by mid-March 2021 – as compared to 88% in mid-July 2019 and 90% in mid-July 2020. With electricity supply being extended to the country's growing population along with increasing per capita consumption, the demand for electricity continues to increase. Historically hydropower has been the only source of clean electricity and because it is intermittent, it has resulted in acute power shortages during Nepal's dry season which were balanced using coal sourced electricity imports from India. Although hydropower is a clean source of energy, in most places in the world it is not considered to be "green energy" as it can often have adverse impacts on river ecosystems and environment. Moreover, rehabilitation and resettlement issues may prevent reaping full benefits of storage hydro projects.

Nepal's current electricity generation mix is depicted in the Figure 3.

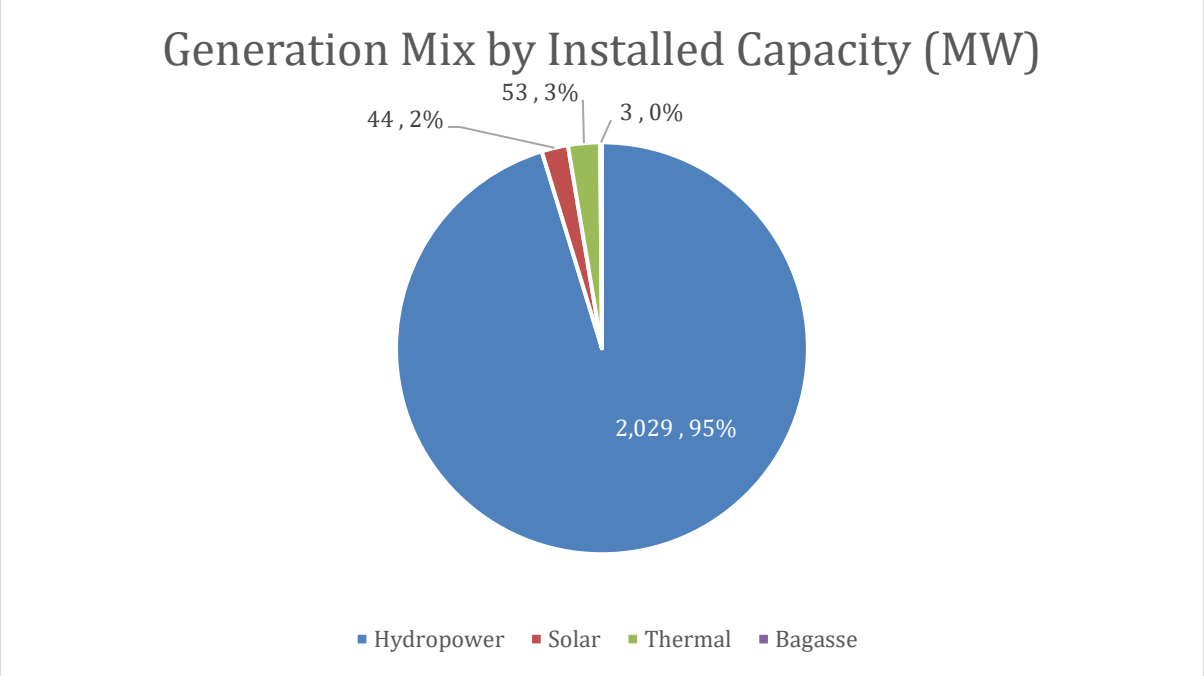



*Figure 2: Generation Mix by Installed Capacity in Nepal as of May 2022*

*Source: NEA 2022*

**Capacity of small-scale RE projects under AEPC are not included*

Figure 3 demonstrates that the share of grid-connected solar power in the total installed capacity is currently only about 2%. However, the recent development in solar power sector shows that the private investors' interest in solar technology is rising rapidly and that if proper policies are in place, solar technology can be an important and suitable means of meeting Nepal's growing electricity demand. This argument is based on literature which emphasizes the feasibility of solar PV-based electricity generation in Nepal and assessed the solar PV output potential of the country (excerpts from the literatures have been given in the previous section of this report). In contrast, the current data for utility-scale solar projects as given in Table 1 shows that only a very small amount of this potential has been tapped.

*Table 1. Installed Capacity and Potential Solar Power Plants in Nepal*

| S.N. | Category and Status | Capacity (MW) |
|---|---|---|
| 1 | Grid-connected IPPs' Installed Capacity | 33.14 |
| 2 | Grid-connected NEA's projects | 11.1 |
| 3 | Survey License awarded by DOED | 1,101.7 |
| 4 | Projects with Construction License | 124.6 |
| 5 | Projects applied for Survey License | 429 |
| 6 | Projects applied for Construction License | 15 |
| 7 | Other (Forwarded by DOED to local Govt.) | 0.99 |
| 8 | Other Projects Studied by OIBN | 550.0 |
| | **Total** | **2,265.53** |

*Source: DOED website as of June 8, 2022, OIBN website and NEA Data as of May 31, 2022*

The arguments in favor of a greater role for solar PV technology in balancing the demand and supply of electricity in Nepal are summarized below:

i. There is a high potential for solar power generation due to strong irradiation in major regions of the country.

ii. Government policies are currently being put in place to increase the share of solar electricity in the total energy mix: According to a White Paper, the GoN's 2016 National Energy Crisis Prevention and Electricity Development Decade policy paper, a RE target of 5-10% in generation mix has been set to be achieved over a ten-year period. Solar projects, being the most studied and implemented among all RE technologies in Nepal, is the energy source most likely to contribute greatest amount towards achieving this White Paper's target.
iii. Photovoltaic solar panel prices have fallen dramatically in recent years.
iv. The generation tariff for solar RE, determined through competitive bidding process, is a market-determined rate, instead of GoN imposing set prices on the projects.

# 2 INTERNATIONAL EXPERIENCE – SOLAR POWER PROCUREMENTMENT

International case studies are used to understand key features needed to conduct a procurement of solar projects using a defined framework. The key components are 1) a well-defined bidding structure; 2) careful bid preparation; 3) bidding processes clarity; and 4) timelines for project completion. In the following sub-headings these components are described together with suitable examples.

## 2.1 BIDDING STRUCTURE

The bidding structure should be tailored to the needs of the project and the desired volume of bidders to attract. This structure should be well planned to ensure that the projects are completed within the stipulated timelines, thereby achieving the purpose of the projects to be developed. The bidding structure should attract or discourage various types of bidders according to the qualification criteria of the structure selected.

International examples are presented below to provide insights regarding various practices adopted in various countries to organize biddings to suit their needs:

| Parameter | Description | International Examples |
|---|---|---|
| **Qualification requirement** | • Technical: Experience of developing similar projects, technical standards to be followed, warranties to be provided.<br>• Financial capability– net worth, turnover, bid bonds.<br>• Consortium structure to encourage participation from diverse players– defined limits on maximum members. | Bangladesh: In September 2021, Bangladesh organized a tender for Engineering, Procurement and Construction (EPC) of 68 MW solar project with a technical qualifying criterion for the bidder to have at least seven years of experience as contractor and at least two projects executed outside their own country with a minimum capacity of 50MW within five years prior to the bid. Financial qualifying criterion specified bidder to have at least $100 million turnover during the past three financial years and bidder's resources to meet or exceed $30 million for the project.[8]<br><br>India: Bidders who participate in solar development bidding in India are required to comply with several standard technical and financial requirements. Past technical experience of similar projects is not required to participate in the bid. Financial qualification typically requires net worth of the bidder to be 20% (twenty per cent) of the Central Electricity Regulatory Commission's Benchmark Capital Cost. |

[8] EPC tender in Bangladesh, accessible at: https://mercomindia.com/bangladesh-floats-epc-tender-68-mw-solar-project/#:~:text=The%20Bangladesh%2DChina%20Renewable%20Energy,Sirajganj%20Solar%20Park%20in%20Bangladesh.&text=The%20last%20date%20to%20submit%20the%20bids%20is%20September%2027%2C%202021.

| | | |
|---|---|---|
| | | Consortium of the members has been set to a limit of three members. |
| **Project size constraint** | • Bid package: Minimum capacity that bidders would develop is defined.<br>• Maximum awarded capacity: It may be specified to allot a maximum size that can be allotted to a single bidder. | Malaysia: In June 2020, tender for 1 GW of solar development were released. Bidders could bid up to a maximum capacity of 50 MW.[9] |
| ***Bidding Parameter*** | • Tariff based bidding: This may be fixed tariff over a period of time, or it may be escalating tariff annually over the period.<br>• Viability Gap Funding (VGF): Financial assistance is given to enable solar power generators to supply power at a given tariff.<br>Ceiling price may be specified to reject bids beyond a price.<br>Bid prices may be invited in terms of fee per unit of power (MW) or energy(kWh). | Germany: In April 2015, bidding for solar PV was organized and bids were invited for a minimum installed capacity of 10 kW and a maximum capacity of 10 MW. Ceiling price of 112.9 EUR/MWh (126.2 USD/MWh) was set before the start of the auction. A capacity of 156.97 MW of solar PV was contracted at an average price of 91.7 EUR/MWh (102.5 USD/MWh) in the bidding. This led to discovery of new Feed In Tariff (FIT) for solar which was higher than the then FIT of 90.2 EUR/MWh (100.82 USD/MWh) for solar installations up to 10 MW.[10]<br>Sri Lanka: In March 2020, Sri Lanka invited bids for 150 MW solar project with a ceiling price of $0.08/kWh with a contract of 20 years to develop and maintain. Bidders could bid with capacity of 1 to 10 MW across 20 locations.[11] |

[9] Malaysia Tender for 1GW solar plant, accessible at: https://renewablesnow.com/news/malaysia-opens-1-gw-solar-tender-under-covid-19-recovery-plan-701119/
[10] International Renewable Energy Agency. (2013): https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/Jun/IRENA_Renewable_Energy_Auctions_A_Guide_to_Design_2015.pdf
[11] Sri Lanka tender for 150 MW solar development project, accessible at: https://mercomindia.com/sri-lanka-developers-solar-projects/

| | | |
|---|---|---|
| **Location constraint** | Location constraint is added to develop the project at specific location rather than allowing the bidder to select a high resource area which may already be utilized. | Germany: Since 2010, Germany discouraged the developers to construct large scale PV systems on arable lands specified by Renewable Energy Act. As a measure, Germany did not offer Feed in Tariff (FIT) to projects located in the zones constructed outside the permitted areas by the act. This resulted in the concentration of large PV systems on specific redeveloped brownfield sites or in the close vicinity of highways and railway lines.[2] |

## 2.2 BID PREPARATION

Bid preparation involves tasks that are required to be executed by the bid process coordinator before the start of the bid. The documents should include not only the bidding documents themselves, but a significant amount of supporting information required for bidders to submit an informed and complete bid. The process preparation and documentation will create a smooth bidding process, leading to streamlined negotiations and construction. With proper documentation and necessary permits, the power from solar projects can reach commercial operations in a timely way. Various bid preparation activities, together with international practices are listed below.

| Parameter | Description | International Examples |
|---|---|---|
| ***Detailed bid document*** | Bid document may comprise of the request for selection, model purchase agreement and model power sale agreement. Document should contain the clearances from authorities for land (if Govt. land), end bid process coordinator and agency developing the solar plant. | Turkey: Bid document contains requirements of bid process coordinator such as plant design, installation procedure, procurement, and commissioning. It contains schedule of prices and schedule of supplementary information. For preparation of bid, various guidelines are set like language of bid documents required, bid form and price schedules, currencies of bid, bid validity, alternative proposal (if any), bid process and format & signing of bids.[12] |
| ***Arrangements related to site*** | • The project may be set up at a specified site or project site selected by solar power generator or a solar park.<br>• The bid process coordinator must identify land and required | India: In India, if the project site is procured by the bid process coordinator or selected by the Solar power generator then the 100% of the land is identified with provision of documents/ agreements indicating availability of 25% of the land |

[12] Tender document by Turkey for procurement of 5MW solar power plant, accessible at: https://www.mofa.go.kr/www/brd/m_4052/down.do?brd_id=14456&seq=368192&data_tp=A&file_seq=1

| | | |
|---|---|---|
| | documents/ agreements to indicate availability of land during different phases of the project.<br>• Environmental studies and grid studies should also be included.<br>• Environment clearance and forest clearance (if required) have to be obtained in advance. Approval for water for the project from the authorities and letter from transmission utilities confirming technical feasibility of connecting plant shall be taken. | during the initial bidding and 90% possession within one month of execution of PPA. Rest 10% must be available within 2 months thereafter. If the site specified is a solar park, then the site is selected in the concentrated zone with access to amenities and having proper infrastructure. Details are specified in the bidding documents along with various clearances from concerned authorities.[13] |

## 2.3 BIDDING PROCESS

The bid process describes and defines how the bidding will take place. Bids can be taken either electronically or by submitting of hard copies of the bids. After the bids have been received, the bidding process should describe the criteria used to evaluate the bid and finally reach the final price and the identity of the developer who will receive the award. Three types of bidding models accepted internationally that might be used to procure solar projects in Nepal are described below:

1) ***Sealed Bid Auction***
This, the simplest form of bidding, is widely used. This bidding model can be conducted either using an **offline mode** of bidding (or **electronic bidding** (e-bidding) platform). Bidders submit the technical specification, their project development experience, and bids in **envelopes** (or e-bids) to the bid process coordinator. The content in the envelope (or e-bids) remains undisclosed until the day of bidding. Qualified bidders are selected, and a **reverse auction** is done by arranging the bids from lowest to highest price and then selecting the lowest price offered. Sealed bid bidding can be performed by selecting the best options from the following as per the needs of the bid process coordinator:

a. Single stage or two stage: In **single stage** bidding the bid process coordinator invites bids for the project with complete project details. Bids are invited and bidders aggressively price to win the project. In **two stage** process, bid process coordinator does not provide complete project details. The first stage comprises of providing initial information and facilitating an early collaboration between bid process coordinator and project developer to carry out preconstruction activities. Inputs are taken before the final contract is build which would help in ensuring complete project parameters are considered and would provide cost certainty to contractor. The second stage of the process will be simply using the criteria agreed in initial stage.

[13] General guidelines by energy department of India for procurement of solar through competitive bidding, accessible at https://mnre.gov.in/img/documents/uploads/62f71161a2f5482bbaa07cb77abb7258.pdf

b. Single envelope and double envelope: In single envelope process, bidders submit their technical and financial proposals in a single envelope. Technical specifications are evaluated and then bids from the screened bidders are ranked from the lowest to the highest price. In double envelope process, technical and financial proposals are submitted in two different envelopes. The first phase is a pre-qualifying round to select eligible bidders based on technical requirements. Then, only amongst the bidders qualified in the first phase, the second envelope is opened to select the lowest tariff quoted.

Key advantages and dis-advantages associated with sealed bid biddings are set out below:

*Table 2: Advantages and Disadvantages of Sealed Bid Biddings*

| Advantages | Disadvantages |
|---|---|
| • It limits cartelization among participating bidders, as price bids are not disclosed.<br>• Single stage process is advantageous when complete details of the construction are with bid process coordinator.<br>• Two stage process is advantageous for complex projects or projects where bid process coordinator is not certain about the project details.<br>• Single envelope process is advantageous over two envelope process in terms of lesser time involved. | • Non-serious bidders who are not capable of executing the project can quote non-realistic bids.<br>• It requires stronger institutional capabilities.<br>• These biddings take long time to declare the results because of the process.<br>• Disadvantage of single stage process is that any additional work is to be done then the project developer may find ways to cut the cost which could lead to compromise in quality.<br>• Disadvantage of two stage process is that the clients are unable to benefit from early contractor engagement since the additional work may be considered even after having finalized the contract in initial stage. |

***Sealed bid case study: Single stage two envelope bidding process in Mongolia[14]***

The solar park biddings conducted by the Asian Development Bank (ADB) for Engineering, Procurement and Construction (EPC) contract for 10 MW Altai solar PV in Mongolia under the project "Mongolia Upscaling Renewable Energy Sector Project" on 30th October 2020. Sealed bids were invited for reverse bidding under single stage two envelope process.

### 2) *Descending Clock Bidding or Iterative Bidding*

Iterative bidding takes place using **electronic bidding** (e-bidding) widely. In this bidding, bidders disclose their bids gradually in bidding round. In each bidding round bidders are given the liberty to change their bids and offer a new price. This is a **reverse bidding** where rounds continue until the

[14] Tender in Mongolia for solar bidding: https://www.adb.org/sites/default/files/tenders/mon3708-altai-a2-rebid-rev-ext2.pdf

capacity is procured. This is a dynamic process where bids are disclosed between participants. All bidders can observe the changes in the bidding price and adapt their bidding strategies to win the bidding. Key advantages and disadvantages of reverse bidding include:

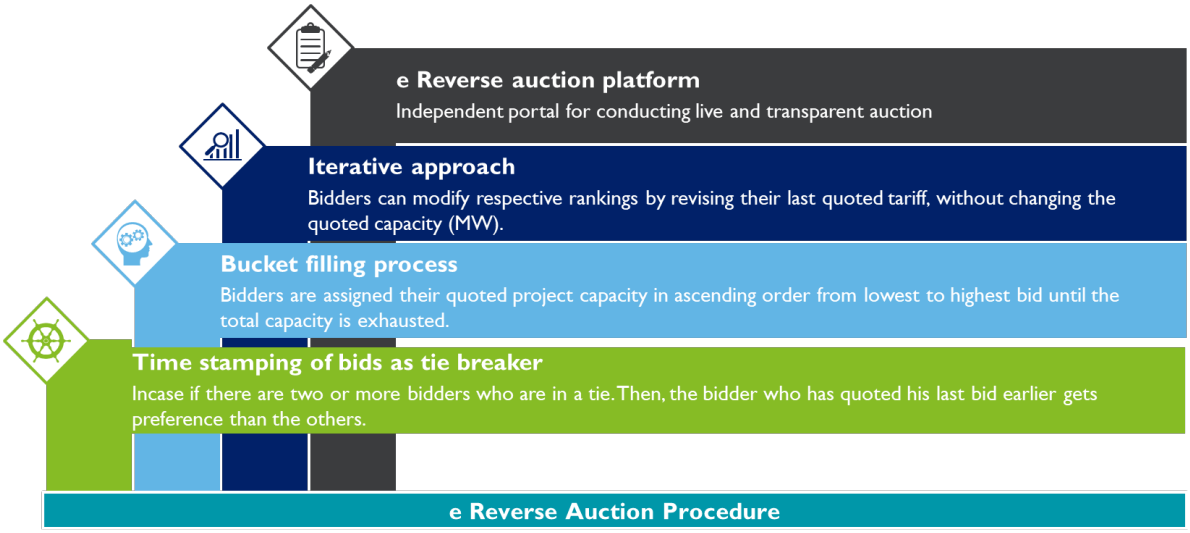
*Table 3: Advantages and Disadvantages of Reverse Bidding Biddings*

| Advantages | Disadvantages |
|---|---|
| • Rapid price discovery.<br>• Since winning bidders do not have to disclose the lowest price, they are willing to bid. | • Unrealistic bids may delay financial close from lending institutions, leading to delay in project commissioning. |

Reverse auction mechanism is a bidding approach for solar PV-based electricity procurement in which qualified bidders (based on pre-defined qualification criteria) are eligible to submit price bids.

E-Reverse auctions conducted on an independent electronic bidding portal/platform on a real time basis, which ensures a transparent bidding process. In e-Reverse auction process, bidders can modify their last quoted tariff by a number of decrements, whereas quoted capacity typically remains fixed.

E-Reverse auction platform enables international bidding where multiple bidders from different geographies can participate on real time. Electronic platforms for conducting reverse auctions can be developed or hired as a service from a third-party service provider on a pay-per-use basis.




The following are the key features to conduct an e-Reverse auction for solar PV-based electricity procurement:

- **Bucket filling process** – Based on the project capacity and initial price offered, bidders are ranked in ascending order. Bidders are allotted their quoted capacity until the entire project capacity available for bidding is exhausted. This feature plays a key role while initial shortlisting of qualified bidders for next round of e- reverse auction based on their initial tariff and project capacity.
- **Ranking of bidders** – Electronic platform dashboard shows a live ranking of each bidder based on their quoted tariff, with the lowest tariff quoted bid ranking first.
- **Iterative approach** – Bidders can reduce their quoted tariff by a minimum decrement amount (for example, 0.10 cents/kWh) from their last offered tariff on the platform. This enables bidders to monitor and improve their ranking in relation to competitors in real time.

- **Time stamping of bids** – In the event of a tie, the e-Reverse auction platform records, and timestamps each bid so that it may be determined which bid came first.
- **e – Reverse auction bid process**: Reverse auction bidding process begins with the first-round tariff, which is based on the opening of financial bids from technically qualified bidders. Following that, lowest first-round tariff bidders are shortlisted for the e-Reverse auction. e-Reverse auction platform offers a transparent and iterative evaluation process in which bidders can reduce their price bids multiple times during live bidding, resulting in better price discovery for the procuring authority.

***Iterative bidding Case Study: Bidding for solar projects to be developed in Solar Park under National Solar Mission (NSM) Phase-II, Batch-IV India***

The solar park biddings conducted by the Solar Energy Corporation of India Limited (SECI) under the National Solar Mission (NSM) Phase-II, Batch-IV India, adopted the process of e-reverse biddings. After a techno-commercial evaluation, an e-reverse bidding was conducted for the total project capacity which was conducted through an online portal. Shortlisted bidders after the financial opening round were able to login 15 minutes prior to the start of the bidding. Respective tariffs of the bidders were displayed on its window. Bidders could mention their revised discounted tariff which had to be at least 1 (one) paisa or 0.10 cent less than its current tariff. The initial bidding period was for one hour, with a provision of automat extension of eight minutes. Bidders were selected in ascending order with the lowest quoted tariff (being L1) and so on, until the capacity was exhausted. The lowest quoting bidder was allotted its qualified project capacity, followed by allotting capacity to the next higher bidder until the total eligible project capacity was exhausted. At the end of selection process, a letter of Intent (LOI) was issued to the successful bidders for each project.

### *3) Hybrid Biddings*

Hybrid bidding is a combination of single-stage sealed bid process and iterative bidding. This is a **reverse bidding** process. Iterative bidding happens at the initial stage followed by the single stage sealed bidding. Bid structure is provided in advance. In phase one, multiple rounds of bidding take place until the capacity is procured. In phase two, bidders directly provide bid process coordinator a price and quantity which is not disclosed to others. This can also be implemented in two phase approach where ceiling price is determined using reverse bidding in the initial round and then tariff-based bidding to discover the lowest price and eligible bidder in the second round.

***Hybrid Bidding Case Study: Hybrid Bidding of Brazil[15]***

Brazil has implemented a hybrid bidding where at zero phase, quantity of energy and ceiling price is provided in advance. The first phase is a descending clock bidding that results in the supply being met within a certain margin. The second stage is a sealed-bid auction which is held to meet actual demand at the lowest price. In the case of Brazil, the use of a hybrid bidding aims to take advantage of the benefits of both bidding systems: price discovery in descending clock bidding – as it has proven to be effective in determining the ceiling price for bids; and no collusion between small numbers of participants for setting the final price in sealed-bid bidding.

[15] International Renewable Energy Agency. (2013). Hybrid Auction in Brazil. Accessible at: https://www.globalccsinstitute.com/archive/hub/publications/138168/Renewable-energy-auctions-developing-countries.pdf

## 2.4 TIMELINES FOR PROJECT DEVELOPMENT

Timelines describe the duration in which the developer must develop the project and commission it for successful supply of electricity. A few international examples are presented below that gives insight about timelines for commissioning of project that are accepted by different countries:

| Parameter | Description | International Examples |
|---|---|---|
| **Part Commissioning** | Bid process coordinator may accept part commissioning of the project if the minimum capacity is achieved, and no penalty would be imposed for it provided that the scheduled commissioning date is not delayed. | California: In California, a renewable power bidding took place where it was observed that half of the projects were rejected for not having capability to meet required commercial operation deadline (COD) of 18 months first round. This led to revision of the COD to 24 months.[2]<br><br>India: As per the Indian guidelines, solar project shall be commissioned within 13 months from the date of execution of PPA and in case if solar project of capacity greater than 250 MW is built outside solar park then it would be commissioned within 15 months. Part commissioning of minimum capacity 50 MW may be accepted provided it does not lead to delay in commissioning schedule.[6] |
| **Early Commissioning:** | Full or part commissioning of solar generator could be accepted earlier than commissioning date. In this case, PPA would be required revised as per the agreements made. | |
| **Commissioning Schedule** | The projects may be commissioned within a certain period from the date of execution of the PPA. Any delay in commissioning may invite penalties on the Solar Power Generator. | |

# 3 UNDERSTANDING THE NEPALESE SCENARIO FOR SOLAR POWER PROCUREMENT

## 3.1 AS-IS ASSESSMENT OF CURRENT BIDDING PRACTICES FOR SOLAR POWER

Nepal has adopted two different approaches to provide license for power projects – first, a competitive bidding process or auction, and second, a first-come, first-served basis, where developers are granted projects(s) based on the sequence of their application. Although legal provisions exist to allow solar power procurement using both such models, only a handful of solar projects have been developed using the latter. Almost all of the private sector led solar power projects that have signed a Power Purchase Agreement (PPA) with NEA as of December 2021 have been procured through the former method of auction or competitive bidding.

The history of competitive bidding to grant license for solar power development is fairly new for Nepal. GoN has made two attempts at initiating competitive bidding for solar projects in 2016 and 2018. Both instances were borne out of the '*National Energy Crisis Prevention and Electricity Development Decade*' policy paper, which envisioned RE constituting 5-10% of the energy mix by 2026.[16] These two auctions are different from the traditional hydropower auctions conducted over the years in two ways – first, while the hydropower auctions were conducted by the Department of Electricity Development (DoED) and Investment Board Nepal (IBN), the solar auctions were conducted by NEA as mandated through the mentioned policy paper, second, while hydropower auctions have involved various winning criteria such as free equity[17], free energy[18], upfront fees[19], and lowest tariff,[20] solar auctions have been based on only lowest tariff reverse auction model. To date, NEA has auctioned a combined total of 123 MWs of solar power for 44 different locations. Such projects have averaged approximately 3 MWs each, with 8.5 MWs being the largest capacity.

Figure 5 illustrates the method followed to procure solar power by NEA.

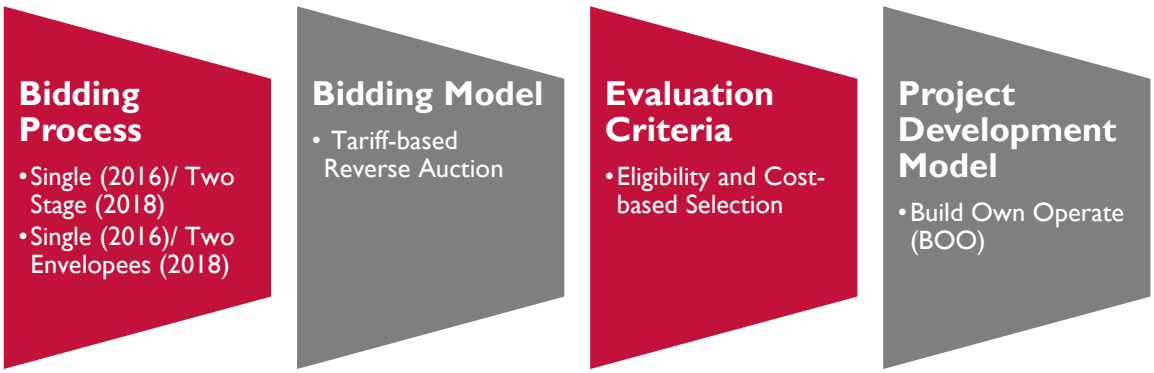



*Figure 3: Bidding/Auction Method Followed by NEA during 2016 and 2018 solar power auctions*

16 The policy paper published in 2016 calls to make alternative energy 5-10% of the total energy mix in the next 10 years
17 Highest percentage of the project's equity provided free to GoN
18 Highest amount of energy (from the project's total energy) provided free to GoN
19 Highest fees provided to GoN upfront at the time of bidding
20 Reverse auction with lowest tariff quoted as the winning criteria

### 3.1.1 BIDDING PROCESS AND EVALUATION CRITERIA

For the 2016 auction, NEA chose a single-stage and single-envelope based bidding process, where NEA requested for both the technical and financial proposals to be enclosed under a single envelope. NEA first filtered the bids based on its technical criteria, which primarily included the participating entity's experience in developing solar power in the past. Then, the bids that passed the first screening criteria were finally judged on the basis of the lowest tariff quoted. Finally, NEA awarded the Letter of Intent (LOI) to those bidders that were selected from this process.

Since the 2018 auction involved Viability Gap Funding (VGF) from Asian Development Bank (ADB), NEA followed ADB's International Competitive Bidding (ICB) process. Under the criteria set by ADB, NEA called for technical and financial bids in two separate envelopes. All the responsive bids were first evaluated based on the contents of the first envelope, which contained various technical parameters. Bidders that passed this stage of screening were then finally judged based on their second envelope, which contained among other criteria, the tariff quoted by each as the main evaluation criterion.

### 3.1.2 BIDDING MODEL

The bidding model for both 2016 and 2018 auctions were reverse auction based on the lowest tariff quoted. While the main selection criterion used in the 2016 auction was a simple lowest tariff-based model, the second auction in 2018 that involved VGF from ADB was a lot more complex – NEA decided to pay NPR. 6.6/KWh throughout the project concession period, while ADB agreed to cover the difference between the tariff bids received and NPR. 6.6/KWh until July 2022 through their VGF program. Hence, bidders were evaluated based on the tariff quoted only until June 30, 2022.

### 3.1.3 PROJECT DEVELOPMENT MODEL

For both the 2016 and 2018 auctions, GoN chose the Build, Own, Operate (BOO) project development modality. Under this model, the selected developers were offered a *take-or-pay*[21] PPA contract for a period of 25 years. Developers were responsible for land acquisition, rights of way, and acquisition of all related government permits.

The level of participation for both the auctions were not as encouraging as expected. Of various developers that took part in both the auctions, those that we interviewed have been fairly critical of the bidding and award processes for several reasons as outlined below.

i. **Policy changes at key junctures**
   Based on the 2016 '*National Energy Crisis Prevention and Electricity Development Decade*' policy paper as discussed above, the GoN initially set the PPA prices at a benchmark rate of NPR 9.61/KWh. Bidders placed their bids based on this rate during the auction. However, a subsequent government regime changed this rate to NPR 7.3/KWh after the bids were received. All those who won the bids were surprised by the move and only a few developers signed PPA with NEA based on the new tariff. Furthermore, the founding of the Electricity Regulatory

[21] A take-or-pay clause is an agreement between the contracting parties that the offtaker will either 'take' power produced, 'or pay' for the power produced if it is not required

Commission (ERC)[22] around the same time, as well as the ensuing changes in PPA approval procedures, contributed to long delays in PPA negotiations, prompting some to abandon the solar projects.

In the 2018 auction held under the ADB VGF, NEA received bids that were significantly higher than either they or ADB had anticipated. Because the tender process did not establish bid ceilings, developers quoted tariffs ranging from NPR 17.80/KWh to NPR 49.00/KWh – tariff rates significantly above the expected rates at the time. Hence, there were various rounds of negotiations until a consensus was reached to fix the tariff for all the winners at NPR 16.6/KWh until July 2022.

**ii. Licensing and permits for solar power development**

Some of the winning developers could not respond in time because of the changes around tariff rates as mentioned in the preceding section. Survey license period allowed by GoN expired before they could renegotiate new PPA terms with NEA. Furthermore, delay in tariff negotiations meant that the project concession period became less than the allotted period of 25 years, which negatively affected the project's anticipated financial returns.

**iii. Land for solar power development**

Both bid processes required developers to arrange their own land for solar installations, which resulted in lengthy delays. Although developers were given the option of either purchasing or leasing the land, they found it difficult to assemble large land parcels near NEA substations.

**iv. Other technical issues**

Developers were also critical of lack of clarity around substations to be used for connection to the national grid and how to properly report energy tables as requested in the auction procedures. This, again, added to the frustrations of the participating developers and added more unneeded delay to the award process.

The GoN has taken a step in the right direction by electing to use competitive bidding to procure solar power. However, because of various inefficiencies around bidding processes and policy decisions, the very fundamentals of auctions – price discovery and transparency – were compromised. While those auctions were supposed to be *"tariff-based",* the fact that developers were eventually allowed to sign PPA based on similar tariff and that only a handful of the auctioned projects have come online 4 to 6 years after the initial biddings, suggests that a careful study is needed to make the solar auction process more efficient in the future.

[22] Energy sector regulator for Nepal with jurisdiction over tariff approvals

## 3.2 GAP ANALYSIS & RECOMMENDATIONS

### 3.1 IMPROVE COORDINATION AMONG GON AGENCIES BY DEFINING ROLES & RESPONSIBILITIES

Clear roles and responsibilities, dictated by clear policies, are arguably the most important elements of a successful bidding process. Policy frameworks which identify government responsibilities within the sector and within the procurement process provide a stable structure for procurement. Not only do these policies provide guidance for government actors, but the policies also serve to reduce risk to investors, by reducing the likelihood of shifting rules, processes, or authorities.

To promote consistency and reduce both internal and external confusion, the GoN should map the roles and responsibilities of each government organization within the electricity industry and within the procurement process. This step provides a solid foundation upon which the procurement and a project can be developed, by reducing risk to both government parties, and developers.

### 3.2 STRUCTURED BIDDING PROCESS

As a next step, following the definition of roles and responsibilities within the sector, the GoN should also define the bidding process to be adopted. This bidding process should set out the tasks of each involved government actor. In that way, each actor is aware of the role within the process, reducing internal conflicts and overlap of duties. Each task should be assigned to an existing government organization, and supported by policy, processes, and capacity within the organization.

For example, at a high level, the following tasks could be mapped as follows:

| Agencies | Responsibilities |
|---|---|
| **ERC** | Approval of tariff discovered through competition. |
| **DoED** | Grant of Generation License once PPP is signed. |
| **NEA** | Entering Take-or-Pay PPA and completion of transmission infrastructure for the evacuation of power. |
| **MoEWRI** | Policy framework which encourages timely available for land for development of solar electricity projects. Further policies which encourage fair return on equity for investors. |
| **MoFE** | Timely clearance of environmental and forest approvals. |

Importantly, this step will reduce risk to developers and investors, and encourage investment in the market by providing clear guidance and setting expectations.

### 3.3 STANDARD CRITERIA AND EVALUATION MATRIX FOR AUCTIONS

As part of the overall procurement process, which has been set out through set policies (Recommendation 1) and a structured bidding process (Recommendation 2), the evaluation criteria and process should similarly be standardized to promote consistency and reduce the risk of differing outcomes among similar procurements. Standard evaluation documents and criteria would also improve the bidding process by providing clarity for both government stakeholders and bidders. Consistent templates which allow for slight deviations for project specifics can make the process more efficient and predictable, thereby reducing risks and costs for all parties. Further, a set of consistent

evaluation principles can ensure that GoN achieves the desired outcomes for the project, including political, environmental, and social outcomes.

### 3.4 STREAMLINE LAND & PERMITTING PROCESSES

In the past, land acquisition difficulties resulting from land scarcity and consequent rise in real estate prices, to various permits needed to acquire government lands have resulted in time and cost overruns. Furthermore, licenses and permits required at multiple stages of project development could result in inefficiencies in co-ordination among government agencies and thereby add yet another layer of hidden costs to the projects. The GoN should review the current licensing and permitting processes and make efforts to streamline these processes to reduce costs and timelines for developers – ultimately also reducing GoN costs. Specifically, the GoN should consider how the permitting processes may differ for different technologies — solar may not need to follow the same process as hydro, for instance. The current two-stage process to award feasibility study rights (survey license), and thereafter rights over sites to allow power generation, may not be the best fit for solar projects.

### 3.5 INTRODUCTION OF E-REVERSE AUCTION PLATFORM

In the past solar tariff bidding conducted was not dynamic enough to accommodate revisions to the tariff bids once the bidders submitted their bids. The gradual bidding for tariff which can be enabled by E-reverse Auction platforms ensures transparency and allow for changes to bidding strategies. For future bids NEA procure services from E-reverse Auction Platform providers for conducting iterative bidding for the tariffs.

### 3.6 DEVELOP INTERNAL FINANCIAL MODELS

Often, government stakeholders are unaware of how changes to the procurement process or project model might affect the expected tariff. A financial model can incorporate many project details, such as percentage of local labor, site remediation, and weather patterns, to predict project costs, and thereby provide insights to the expected offered tariff from developers. To better understand project dynamics and financial impacts, the GoN should develop an internal financial model to aid in decision-making processes, and better predict procurement outcomes.

# ANNEXURE

## ANNEX 1: SOLAR POTENTIAL IN NEPAL

As shown in Figure 2, The World Bank/SolarGIS study 'Global Photovoltaic Power Potential by Country' has described three levels of practical potential for development of utility-scale PV power plants for Nepal.[23]

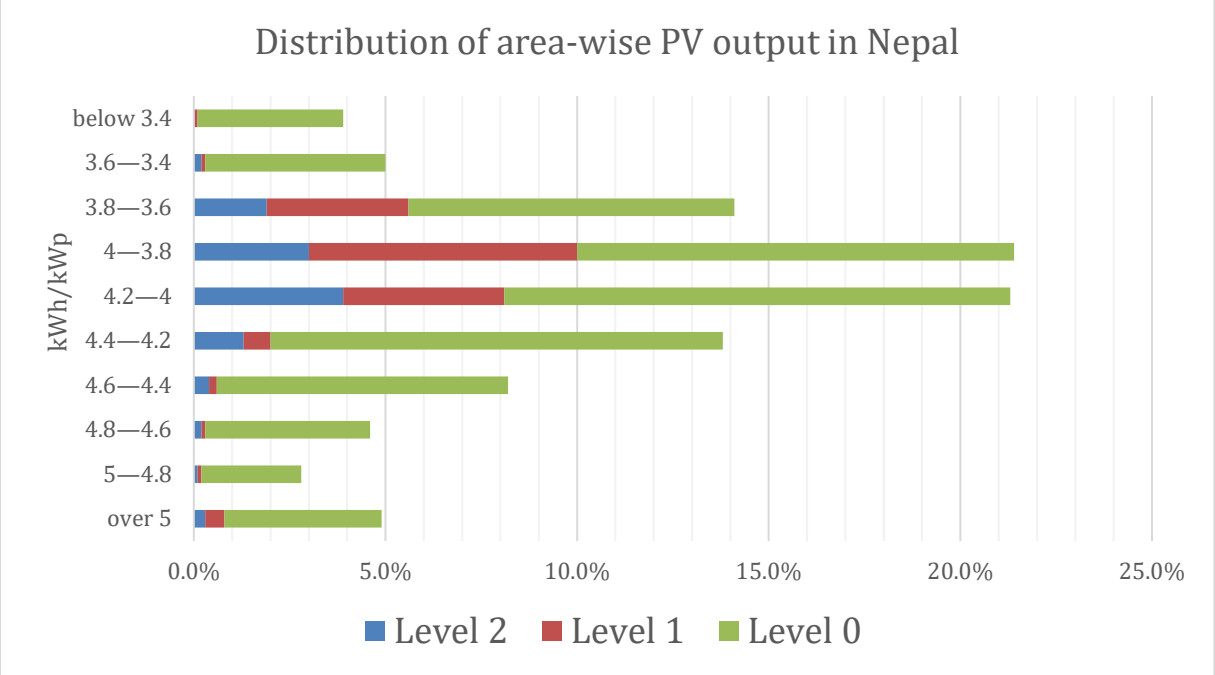



*Figure 4: Distribution of Area-wise PV Output in Nepal*

*Source: Global PV Power Potential, Country Factsheet (https://globalsolaratlas.info/global-pv-potential-study)*

Level 0 in the above diagram captures all the potential area for solar PV installation, disregarding any limitations to the development and operation of solar power plants. As shown in the chart, at this level, 21.3% of Nepal's evaluated area of 147,180 km$^2$ has the potential PV output in the range of 4 kWh/kWp to 4.2 kWh/kWp. To assess the potential more realistically, the study considers certain constraints to the development and operation of solar power plants and hence, excludes unsuitable land, with use of relevant global datasets. At Level 1, areas due to physical/technical constraints, such as rugged terrain, presence of urbanized/industrial areas, forests, and areas that are too distant from the centers of human activity have been excluded. 4.2% of the evaluated land area in Level 1 category has PV potential of 4 kWh/kWp to 4.2 kWh/kWp. At Level 2, additionally, areas that might be unsuitable due to regulations imposed by national or regional authorities (such as conservation of cropland or nature conservation) has been discarded. 3.9% of the evaluated land area in Level 2 category has PV potential of 4 kWh/kWp to 4.2 kWh/kWp.

23 https://globalsolaratlas.info/global-pv-potential-study

In the World Bank Study *'Solar Resource and Photovoltaic Potential of Nepal'*, eight sites, located at different regions of Nepal, were selected to gauge the solar irradiance in order to estimate the solar power production potential in Nepal. The study showed that, in Nepal, the average yearly total of specific PV power production varied between 1,200 kWh/kWp (equals to average daily total of about 3.3 kWh/kWp) and 2,200 kWh/kWp (about 6.0 kWh/kWp daily) with high values in north-western region of the country. High PV power production was identified at Jomsom and Simikot sites; lower potential was in Khandbari and Biratnagar. Difference in PV power production between the sites with higher and lower elevation was quite large: Jomsom (5.07 kWh/kWp) and Biratnagar (3.62 kWh/kWp), which is 28%.

A large partof the country has specific PV electricity outputs in the range between 1,400 kWh/kWp and 1,600 kWh/kWp (equals to average daily totals between 3.8 and 4.4 kWh/kWp). This places Nepal in the category of regions with very feasible potential for PV power generation. Additionally, the seasonal variability in the country is very low, compared to other regions further away from the equator. The ratio between months with maximum and minimum GHI is about 1.63, while the same ratio in Upington, South Africa, is 2.29 and in Sevilla, Spain, it is 3.54[24].

24 Solar Resource and Photovoltaic Potential of Nepal, The World Bank/ESMAP, 2017

## About USAID's Urja Nepal Project:

USAID's Urja Nepal Project supports the efforts of the Government of Nepal in establishing effective policy, regulatory and operational changes to create a financially viable electricity sector, thereby enabling it to provide affordable, reliable, and secure electricity while encouraging private sector investment into Nepalese energy market. The Urja Nepal Project is supported by the American people through the United States Agency for International Development (USAID) and is implemented by Deloitte Consulting LLP.

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