



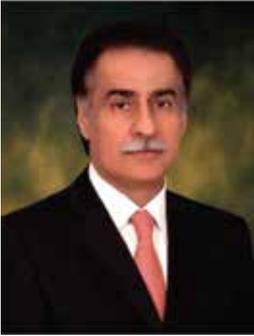
THE FIRST NET METERING LICENCE ISSUED IN PAKISTAN BY THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA):

A CASE STUDY OF THE PARLIAMENT HOUSE 1-MEGAWATT SOLAR PHOTOVOLTAIC INSTALLATION



PARLIAMENT HOUSE,
ISLAMABAD, SEPTEMBER 2016

Remarks By The Honourable Speaker Of The National Assembly



It gives me immense pleasure to share this booklet describing our journey for obtaining a net metering arrangement to sell excess solar energy from the 1-megawatt solar photo-voltaic installation at Parliament House. As this was the first net metering licence issued by NEPRA based upon their recent regulations issued in September 2015, we had to face many hurdles, which we overcame one by one. I was personally involved in resolving many of these hurdles, and therefore understand that the early adopters of similar net metering solutions would probably face even greater challenges.

I take this opportunity to praise the efforts of our resident engineer Shahid Shaukat and other colleagues at Parliament House, who provided the necessary technical guidance and perseverance for this success.

It is my wish that this booklet will serve in a modest way to share our experience so that many other organisations and individuals will also be able to obtain net metering to enhance renewables in Pakistan and reduce the burden on the national electricity grid.

Sardar Ayaz Sadiq
Speaker, National Assembly of Pakistan

Remarks By Engineer Shahid Shaukat

It is an honour and privilege for me to have been involved in this first net metering solution for a solar installation in Pakistan. I am extremely grateful to the Honourable Speaker, Sardar Ayaz Sadiq, for supporting me and providing assistance at every stage of this process. There were many hurdles that we had to overcome, and he was always available to listen to my concerns and then follow up on them actively until they were resolved.

I am also very happy to note that, subsequent to the net metering solution for Parliament House, additional net metering licences have been issued for the Speaker House, the Pakistan Engineering Council, and even to a private citizen in Islamabad, Mr. Rasheed Ramay.

I would like to offer to provide guidance to any organisation or individual planning to obtain a net metering licence, as it would enhance the adoption of solar energy solutions in the country.

Engineer Shahid Shaukat
National Assembly of Pakistan

Executive Summary

Recently, under the initiative of the National Assembly's Honourable Speaker, a solar photovoltaic (PV) based power generation system of 1-megawatt capacity was installed at the Parliament as part of the larger Green Parliament initiative¹. This was supported by the Government of China. The system consists of 3,940 solar panels, 1,180 panels of which are installed on the Parliament building's rooftop, while the remaining 2,760 panels are installed in a parking lot.

Following the installation of a solar power system, Parliament House became the first entity to receive a net metering licence from NEPRA in February 2016. Net metering is where a consumer both buys and sells electricity to the utility company. Electricity is purchased when the renewable energy installation at the consumer premises is unable to meet demand, and electricity is sold to the utility when the renewable energy generated is greater than the

consumer demand. At the end of the billing period (usually one month), the consumer receives a bill that nets off the electricity supplied by each party to the other. A net meter calculates the import and export of the electricity supply.

Parliament House's net metering licence enables it to save approximately Rs. 30 million per year in electricity bills², as well as receiving credit for the electricity exported to the grid connection with IESCO (Islamabad Electric Supply Company). Subsequently, the 5-kilowatt solar PV at Speaker House (residential quarters of the Honourable Speaker) and the 178-kilowatt solar PV at the Pakistan Engineering Council have also acquired net metering licences from NEPRA (National Electric Power Regulatory Authority).

This handbook attempts to capture the experience of Parliament House in obtaining the first net metering licence

from NEPRA, in order to share lessons learned with those entities or individuals planning to obtain a similar net metering licence from NEPRA.

The handbook clearly illustrates the process, following the requirements of the NEPRA Rules 2015.

Table 1 and Figure 2 explain the process, while the section on Additional Requirements provides the statutory requirements and roles of the power generator, distribution company and NEPRA. Annex 3 provides all the Schedules that are required by NEPRA and DISCOs to acquire the status of an independent power generator as well as a Net Metering Licence.

This booklet has been prepared with the support of Research and Advocacy for the Advancement of Allied Reforms (RAFTAAR).

¹ www.na.gov.pk/uploads/1429522953_299.pdf

² www.na.gov.pk

Overview of Net Metering

Figure 1: Energy Flows in a Net Metering Installation

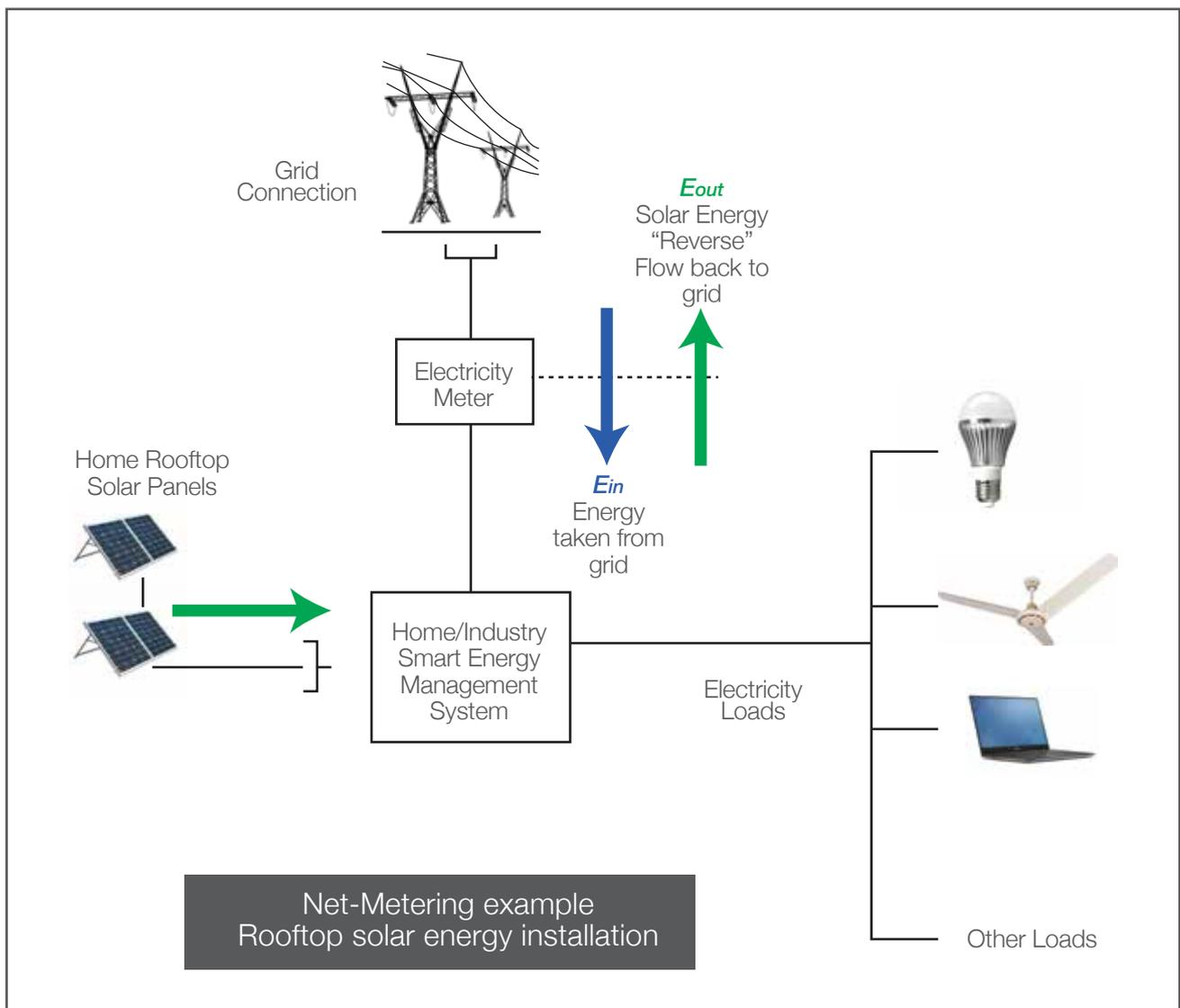
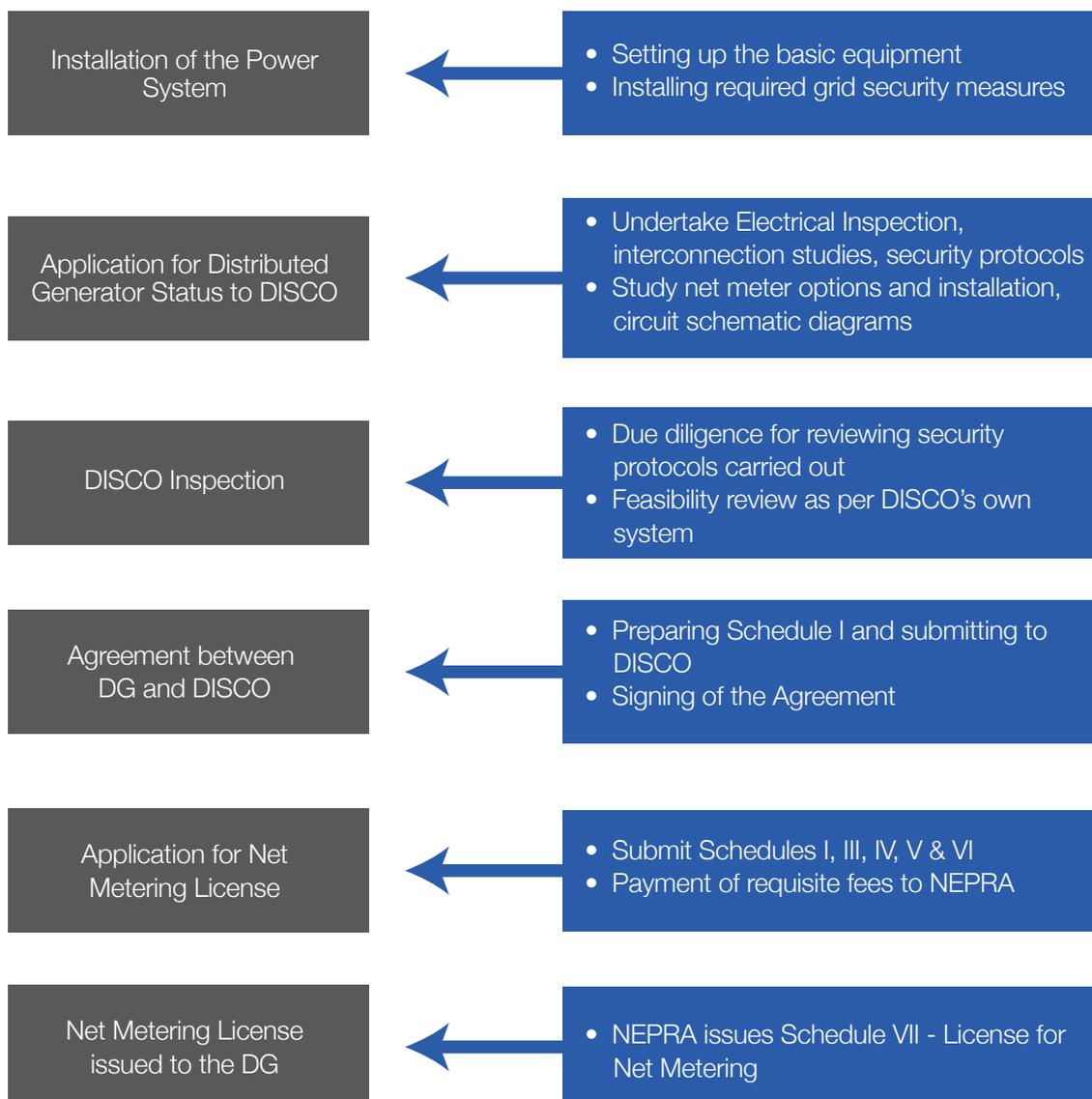


Figure 2: The Process of Acquiring a Net Metering Licence



The Journey Of Parliament House

The Speaker of the National Assembly, Sardar Ayaz Sadiq, commissioned an energy audit for Parliament House as he was concerned about excessive electricity consumption and excessive maintenance cost. Sui Northern Gas Pipelines sent one of its engineers, Shahid Shoukat, to Parliament House to conduct a preliminary energy audit. Mr Shaukat quickly identified substantial opportunities for energy saving, including changes to the electrics in the Parliament House lift, replacing air-conditioning chillers with energy-efficient ones and converting existing lights to LED lightbulbs.

During this audit, an opportunity to install a solar photovoltaic became possible when the Chinese government offered to provide Parliament House with a 1,000-kilowatt solar installation. The Speaker was keen to utilise this opportunity. Mr Shaukat was seconded

to Parliament House and was able to draw on his technical expertise to assist with the planning process for the solar installation.

Considering that the capacity of 1,000 kilowatts of power exceeded the requirements of Parliament House, it was proposed that excess power could be exported to the IESCO grid under the Net Metering scheme approved by NEPRA in 2015.

By February 2016 the 1,000-kilowatt solar installation had been commissioned and excess power was being exported to IESCO.

The Speaker admitted that this was not an easy journey as a number of technical and administrative hurdles had to be overcome, particularly as this was the first Net Metering licence issued by NEPRA.

Figure 2 illustrates the six required steps for those who wish to apply for a Net Metering licence from NEPRA.

Parliament House has provided an excellent service by putting in the effort to obtain the first Net Metering licence, and the lessons learned will assist others who have applied or intend to apply for similar Net Metering licences from NEPRA.

The objective of this booklet is to both celebrate this achievement and to record critical steps, especially bottlenecks that were overcome, in order to better prepare subsequent applicants.

Information on NEPRA rules and requirements, with further details of the experiences from Parliament and Speaker's House, are provided in Table 1 below.

Table 1: Process Description of Acquiring Distributed Generator Status and a Net Metering Licence, Illustrated by Solar PV Examples

NEPRA Rule	Requirement	Parliament House Solar PV System of 1 Megawatt capacity	Speaker House Solar PV System of 5 Kilowatt Capacity
Preparation			
Any person who meets the requirements of a Distributed Generator as defined under the regulations 2(k) is eligible for submitting application as specified in Schedule II to a Distribution Company.	A Distribution Company's three-phase 400V or 11 kV consumer, i.e. domestic, commercial or industrial and who owns and/or operates the Distribution Generation Facility, and is responsible for the rights and obligations related to the Agreement and licensed by the Authority under these Regulations.	Parliament House applied for a three-phase connection based DG.	Speaker House applied for a single-phase connection based DG.

NEPRA Rule	Requirement	Parliament House Solar PV System of 1 Megawatt capacity	Speaker House Solar PV System of 5 Kilowatt Capacity
Preparation			
<p>Application to Distribution Company along with necessary documents shall be submitted by intending Distributed Generator to Distribution Company.</p>	<p>Application Form is available within the NEPRA Rules 2015, as Schedule II.</p>	<p>Before applying, the entire power generation system (panels, inverters, etc.) was in place. After contractor selection, it took six months to design and install the system. Prior to the application, electrical inspection was carried out for all systems by Electrical Inspector from Punjab govt. for safety and hazard risk; this exercise usually takes five to seven days.</p>	<p>Before applying, all panels and systems were in place, ready for Electrical inspection by Electrical Inspector, Govt. of Punjab. System was installed in seven days; inspection usually takes three to four days depending on the availability of the Inspector.</p>
<p>A Distribution Company shall allow any of its consumers to establish Distributed Generating facilities to be interconnected with its Distribution System.</p>	<p>This requires using either (a) a standard meter capable of registering the flow of electricity in two directions, or (b) two separate meters: one for selling electricity to the Distribution Company and the other for purchasing electricity from the Distribution Company.</p>	<p>Parliament House Team studied meter options between one-way or two-directional meters; they decided on bi-directional meter, rather than two separate meters based on NTDC recommendation. The meter installed is of Slovakian make, usually used in GENCOs.</p>	<p>The same process was followed for the Speaker House and a bi-directional meter has been installed.</p>
<p>A Distribution Company has the right to review the design of a Distributed Generation Facility and Interconnection Facilities and to inspect the same prior to the commencement of parallel operation with its Distribution System, and may require the Distributed Generator to make modifications as necessary to comply with the requirements of these Regulations.</p>		<p>On initial request, IESCO team visited to review protection schemes (wiring, earthing/grounding, etc.) and as per their recommendation, Contractor carried out the Interconnection Study (load flow study, short circuit study, prepared on PSSC software).</p>	<p>The IESCO team visited to review protection schemes (wiring, earthing/grounding, etc.). As per NEPRA and IESCO standard operating procedures, the distributed generators (DG) of less than 10 KW do not require a load flow/interconnection study.</p>

NEPRA Rule	Requirement	Parliament House Solar PV System of 1 Megawatt capacity	Speaker House Solar PV System of 5 Kilowatt Capacity
Protection			
<p>The Distributed Generator shall be responsible for the installation of equipment, including, without limitation, electrical lines or circuits, transformers, switch gear, safety and protective devices, meters or electrical plant, to be used for interconnection.</p>	<p>If the Distributed Generator is unable to install requisite equipment, used for interconnection, the Distribution Company may execute the requisite work in case the Distributed Generator offers to deposit the cost to be incurred on the requisite work at mutually agreed term.</p>	<p>In Parliament's case, the contractor was capable of installing the equipment as per requirements of IESCO.</p>	<p>Similarly, the contractor was capable of installing the equipment as per requirements of IESCO.</p>
<p>The grid connected inverters and generators shall comply with Underwriter Laboratories UL 1741 standard (Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources), which addresses the electrical interconnection design of various forms of generating equipment, IEEE 1547 2003, IEC 61215, EN, or other international standards.</p>		<p>Compliance with this clause (Clause 9.5) has to be submitted with the DG application; contractor ensured that the standards mentioned were being followed and complied with.</p>	<p>Compliance with this clause was submitted with the DG application; contractor ensured that the standards mentioned were being followed and complied with.</p>
<p>Upon being satisfied that the Application is complete in all respect, the Distribution Company shall perform an initial review to determine whether the Applicant qualifies for Interconnection Facility, or may qualify subject to additional requirements.</p>		<p>IESCO performed a due diligence once all the requirements were fulfilled. After all the studies' approvals, visits and inspections, IESCO issued a NOC to move ahead with the agreement. Once the NOC was received, the team submitted Schedule I (agreement) as per NEPRA notification.</p>	<p>IESCO performed a due diligence once all the requirements were fulfilled. After all the studies' approvals, visits and inspections, IESCO issued a NOC to move ahead with the agreement. Once the NOC was received, the team submitted Schedule I (agreement) as per NEPRA notification.</p>

NEPRA Rule	Requirement	Parliament House Solar PV System of 1 Megawatt capacity	Speaker House Solar PV System of 5 Kilowatt Capacity
<p>If the Distribution Company is satisfied that the Applicant qualifies as Distributed Generator, then the Distribution Company and the Applicant shall enter into an Agreement within ten working days and Distribution Company shall send a copy of the Agreement to the Authority within seven working days of the signing of the Agreement.</p>		<p>Agreement was signed by Deputy Director (E&M), CDA, on behalf of the Parliament, and by the Chief Engineer, IESCO.</p>	<p>Agreement was signed by Deputy Director (E&M), CDA, on behalf of the Parliament, and by the Chief Engineer, IESCO.</p>
Net Metering Licensing			
<p>Any consumer who enters into an Agreement with the Distribution Company under net metering arrangement qualifies for grant of a Distributed Generator Licence.</p>	<p>Distribution Company shall forward the Application for grant of Licence as specified in Schedule III to the Authority, along with following:</p> <ul style="list-style-type: none"> • Agreement • Application for exemption from the requirement of section 24 of the Act as specified in Schedule-IV • Evidence of deposit of fee as may be specified by the Authority as specified in Schedule-V • Affidavit by Distributed Generator as specified in Schedule-VI 	<p>The team submitted all the schedules as per requirements, signed by the Deputy Director, CDA.</p>	<p>The team submitted all the schedules as per requirements, signed by the Deputy Director, CDA.</p>
<p>The Authority may, on receipt of the Application and the documents specified above, grant a licence as specified in Schedule VII to the Applicant</p>		<p>NEPRA issued Schedule VII – Net Metering Licence, in February 2016, and the connection with the grid was established. It is recommended to have DISCO present at the time the connection is established.</p>	<p>NEPRA issued the Net Metering Licence in July 2016.</p>

Specific administrative and technical bottlenecks faced by Parliament House are detailed below.

Required Technical Specifications of the Solar Inverter

The solar inverter is the electronic device that converts the solar energy being generated in DC (Direct Current) form to 3-Phase AC (Alternating Current) to synchronise with grid electricity. NEPRA has stated that only inverters of relevant specifications are allowed for grid synchronisation, and thus these specifications were shared by Shahid Shaukat with the Chinese vendor, and took some effort to obtain the correct equipment. This knowledge is essential, since the applicant can easily purchase an incorrect inverter by mistake.

Special Electricity Energy Meter

The electrical meter installed also has to be a special one that conforms to certain international specifications. The specifications followed for Parliament House were from the IEEE, the global association of electrical engineers. Since these electricity meters are not available in the market, Shahid Shaukat was able to meet the standard by utilising a PEL meter that had been purchased for another purpose, and had been certified to meet the necessary IEEE standard.

IESCO Capacity

Since IESCO did not have prior experience of interconnectivity with a net-metered solar solution, the offices of Parliament House were critical in facilitating the administrative approval

process. This is one of the most critical steps, as no other DISCO in Pakistan has yet entertained a net metering application, and when approached stated that they do not have capacity to implement this new NEPRA regulation.

Inspection by Electrical Inspector

The NEPRA Regulations require an inspection by an authorised Electrical Inspector, which comes within the jurisdiction of provincial governments. Since the Islamabad Capital Territory does not have such an inspector, an arrangement was made by Parliament House for the relevant Electrical Inspector from the Punjab government to carry out the inspection and approve the installation accordingly.

Additional Requirements

- A Distribution Company may limit the operation and/or disconnect or require the disconnection of a Distributed Generation Facility from its Distribution System at any time, with or without notice, in the event of Fault.
- A Distribution Company may also limit the operation and/or disconnect or require the disconnection of a Distributed Generation Facility from its Distribution System upon the provision of thirty days' written notice for the following conditions:
 - To allow for routine maintenance, repairs or modifications to the Distribution System of the Distribution Company;
 - Upon the Distribution Company's determination that the Distributed Generation Facility is not in compliance with these Regulations;
 - Upon termination of the Agreement
- The Distributed Generator shall not have any right to utilise the Distribution Company's Interconnection Facilities for the sale of electricity to any other person.
- The term of the Agreement between the Distributed Generator and the Distribution Company shall be three years with effect from the commissioning of the Distributed Generator Facility.
- At the expiry of the initial term, the Agreement may be automatically renewed by mutual understanding between the Distributed Generator and the Distribution Company for another term of three years, and so on.
- The Distributed Generator may terminate the Agreement upon thirty days' written notice if the Distributed Generator decides to discontinue the sale of electricity to the Distribution Company.
- The Distribution Company shall not terminate the Agreement in any event without prior approval of the Authority.
- At the end of each Billing Cycle, following the date of final interconnection of Distributed Generation Facility to the Distribution System of the Distribution Company, the Distribution Company shall net off the kWh supplied by the Distributed Generator against the kWh supplied by it.
- In case the kWh supplied by the Distribution Company exceed the kWh supplied by the Distributed Generator, the Distributed Generator shall be billed for the net kWh in accordance with the Applicable Tariff.
- In case the kWh supplied by the Distributed Generator exceed the kWh supplied by the Distribution Company, the net kWh shall be credited against the Distributed Generator's next billing cycle for future consumption, or shall be paid by the Distribution Company to the Distributed Generator quarterly.
- The tariff payable by the Distribution Company shall only be the off-peak rate of the respective consumer category of the respective month, and other rates such as variable charges for peak time, fixed charges, fuel price adjustment, or duties/levies will not be payable by the Distribution Company.

The Importance Of Net Metering In Reducing The Electricity Supply-demand Gap

A market instrument to enhance adoption of solar PV

Since the NEPRA Net Metering Regulations allow any person with a solar installation of 1 kilowatt or above to apply for a licence, they provide a major market incentive for individuals, companies and organisations to install solar panels without worrying about wasting any solar energy they cannot use.

Potential for rooftop solar PV with net metering

The substantial potential for rooftop PV in meeting electricity needs is well established, and has been illustrated by recent research undertaken by the University of Punjab³. This research concluded that rooftop space available in the Punjab Government Servants Housing Society Lahore was able to accommodate enough solar panels to generate nine times more energy than required in all the houses within the society. This could be expected in any typical housing society in Pakistan.

Annex 1: DEFINITIONS FROM THE NEPRA NET METERING REGULATIONS

1. "Agreement" means the agreement between the Distribution Company and the Distributed Generator on the Authority's approved format as per Tariff Schedule;
2. "Applicable Documents" means the rules and regulations issued in pursuance of the Act by the Authority, from time to time, the generation, distribution and transmission licences, the Grid and Distribution Codes and any documents, instruments, approvals, directions or authorisations issued or granted by the Authority in exercise of its powers under the Act and any document in each case of a binding nature applicable to the licensee;
3. "Applicable Tariff" means tariff approved by the Authority for the relevant period and category of consumers of the Distribution Company;
4. "Applicant" means a consumer of a Distribution Company who submits an Application to interconnect its Distributed Generation Facility to the Distribution System of the Distribution Company and who applies for grant of the licence to operate a Distributed Generation Facility as a Distributed Generator;
5. "Application" means the application submitted by an Applicant to a Distribution Company, for interconnection of a Distributed Generation Facility to the Distribution System of a Distribution Company and includes application for grant of licence to the Authority;
6. "Authority" means the National Electric Power Regulatory Authority established under the Act;
7. "Billing Cycle" means energy recorded by the meters in a period of thirty days;
8. "Distributed Generation Facility" means a facility set up by a Distributed Generator using Solar or Wind energy resource for generation of electricity up to 1 MW;
9. "Distributed Generation" means electrical power generation by solar or wind that is interconnected to the Distribution System of the Distribution Company at Interconnection Point;
10. "Distributed Generator" means a Distribution Company's 3-phase 400V or 11kV consumer, i.e. domestic, commercial or industrial and who owns and/or operates the Distributed Generation Facility, and is responsible for the rights and obligations related to the Agreement and licensed by the Authority under these Regulations;
11. "Distribution System" means the distribution facilities situated within the Service Territory owned or operated by the licensee for distribution of electric power including, without limitation, electric lines or circuits, electric plant, meters, interconnection facilities or other facilities operating at the distribution voltage, and shall also include any other electric lines, circuits, transformers, sub-stations, electric plant, interconnection facilities or other facilities determined by the Authority as forming part of the distribution system, whether or not operating at the distribution voltage;
12. "Fault" means an equipment failure, conductor failure, short circuit, or other condition resulting from abnormally high or low amounts of current from the power system;
13. "Interconnection Facilities" means the equipment, including, without limitation, electrical lines or circuits, transformers, switch gear, safety and protective devices, meters or electrical plant, used for interconnection services;
14. "Interconnection Point" means the point where the metering, installation and protection apparatus of the Distributed Generator is connected to the Distribution System of the Distribution Company;
15. "kWh" means kilowatt hour;
16. "MW" means megawatt;
17. "Net Energy Billing" means a billing and metering practice under which a Distributed Generator is billed on the basis of net energy over the billing cycle;
18. "Net Energy" means a balance (positive or negative) of the kWh generated by the Distributed Generator against the kWh supplied by the Distribution Company at the end of the Billing Cycle;
19. "Net Metering Facility" means a facility comprising one or two meters for measuring the kWh generated by a Distributed Generator and supplied by a Distribution Company for determining the net energy;
20. "Tariff" means the rates, charges, terms and conditions for sale of electric power to consumers as approved by the Authority and duly notified by the Federal Government from time to time.

³ Luqman, M (2015). Estimation of Solar Energy Potential from Rooftop of Punjab Government Servants Cooperative Housing Society Lahore Using GIS, <http://www.scirp.org/journal/sgre>

Annex 2:
COPY OF THE ACTUAL NET METERING LICENCE FOR PARLIAMENT HOUSE

**National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan**

GENERATION LICENCE

No. DGL/01/2016

NEPRA hereby grants Generation Licence to the Parliament House of Pakistan, under Regulation-4 of the National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations, 2015 ("the A&RE Regulations") for a period of three (03) years. This Licence is valid up to 27 day of January 2019.

2. The Licensee shall abide by the provisions under the A&RE Regulations during the currency of the Licence.

3. The technical parameters of net metering arrangements are shown hereunder:-

(i) Primary Energy Source:	Solar
(ii) Size of Distributed Generation Facility:	01.00 MW
(iii) Generator/Inverter Information:	
Manufacture:	Guanya Power Equipment Co. Ltd. China
Model Nos:	
GSG-250KTT-TV	01 x250 KW
GSG-500KTT-TV	01 x500 KW
GSG-100KTT-TV	02 x100 KW
GSG-50KTT-TV	01 x50 KW
(iv) Generation Type:	Inverter

4. This Licence may be renewed subject to the A&RE Regulations, 2015.

This Licence is given under my hand this 28th of January Two Thousand & Sixteen

Muse
Registrar 28.01.16

REGISTRAR

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
ISLAMABAD - PAKISTAN

Muse
26/1/16
Hina
27-1-16