



# Scaling up Rooftop Solar under Net Metering

Presented by:

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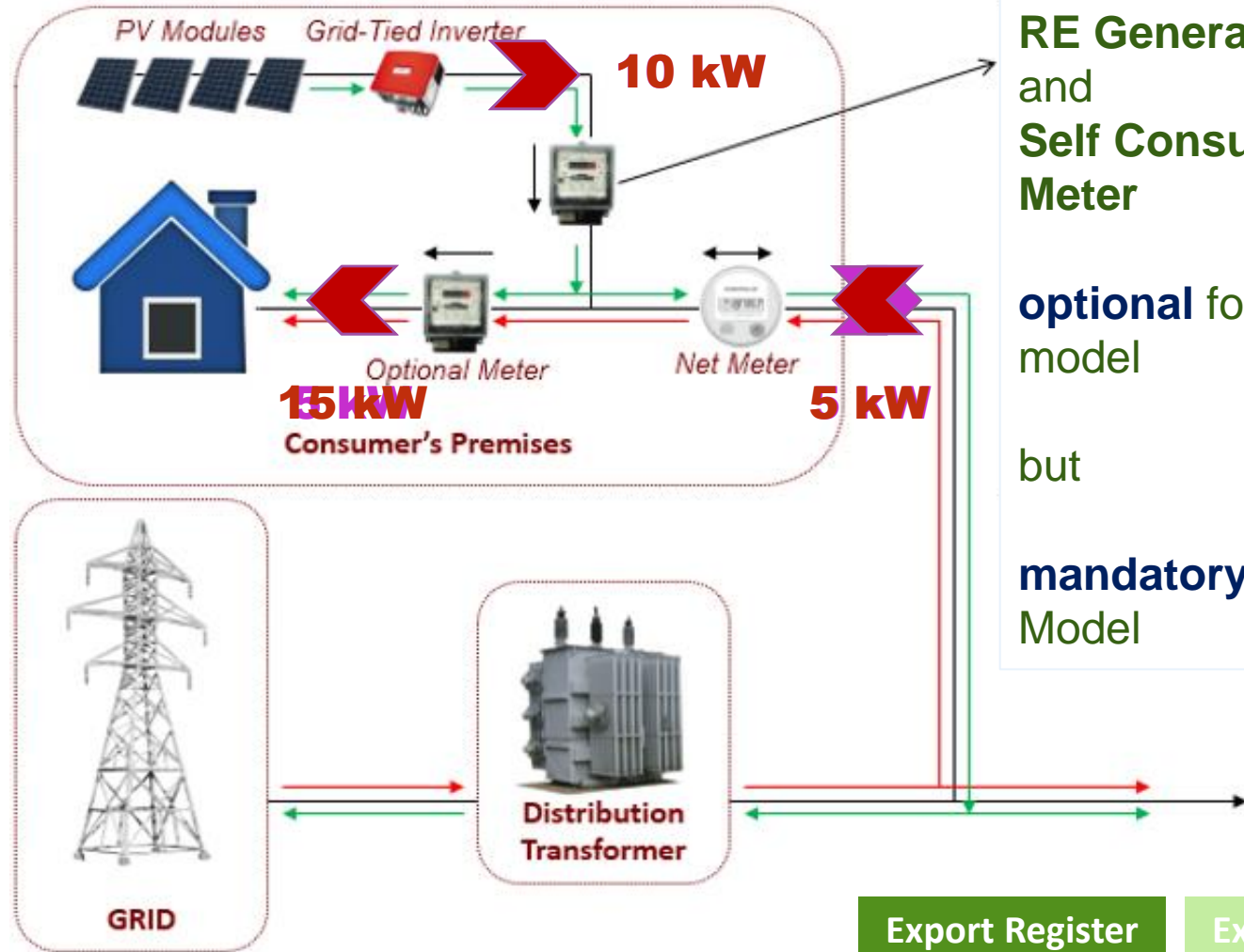
# What is Net Metering ?

11:00:20 AM

নেট মিটারিং নির্দেশিকা-২০১৮  
[১৪ নভেম্বর ২০১৯ খ্রি. তারিখে সংশোধিত]



টেকসই ও নবায়নযোগ্য স্থালানি উন্নয়ন কর্তৃপক্ষ (প্রেডা)  
বিদ্যুৎ বিভাগ  
বিদ্যুৎ, স্থালানি ও খনিজ সম্পদ মন্ত্রণালয়  
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার



**RE Generation Meter and Self Consumption Meter**

**optional** for CAPEX model

but

**mandatory** for OPEX Model

Export Register

Export Register

Import Register

Import Register

First Published: 28 July 2018

Revision: 14 Nov 2019



# Energy Calculation and Settlement

**Billing Period:** Monthly

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$$\text{Monthly Billing Unit (BU)} = I - E - C$$

**BU > 0**, Consumer will pay BU, Demand Charge, Vat etc.

**BU = 0**, No energy charge  
Demand charge and Vat only

**BU < 0**, No energy charge  
Demand charge and Vat only

**C=|BU| unit will be credited** for Next month or Settlement for June

I: Electricity Import

E: Electricity Export

C: Credit Amount

**Settlement Period:** Fiscal Year (July – June)

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**C > 0**, Utility will pay to consumer @ 33 kV Bulk rate

**C = 0**, No payment by distribution Utility



# Eligibility Criteria

- ✓ All **3 phase** consumer classes of LT, MT and HT
- ✓ Applicable only for **RE sources**
- ✓ After self consumption, surplus electricity can be exported to the grid
- ✓ **Up to 70% of sanctioned load; but not exceeding 10 MW**



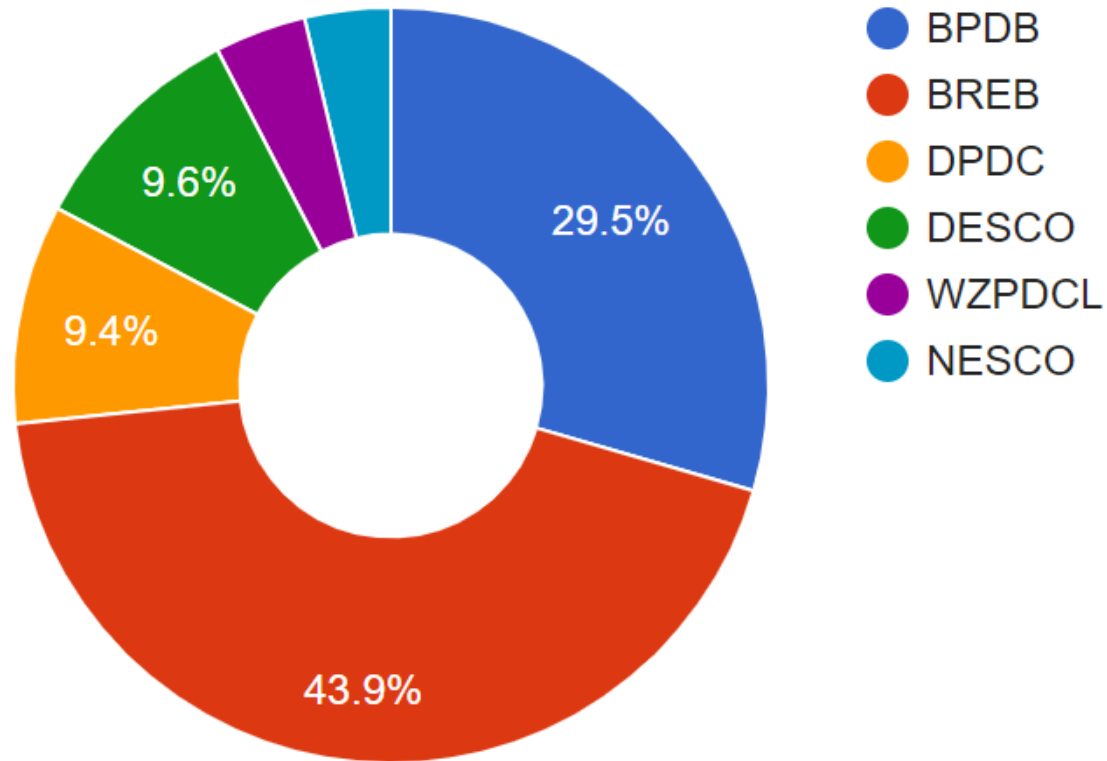
# Modalities

- CAPEX- Capital Expenditure
  - Own Finance
  - With Loan
- OPEX- Operational Expenditure



# Net Metering Progress

Share of Installed Net Metering Systems (MW)



Utility Name	Installed Capacity	Quantity
BPDB	6.788 MW	295
BREB	10.094 MW	204
DPDC	2.158 MW	235
DESCO	2.216 MW	313
WZPDCL	0.903 MW	179
NESCO	0.848 MW	43
<b>TOTAL</b>	<b>23.007 MW</b>	<b>1269</b>

Source: [www.renewableenergy.gov.bd](http://www.renewableenergy.gov.bd), Last Access on 14.03.2021



# CAPEX: Case Study (Self finance)

Rooftop Space  
500 Sq.m

Solar System  
60 kWp

SL#	Item	Price	Share
1	Solar PV Module	15,90,000/-	53%
2	Module Mounting Structures	2,40,000/-	8%
3	Solar Grid-tied Inverter	5,00,000/-	16.66%
4	Hybrid/Fuel Save controller	1,50,000/-	5%
5	Monitoring & Communication System	45,000/-	1.5%
6	Energy Meter (SCM + SGM + NEM)	50,000/-	1.67%
7	PVC Pipe and Combiner Box	50,000/-	1.67%
8	Earthing/Lightning protection, cable and maintenance free Chemical earthing	80,000/-	2.67%
9	Cables, Connectors and other parts	1,20,000/-	4%
10	Cleaning system: Walkway, Handheld unit, Pump etc.	30,000/-	1%
11	Safety Equipment for O&M: Rapid Shut-down Device, Circuit breaker, Surge protector etc.	65,000/-	2.16%
12	Transportation, Installation & Interconnection, Commissioning	50,000/-	1.67%
13	Design & Consultancy	20,000/-	0.66%
14	Legal Communication & Other costs	5,000/-	0.17%
15	Environmental Consultancy	5,000/-	0.17%
<b>TOTAL PROJECT COST</b>		<b>30,00,000/-</b>	<b>100%</b>

Cost/Wp  
**BDT 50**





# CAPEX: Case Study (Self finance)

Installation and Operational Expenditure		
1	Initial Investment Cost	30 Lac BDT
2	Inverter & Others replacement cost at 11 <sup>th</sup> year [25% of IIC]	4.1 Lac BDT [FV: 7.5 Lac]
3	Regular Maintenance [5% of Annual Return]	4.13 Lac BDT [38-40 Th.BDT/Yr]
4	Insurance Cost [0.5% of IIC, Every Year]	1.77 Lac BDT [15 Th.BDT/Yr]
<b>5</b>	<b>Total Cost in Present Value</b>	<b>40 Lac BDT</b>





# CAPEX: Case Study (Self finance)

Standard Solar Electricity Generation @100% Module Efficiency: **1200 kWh/kWp/Year**

## 0.8% Annual Degradation

Y0	100%
Y1	98%
Y2	97.2%
Y3	96.4%
Y4	95.6%
~	~
Y20	82.8%

## Yearly Electricity Generation Assumption

Y1= 71281 kWh, Y2= 70273 kWh, Y3= 69697 kWh, Y4= 69121 kWh,  
Y5= 68545 kWh, Y6= 67969 kWh, Y7= 67393 kWh, Y8= 66817 kWh,  
Y9= 66241 kWh, Y10= 65665 kWh, Y11= 65089 kWh, Y12= 64513 kWh,  
Y13= 63937 kWh, Y14= 63361 kWh, Y15= 62785 kWh, Y16= 62209 kWh,  
Y17= 61633 kWh, Y18= 61057 kWh, Y19= 60481 kWh, Y20= 59905 kWh

**20Yr's Electricity Gen.: 13,07,978 kWh**

Net Metering Calculator : <https://nemcalc.sreda.gov.bd>



# CAPEX: Case Study (Self finance)

Consumer Class	BDT/kWh	+5% VAT	PV of 1 <sup>st</sup> Yr SE	Pay Back Period	Net Present Value (NPV)	IRR
LT Commercial Flat	10.30	10.82	7.3 Lac	6.42 Yr	52.86 Lac	23.22%
LT Commercial Offpeak	9.27	9.73	6.57 Lac	7.12 Yr	44.8 Lac	20.71%
LT Small Industrial Flat	8.53	8.96	6.04 Lac	7.8 Yr	39.01 Lac	18.89%
LT Small Industrial Offpeak	7.68	8.06	5.44 Lac	8.72 Yr	32.36 Lac	16.77%
MT Industrial Flat	8.55	8.98	6.06 Lac	7.78 Yr	39.17 Lac	18.98%
MT Industrial Offpeak	7.70	8.09	5.45 Lac	8.7 Yr	32.52 Lac	16.82%

Inflation Rate:

5.65%

Source: Bangladesh Bank & BBS

Co-benefit:

CO<sub>2</sub> Reduction

618.67 ton

Levelized Cost of Solar Electricity

**LCOE: 3.10 BDT/kWh**



# CAPEX: Case Study (With Loan)

IDCOL *	
Facility	Term Loan
Loan amount	80% of the project cost
Tenor	10 years
Grace period	1st year (principal only)
Repayment	Quarterly
Interest rate	6% (Fixed for Loan Tenor)

Case Study Project	
Initial Investment cost	30 Lac BDT
Loan amount (80%)	24 Lac BDT
Yearly Principal Payment (LA/9)	2,66,667₹

Year	Rem. Principal	Principal Pay	Interest	PVF	Interest in PV
Y1	24,00,000₹	0₹	1,44,000₹	0.943396	1,35,849₹
Y2	24,00,000₹	2,66,667₹	1,44,000₹	0.889996	1,28,159₹
Y3	21,33,333₹	2,66,667₹	1,28,000₹	0.839619	1,07,471₹
Y4	18,66,667₹	2,66,667₹	1,12,000₹	0.792094	88,714₹
Y5	16,00,000₹	2,66,667₹	96,000₹	0.747258	71,737₹
Y6	13,33,333₹	2,66,667₹	80,000₹	0.704961	56,397₹
Y7	10,66,667₹	2,66,667₹	64,000₹	0.665057	42,564₹
Y8	8,00,000₹	2,66,667₹	48,000₹	0.627412	30,116₹
Y9	5,33,333₹	2,66,667₹	32,000₹	0.591898	18,941₹
Y10	2,66,667₹	2,66,667₹	16,000₹	0.558395	8,934₹
<b>END</b>	<b>0₹</b>	<b>24,00,000₹</b>	<b>8,64,000₹</b>		<b>6,88,882₹</b>

Cost of Money **6.89 Lac BDT** [23% of the initial investment]

LCOE **3.60 BDT/kWh** Payback period will increased by at least **1 yr.**

\* IDCOL: Infrastructure Development Company Ltd.



# OPEX Model (LT Flat)

Hassle free solution for the consumer

Tariff of the consumer : **8.53 BDT/kWh**. Let, Negotiated OPEX tariff : **7.50 BDT/kWh**

**1<sup>st</sup> year:** Electricity Generation **71,281 kWh**

Benefit of Industry Owner	Benefit of OPEX Investor
$71,281 \times (8.53 - 7.50)$ <b>= 73,419 BDT</b>	$71,281 \times (7.50 - 3.60)$ <b>= 2,77,996 BDT</b>

**20 years:** Electricity Generation **13,07,978 kWh**

Benefit of Industry Owner	Benefit of OPEX Investor
$13,07,978 \times (8.53 - 7.50)$ <b>= 13,47,217 BDT</b>	$13,07,978 \times (7.50 - 3.60)$ <b>= 51,01,114 BDT</b>

*No risk for industry owners, only paying for the generated electricity*



# System Installation Procedure

SL	Stage	Max. Time duration	Responsibility
1	Application submission to the respective distribution utility office	5 working days	Utility
2	Application Evaluation [Building, Connection point and Distribution System]	10 working days	Utility
3	System Installation	8 months	Consumer
4	System Evaluation	10 working days	Utility



# Equipment Standards

SL	Product Name	Name of Standards
1.	Solar Module/Panel	<b>BDS IEC 61215</b> <b>BDS IEC 61730-1:2019</b> <b>BDS IEC 61730-2:2019</b>
2.	<b>Inverter (All)</b> <i>[Off-grid and Grid-tied, both]</i>	<b>BDS IEC 62109-1</b> <b>BDS IEC 62109-2</b>
3.	Grid-tied Inverter	<b>BDS IEC 61727:2020</b> <b>BDS IEC 62116:2020</b>





# Installation Standards

- ✓ DIN VDE0100 (General Requirements), VDE 0100-712 and VDE-AR-N 4105 (Special Requirements), IEC 62446 (Inspection) and VDE 0100-520 (Cable and Power line selection)

SL	Product Name	Name of Standards
1.	<b>DIN VDE 0100-100 (IEC 60364-1:2005)</b>	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions
2.	<b>DIN VDE 0100-712 (IEC 60364-7-712:2017)</b>	Low voltage electrical installations - Part 7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply systems
3.	<b>VDE-AR-N 4105 (Anwendungsregel:2018 -11)</b>	Generators connected to the low-voltage distribution network Technical requirements for the connection to and parallel operation with low-voltage distribution networks
4.	<b>IEC 62446-1:2016 (AMD1:2018)</b>	Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 1: Grid connected systems - Documentation, commissioning tests and inspection
5.	<b>DIN VDE 0100-520 (IEC 60364-5-52:2009)</b>	Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems





# Mounting Structure

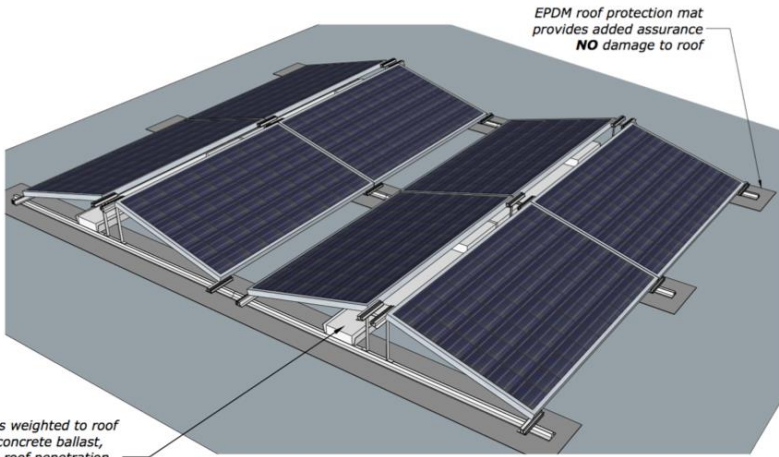
## Sloped roof



A standard rail system

Dual tilt system

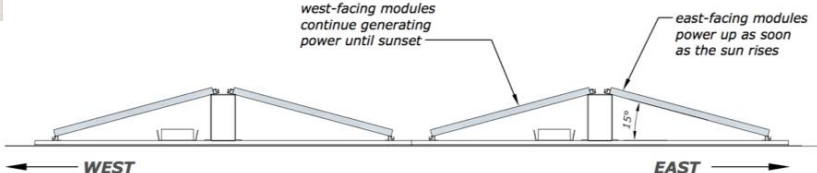
## Flat roof



Rail-based mounting system

Ballasted mounting system

Anchored mounting system



# Inverter Type Selection



Micro Inverter



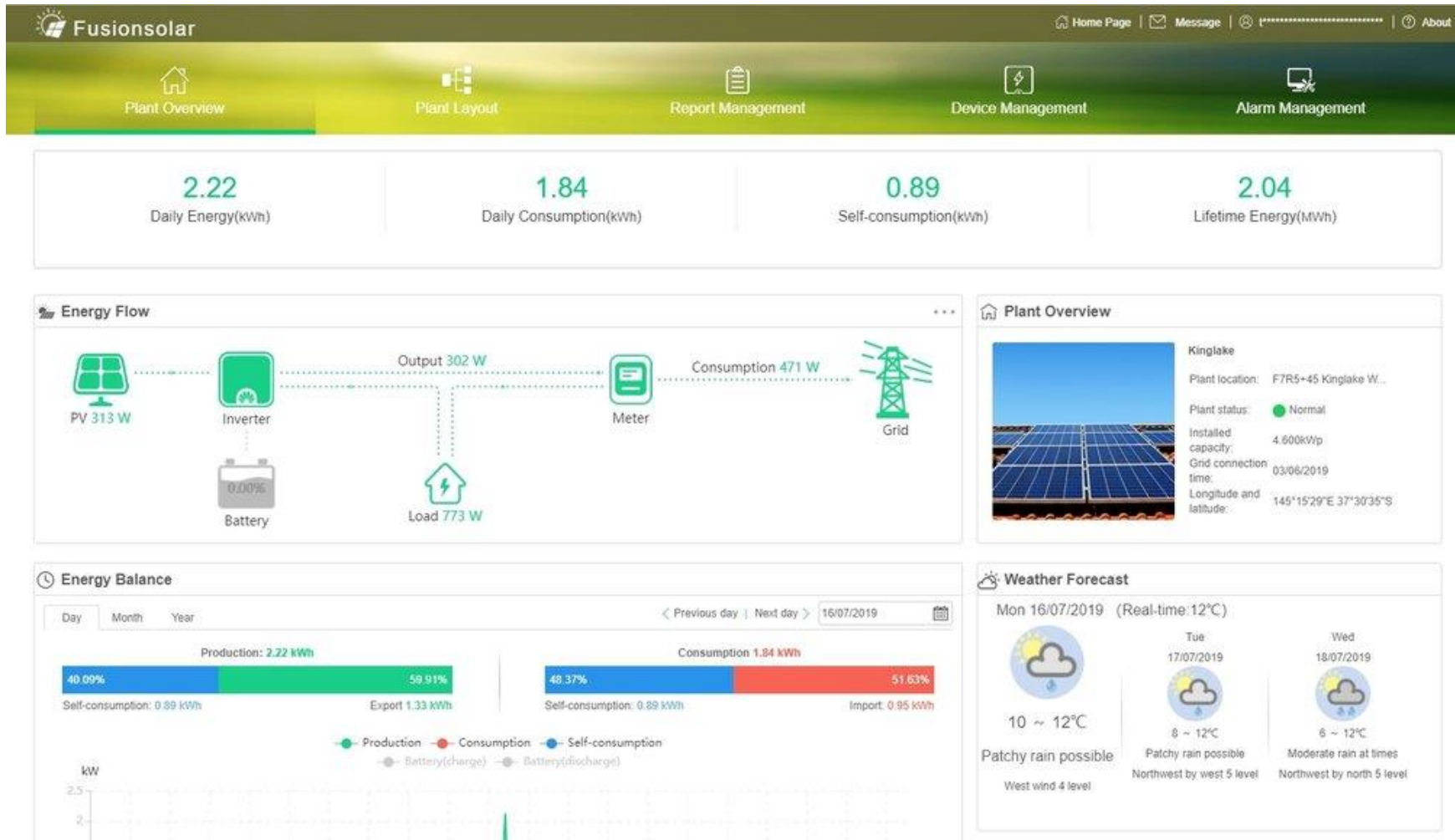
String Inverter



Central Inverter



# Inverter Monitoring Platform



Available through: Web browser and app





Rooftop solar PV system offers an **attractive option** for future development.

# Thank you

[To download the copy of the Net metering Guideline,  
visit: <https://solar.sreda.gov.bd> ]

