ROOFTOP SOLAR (RTS) DEVELOPMENT
Policy Interpretation and Market Analysis

USAID Vietnam Low Emission Energy Program
Duc Nguyen, Renewable Energy Advisor
CONTENT

• Section I. Background
• Section II. Decision 13 on Solar Development
  – Decision Briefings
  – The Imperfections
• Section III. Market Outlook
Section I.
BACKGROUND
Legislations Background

18 MAR 2016
428/2016/QD-TTg
Approval of revised Power Development Plan VII

11 APR 2017
11/2017/QD-TTg
Mechanism for promotion of solar power project development in Vietnam

12 SEP 2017
16/2017/TT-BCT
Project development and model PPA applied to solar power projects

02/2019/QD-TTg
AMENDED BY

05/2019/TT-BCT
AMENDED BY

INCENTIVES FOR SOLAR ROOFTOP DEVELOPMENT
FIT for excess power: 9.35$c/kWh
PPA validity: 20 years
Net Metering mechanism (later revised as Net Billing)
COD before June 30th, 2019
Capacity limit: 1MWp

25 NOV 2015
2068/QD-TTg
Approval of Renewable Energy Development Strategy to 2030 with vision to 2050

18 MAR 2016
2068/QD-TTg
Market Achievement - 2019

Total RTS system

- No of system, 22,323
- No of system, 12,765
- No of system, 9,314
- No of system, 1,510

Total installed systems by location

- NPCs: 6%
- SPCs: 25%
- CPCs: 19%
- HNPCs: 18%
- HCMPCs: 1%

Total installed capacity by location

- NPCs: 58%
- SPCs: 26%
- CPCs: 18%
- HNPCs: 1%
- HCMPCs: 5%

Total installed capacity, 377.9431 MWp

No of system, 1,510
No of system, 9,314
No of system, 12,765
No of system, 22,323
 Outstanding & Responsive Actions

- Interconnection process, standard and codes
  - 5113/EVN-KD
  - 1532/EVN-KD
  - 3450/EVN-KD

- Low Power Retail Tariff
  - Dec. 648/QD-BCT

- Metering and billing arrangement
  - Dec. 02/2019/QD-TTg
  - Cir. 05/2019/TT-BCT

- Public Policy Support
  - Dec. 2023/QD-BCT
  - Dec. 612/QD-BCT

- Legal and institutional considerations for RTS
  - Dec. 13/2020/QD-TTg

- Permitting and Licensing requirement
  - [For >1MWp]
Section II.
DECISION 13 ON
SOLAR DEVELOPMENT
New Decision Briefings

1. unified nationwide FiT
2. Provide separate guidance and new definition of RTS
3. Allow other electricity off-takers
4. Allow private PPA
5. Net billing mechanism
6. Monthly payment

1 MWp

“speed bump”
## One Unified Tariff

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Tariff for Zone I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>VND/ kWh</td>
</tr>
<tr>
<td>1</td>
<td>Ground mounted projects</td>
<td>1,620</td>
</tr>
<tr>
<td>2</td>
<td>Floating projects</td>
<td>1,758</td>
</tr>
<tr>
<td>3</td>
<td>Rooftop solar power projects</td>
<td>1,943</td>
</tr>
</tbody>
</table>

Note: Applied for projects sell excess power to EVN grid and achieve COD from 1/07/2019 until 31/12/2020

### New definition of RTS

**Rooftop solar power system means:**

- A solar power system with photovoltaic panels
- Installed on the roofs of civil works or industrial works (*) and
- Has a capacity of less than or equal to 1 MWp and
- Directly or indirectly connected to Electricity purchaser with
- Connection voltage of 35 kV or less.

Note: Reference to Circular 03/2016/TT-BXD
New Definition of Electricity Off-taker

**Electricity Off-takers:**

- **Purchaser means** *Electricity of Vietnam (EVN)* or its authorized member unit or an organization, individual buying electricity from the *Electricity Seller* or an organization taking over the rights and obligations of the above-mentioned organizations as prescribed by law.
- **Seller means** an organization, individual operating in the field of solar power generation or an organization, individual taking over the rights and obligations of the above organizations and individuals as prescribed by law.

Open Business Model

**Allow rooftop solar power system to:**

- **Sell** part or all of the electricity produced to the Purchaser being:
  - **EVN OR**
  - An organization or other individuals in case of not using EVN grid
- **Formally accept** private B2B PPA
The Imperfections

01. LOWER FIT
02. 1MWP THRESHOLD

03. LATE ISSUE DATE

04. SHORT EFFECTIVENESS
   - Reduce readiness;
   - Into another gold rush;
   - Concern on system price;
   - Concern on EPC quality/construction safety
Section III.
MARKET OUTLOOK
Conventional models

- SELF-FINANCE
- EPC
- O&M
- EPC
- OWNER
- EXPORT
- METERING
- UTILITY
- BANK
- LOAN
- INTEREST
- PAYING
- BANK LOANS
Modern Models | ROOF LEASE

DESCRIPTION

- The roof owner lease the roof to RTS developer and receive monthly payment
- RTS investor to invest, install, do O&M for the PV system and sell all generated electricity to EVN
DESCRIPTION

- RTS investor to invest, install, do O&M for the PV system, sell all or part of generated electricity to the roof Owner and remaining electricity to EVN (if any).
- The payment scheme between RTS investors and roof Owner is negotiated through private PPA.
- For excess power sold to EVN (if any), standardized PPA will applied.
RTS Market Outlook – YTD

RTS System by Segments

- Industrial: 7%
- Commercial: 6%
- Residential: 85%
- Administrative: 2%

27,845 system

Installed Capacity by Segments

- Industrial: 56%
- Commercial: 28%
- Residential: 11%
- Administrative: 5%

573MWp

Top Installations by cities

- HCM: 6,662
- BRVT: 1,178

Top installed capacity by cities (MWp)

- Tay Ninh: 34
- Gia Lai: 28
- Dak Nong: 19
- Long An: 17
- Khanh Hoa: 15
- Dong Nai: 13
- Binh Duong: 11
- Dak Lak: 6
- Ninh Thuan: 5
- HCM: 4

5/20/2020
THANK YOU

USAID Vietnam Low Emission Energy Program

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1. Prediction of FiT extension?
2. Is rooftop solar applicable for DPPA?
3. Regarding rooftop solar which has capacity of more than 1MW, is the project allowable under Vietnam legal law, or any permitting process?
4. How will the COVID-19 impact the solar power especially rooftop solar?
DEEP C Industrial Zones for RE Buyers Vietnam Working Group Webinar #2

EPC selection WWWHP rooftop solar project

May 21st 2020
BACKGROUND

Target: supply 50% of DEEP C’s electricity demand with renewable energy by 2030

DEEP C Quang Ninh I + II
315 MVA

DEEP C Hai Phong I +
98 MVA

DEEP C Hai Phong II
121 MVA

DEEP C Hai Phong III
97.5 MVA

DEEP C Quang Ninh I + II
315 MVA

Excessive power for hybrid barge

DPPA with 3rd party

No feedback to grid

Coal-fired and hydroelectricity

Solar projects

Waste-to-energy

Wind projects

Battery storage
BACKGROUND

Preceding development

› 2016: pre-feasibility study by international consultant
› 2017: measurement campaign with small test installation
› 2018: yield study based on 12 months’ data
   » Consistent with satellite readings for area
   » Observed performance ratio in line with expectations
› 2019 – 2021: business case rooftop solar
   » CAPEX model: higher return (+ develop own expertise)
   » 2019-2020: 1st pilot of 2,1756 MWp on warehouses WWWHP
      › Demonstrate economic viability
      › Already in PDP under Decision 4274/QD-TTg
      › Set up legal framework for ‘copy-paste’
   » 2020-2021: further roll-out additional capacity to XX MWp
      › New and existing tenants
      › Strong interest for green utilities (option to add REC handover)
OFFER GATHERING

Request for Quotations – RfQ

› 12 suppliers (some known from before 2019, some from conferences/exhibitions)
› Limited process, consisting of building plan, proposed lay-out and basic technical specifications
› 9 local, 3 international
› Price range: 490 USD/kWp to 700 USD/kWp
› Selection criteria:
   » Price (within budget)
   » Materials used
   » Production specifications
   » Vietnamese references
   » International references if available
› Phase running until October 2019
OFFER GATHERING

Request for Proposals – RfP

› 4x supplier from RfQ, 2x supplier from reference other partner
› Official RfP process: proposal document with all technical/contractual specifications
› Support from Clean Energy Investment Accelerator (CEIA)
  » Experts on different topics
    › Contracting/legal
    › AC
    › Safety/O&M
  » Several online sessions to discuss progress
  » Helped to eliminate 3 suppliers not sufficiently according to requirements RfP
› Discussion on all levels with local team
› Phase running until January 2020
EPC SELECTION

Parameter definition

› Selection criteria:
  » Low price/kWp installed
  » Good relative production
  » International expertise
  » Trusted sub-contractor(s)
  » Good references
  » No compromises in terms of quality
  » Payment terms

› Attention points:
  » Location of HQ
  » Offering of LV/MV
  » Financial stability/guarantee
EPC SELECTION

Price comparison

- Excluding maintenance costs vs. including maintenance costs
  - High maintenance burden on profitability
  - Low maintenance not realistic

- Excluding medium voltage equipment vs. including medium voltage equipment
  - Needed for connection to the grid
  - Prices can differ according to expertise supplier

<table>
<thead>
<tr>
<th>Bidding Company</th>
<th>Excl. maintenance</th>
<th>Incl. Maintenance</th>
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<tbody>
<tr>
<td></td>
<td>Excl. MV USD/kWp</td>
<td>Incl. MV USD/kWp</td>
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<tr>
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<td>USD/kWh</td>
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<td></td>
<td>Excl. MV USD/kWh</td>
<td>Incl. MV USD/kWh</td>
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EPC SELECTION

BoQ comparison

- Know the prices of your components
- Compare on specific items (too low vs. too high)

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<tr>
<th>Cost Component</th>
<th>USD</th>
<th>USD/Wp</th>
<th>USD</th>
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<th>USD</th>
<th>USD/Wp</th>
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<td>Panels</td>
<td>239.541</td>
<td>0.238</td>
<td>476.171</td>
<td>0.239</td>
<td>507.036</td>
<td>0.236</td>
<td>562.074</td>
<td>0.236</td>
<td>483.002</td>
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<td>Mounting</td>
<td>123.189</td>
<td>0.057</td>
<td>75.842</td>
<td>0.038</td>
<td>141.971</td>
<td>0.070</td>
<td>76.531</td>
<td>0.036</td>
<td>57.216</td>
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<td>DC Cables</td>
<td>78.528</td>
<td>0.036</td>
<td>119.902</td>
<td>0.082</td>
<td>64.974</td>
<td>0.030</td>
<td>33.679</td>
<td>0.017</td>
<td>20.242</td>
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<td>Inverters</td>
<td>117.438</td>
<td>0.054</td>
<td>117.666</td>
<td>0.059</td>
<td>99.932</td>
<td>0.046</td>
<td>101.869</td>
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<td>80.783</td>
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<th>TOTAL excl. MV</th>
<th>USD</th>
<th>USD/Wp</th>
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<td>TOTAL incl. MV</td>
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<td>USD</td>
<td>USD/Wp</td>
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<td>USD/Wp</td>
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</table>
CONCLUSION

End result

› Two suppliers with very strong proposals
   » ‘Luxury of choice’
   » Good negotiation position

› Successful start of the project with BEC
   » Strong investment case
   » No surprises before or after contract signing
   » Good preparation and project planning means less impact from COVID-19
THANK YOU FOR YOUR ATTENTION!

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CORPORATE BUYER PERSPECTIVE

Lessons and Learnings from adidas Rooftop Solar Experience in Vietnam with suppliers

Tracy Nilsson
Senior Director, Global Environment
CONTENTS

1. ADIDAS CARBON TARGETS AND ROADMAP
   - ADIDAS FOOTPRINT IN VIETNAM
   - SUCCESSFUL ROOFTOP ADOPTION IN VN

2. ADIDAS SOLAR ROOFTOP PROGRAM
   - END TO END APPROACH

3. ADIDAS SOLAR ROOFTOP GUIDELINE

4. KEY TAKEAWAYS

5. Q&A
ADIDAS CARBON TARGETS AND ROADMAP

2050 Target

- Climate neutrality

2030 Target

- 30% absolute CO2 reduction target [UNFCCC]*
  - 60% of adidas carbon emission directly linked to its T1 & T2 suppliers

2020 Action

- 100% of strategic suppliers must conduct a rooftop solar feasibility study
- Produce at least 5% of on-site renewable energy
- Pilot dPPA for strategic suppliers in Vietnam
- Adopt the adidas rooftop solar guideline

Note (*): baseline year 2017
ROOFTOP SOLAR PROGRAM IN VIETNAM

adidas’ support to suppliers

1. Collect monthly energy data from each facility
2. Track their progress towards RE and Carbon target
3. Identify gaps and opportunities for any RTS system
4. Financing both desktop and on-site RTS feasibility studies for 33 suppliers*
5. Partner with technical experts to support suppliers adoption of RE solutions

Note(*): excluded facilities either have RTS already completed, under constructions, have already conducted FS, or leased building
The end-to-end process guides adidas’ suppliers through every step of the way to the solar roof-top installation.

**ADIDAS’ END-TO-END ROOFTOP PROCESS**

1. Select Vendor
   - RfP Process and state requirements
2. Conduct desktop assessment
3. Facility’s pre-assessment questionnaire
4. Positive desktop results proceed to on-site assessments
5. Evaluate and submit result to adidas
6. Select developer and sign agreement
7. Install and operate Solar PV
Identify key information of facilities to effectively evaluate the solar compatibility and admission into the project.

**KEY ELEMENTS TO CAPTURE & EVALUATE:**

1. GPS location
2. Building ownership
3. Grid connection
4. Current electricity consumption
5. Rooftop information (dimension, type of roof, etc.)
KEY INSIGHTS FROM DESKTOP FEASIBILITY STUDY

Assess technical feasibility for a potential PV generation based on supplier specific electricity data and position coordinates

KEY ELEMENTS TO CONSIDER & EVALUATE:

1. Usable rooftop maximum potential
2. Proposed RTS capacity based on energy demand
3. Avoided CO2 emissions
4. Financial business case
FINANCIAL BUSINESS CASE

Financial analysis to derive amortization and savings are necessary

KEY ELEMENTS TO CONSIDER & EVALUATE:

1. Cost and saving overview (USD/year) compared to existing case
2. ROI (if self-invest)
3. Availability of leasing model
4. Availability of on-site PPA options
Key factors to consider for RfP of solar developers

1. Extend RfP to multiple developers
2. Both desktop and on-site assessments should be conducted – on-site assessment is a minimum requirement and necessary to ensure that technical details are considered.
3. Consider factors other than price - Ensure all key criteria / quality / hidden cost are checked and evaluated before making the final decision
4. Ensure the solar developers have experience in your local market
The guideline provides detailed guidance on how to approach and address the feasibility study, select a developer and answers the following key questions:

1. What does the process of conducting a feasibility study look like?
2. What are the adidas minimum requirements to fulfill the solar roof-top feasibility study?
3. What minimum parameters are needed for the supplier to determine if they proceed to the next steps in developer selection?
4. What does the general process of developer selection look like and what are the important criteria in each step in the process?
5. How to choose a reliable developer and what to look for?
6. How to ensure a successful outcome (Do’s and Don’ts)?
1. Brandsupplier collaboration is critical to reduce carbon footprint

2. Understand the supplier’s energy consumption and potential RTS capacity

3. Credible external technical expertise needed to conduct both desktop and on-site

4. Keep informed on the country’s renewable energy policy and incentives
Q&A

THANK YOU

Tracy Nilsson
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ROOFTOP SOLAR POWER

CONTENTS

1. INTRODUCTION TO TTC GROUP AND TTC ENERGY
2. O&M MODEL
3. ORIENTATIONS AND DEVELOPMENT
TTC GROUP

ENERGY

REAL ESTATE

AGRICULTURE

TOURISM

- **Charter capital**: 18,152 billion VND
- **Owner's equity**: 20,968 billion VND
- **Total assets**: 61,873 billion VND
- **Net revenue**: 10,314 billion VND
- **Profit before tax**: 1,167 billion VND
- **Member companies & affiliates**: 3 Corporations, 1 Sectoral Committee, > 120 Belonged units
- **Employees**: over 8,000

www.ttcenergy.vn
Solar power systems have been installed in over 20 large cities, provinces in Vietnam, Laos, Cambodia.

Over 132 works with a total installed capacity as of January 2020: 50 MWp
A SOLID FOUNDATION

• A solid foundation formed by Gialai Electricity JSC (GEC) with more than 30 years of experience in energy sector, including solar power (7 plants: 380 MW), wind power, hydropower and thermal power.

• Sponsored by well-known international organizations:
  - **IFC**: International Finance Corporation of World Bank
  - **ARMSTRONG**: Singaporean Clean Energy Fund
CUSTOMER’S CHOICE

SUPPORTED BY TTC GROUP - A MORE THAN 40-YEAR BRAND

- Commit to accompany the Customer in 25 years of the product life cycle.
- Commit to the warranty for products and services until the last year of the product life cycle.

ASSURED SYSTEM’S QUALITY

- Solar power system’s equipment is strictly selected and tested by TTC through the installation of projects invested by TTC Group.
- A skilled technical team with over 30 years of system installation and operation experience.

www.ttcenergy.vn
1. TRENDS AND REQUIREMENTS

- Popularity and Wide Development
- Awareness of Actual Benefits
- Environmental Protection
- Stable Operation
- Long-Term Service Life
- Maximum Performance
- Bold Investment
II. O&M MODEL

3. WORK

❖ Regular maintenance and cleaning:
II. O&M MODEL

3. WORK

❖ Regular maintenance and cleaning:

❖ **Cause:**
  • Dirt, dry leaves, moss, pollen and guano are accumulated on the surface of the panels

❖ **Impact:**
  • Performance reduction
  • Impact on the panel’s material: mirror surface, aluminum frame, etc.

❖ **Solution:**
  • Manual cleaning
  • Semi-automatic cleaning

❖ **Cycle:**
  • Evaluate the dirt concentration and shading impact of surrounding objects
  • Cost balance
II. O&M MODEL

3. WORK

- Regular maintenance and cleaning:

  1. Evaluate the environmental conditions to select the frequency and timing for cleaning (Typically every 3 months)
  2. Monitor weekly, monthly or annual output to increase or decrease the cleaning frequency
  3. Prepare a plan and select solutions.
  4. Develop implementation solutions
  5. Monitor and evaluate the output before and after cleaning
II. O&M MODEL

3. WORK

❖ Regular maintenance and cleaning: MANUAL CLEANING

1. Use clean water and specialized equipment: A brush made of soft nilon fibre with a handle
2. Avoid strong detergent
3. Avoid strong impact
4. Use water at normal temperature
5. Appropriate time for solar panel cleaning
6. Comply with safe working procedures
II. O&M MODEL

3. WORK

❖ Regular maintenance and cleaning:

Manual cleaning
II. O&M MODEL

3. WORK

- Regular maintenance and cleaning:

Semi-automatic cleaning (cleaning robot)
### 3. WORK

- **Preventive maintenance**

<table>
<thead>
<tr>
<th></th>
<th>System operation principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Ensure that the mechanical installation complies with installation guidelines.</td>
</tr>
<tr>
<td>2</td>
<td>• Ensure that the electrical installation complies with installation guidelines.</td>
</tr>
<tr>
<td>3</td>
<td>• Ensure that all switches, MCB, MCCB are off.</td>
</tr>
<tr>
<td>4</td>
<td>• Assure technical requirements.</td>
</tr>
<tr>
<td>5</td>
<td>• Ensure electricity safety.</td>
</tr>
</tbody>
</table>
II. O&M MODEL

3. WORK

- Common issues

The panel surface is broken
II. O&M MODEL

3. WORK

- Common issues

The outer layer of electric cable is scratched
II. O&M MODEL

3. WORK

- Common issues

Fuse is broken, flash point or overheating occurs
II. O&M MODEL

3. WORK

- **Common issues**

  MC4 joint is loose, not tightened
II. O&M MODEL

3. WORK

❖ Common issues

Frame, screws, and bolts are rusty
III. ORIENTATIONS AND DEVELOPMENT

1. OBJECTIVES

• Maintain the good condition of equipment at the lowest cost (VND/Kwp/year)

• Study to improve the system performance (%)

• Provide professional O&M service
III. ORIENTATIONS AND DEVELOPMENT

2. R&D

MOBILE APP: TTCE

PROJECT MANAGEMENT
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