United Nations Framework Convention on Climate Change

Agenda item 4.1 (b)
Paragraph 32 of the annotated agenda

Information note “Analysis of share and levelized cost of electricity generation of grid-connected solar PV technology”

CDM EB 113

Bonn, Germany, 8 to 11 March 2022

UNFCCC Secretariat
Mitigation Division

Background

- TOOL32 contains **positive list** for;
  - **a) Landfill gas recovery** and its gainful use;
  - **b) Methane recovery** in wastewater treatment;
  - **c) Renewable energy technologies** (RETs) such as solar PV, concentrating solar power, off-shore wind, marine wave, marine tidal and ocean thermal technologies, for large-scale and small-scale **grid-connected** power generation;
  - **d) RETs** for large-scale and small-scale **off-grid** power generation;
  - **e) Rural electrification projects**; and
  - **f) Technology/measure** used by household, communities and SMEs.
- For large-scale grid-connected RETs*:*

(a) The % share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is ***=< 2%****; or*

(b) The total installed capacity of the technology in the host country is ***=< 50 MW****.*

Background

- **Validity** of the positive list included in the tool shall be **assessed every 3 years;**
- MP shall conduct the assessment **at least 365 days before expiry** of the positive list;
- *MP shall review relevant **information on costs, penetration rates and other related information** (e.g. regulations) pertaining to the technologies and conditions contained in the positive list and comparable alternatives that are applicable to non-Annex I Party countries taking into account **size thresholds** and prepare a recommendation on the continuation or graduation of technologies contained in the positive list for consideration by the Board.*
- Board shall **decide on the continuation or graduation** of the technologies contained in the positive list.
- Current positive list is valid **until November 2022**.

Purpose

- To inform the Board about the **analysis conducted for assessment of the validity** of the positive list.

Key issues - Scope

- Analysis covered **positive list for RETs**, other areas of positive list are based on project specific scenarios.
- As per IRENA, **global installed capacity for off-grid RETs <0.5%** compared with the installed capacity of the grid-connected RETs.
- Hence, current analysis is covered **grid-connected RETs**.
  - **Focus of the work was grid-connected solar PV technology only** consistent with previous analysis (2018)
- Other RETs currently included in the positive list are not further assessed under this study (i.e. no change in tool 32 is foreseen in relation to those technologies)

Key issues – Method

- Analysis considers data from ;

  a) 126 non-Annex-I countries across Africa, Asia, Central America and the Caribbean, Middle East, Oceania and South America regions;

  b) Data vintage of **3 years from 2017 to 2019**

- Share of solar PV technology for each country is calculated separately **based on;**

  a) grid-connected **electricity generation** and

  b) grid-connected **total installed capacity**.

- **Levelized cost of electricity (LCOE) of HFO, NG and coal-based technologies** is calculated **at minimum and maximum fuel costs**, and is compared with LCOE of solar PV technology;

- **LCOE of solar PV technology** is calculated for **minimum, maximum and weighted average investment costs**.

Key issues - Assumptions

a) Analysis considers data from
   - **Utility scale solar PV plants** i.e.>1 MW;
   - **Economically viable plant capacities**, i.e. **> 50 MW for NG**, **>250 MW for coal** and **> 5 MW for HFO-**based technologies;

b) **Global average minimum and maximum fossil fuel cost** during 2017 to 2019 is considered as reliable country specific information on fossil fuel cost was not publicly available;

c) **Global average values** for plant lifetime, investment cost/kW (except for China, India and Mexico), O&M cost, degradation factor for solar PV technology are referred from REN21, 2019 and IRENA report;

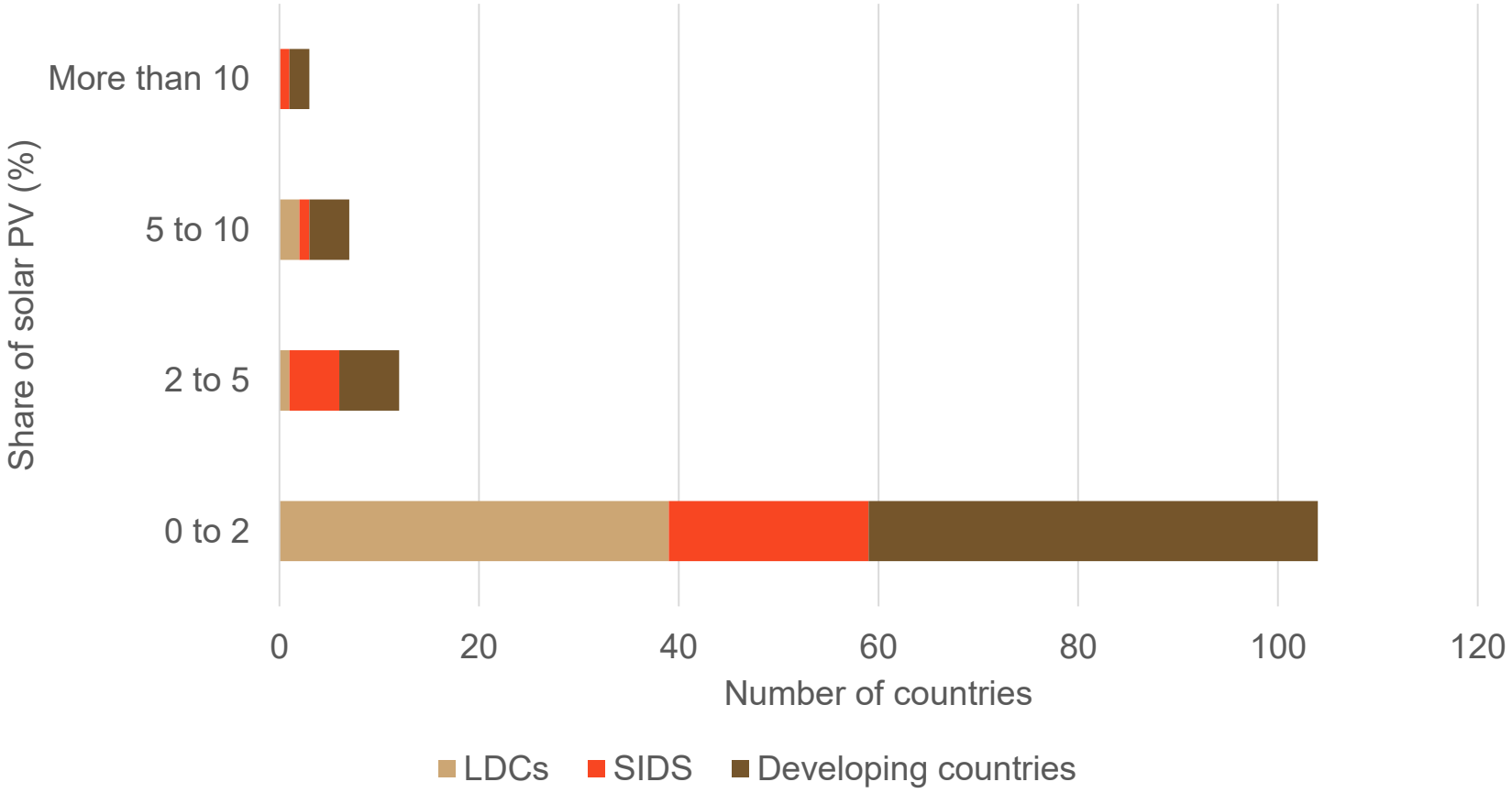
d) **Country specific commercial equity and debt lending rates** are used to determine the weighted average cost of capital that is used as discount rate;

e) **No differentiation is made for the sub-types of solar PV** due to paucity of reliable and current data related to installed capacity, annual generation and capacity factors for the different types;

f) LCOE calculation **does not take into account**:

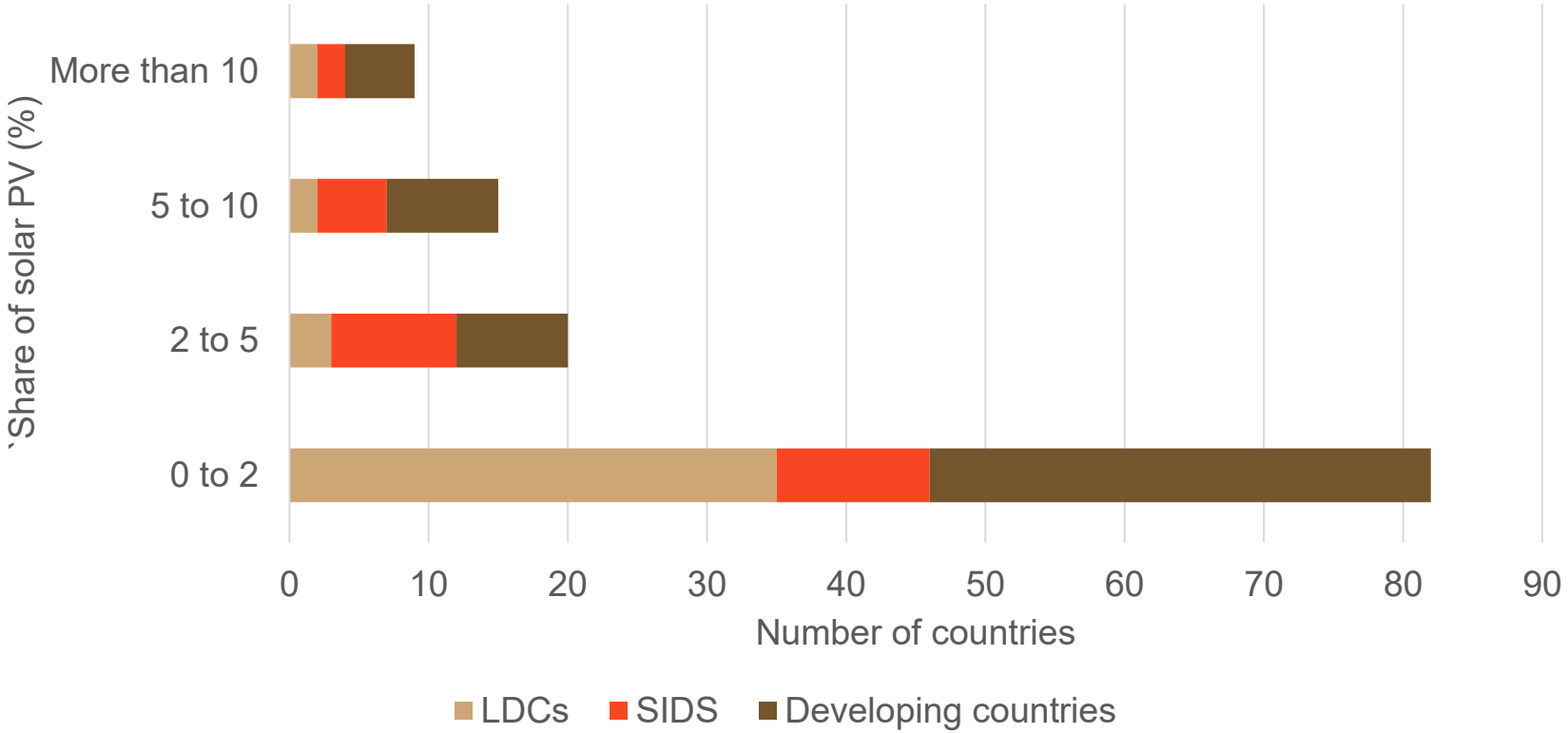
- fossil fuel **subsidies, taxes, distribution costs**; and
- incentives such as **subsidies, grants, feed-in-tariffs** provided to RETs;
- **transport costs** of fuels and **cost of deployment** of RETs;

Key findings - Share of solar PV technology based on total grid connected electricity generation



104 countries (i.e. 83%) have share of solar PV =< 2% based on the annual average electricity generation

Key findings - Share of solar PV technology based on total grid connected installed capacity



82 countries (i.e. 65%) have share of solar PV =< 2% based on the annual average installed capacity;

84 countries (i.e. 67%) have total installed grid-connected capacity of solar PV =< 50 MW.

Key findings

- Compared to previous analysis in 2018 (2014 to 2016 vintage), global average share of solar PV technology based on
  a) electricity generation has **increased from 0.8 to 1.3%**; and
  b) avg installed capacity has **increased from 1.4 to 3%**.

- Approx. 80% of the capacity addition during 2017 to 2019, **in Africa and Middle East was from fossil fuel-based technologies** and 57% was from solar PV in **Asia and Oceania**;

- Majority of the recent capacity addition in solar PV occurred in China and India;

Key findings

Fossil fuel (FF)	Number of countries using FF as main source for electricity generation	% countries (out of 124) where		
		Solar PV_Min LCOE < FF LCOE_Max	Solar PV_Max LCOE < FF LCOE_Max	Solar PV_WA LCOE < FF LCOE_Max
Coal	18	1	0	1
HFO	70	57	5	50
Natural gas	36	25	0	12

- At lower-end investment estimate **solar PV is the cheapest option for 82% countries** that rely on HFO-based and NG-based technologies for electricity generation;
- At higher-end investment estimate **solar PV is the cheapest option for 5% countries** that rely on HFO-based technologies for electricity generation;

Limitations to the analysis

- Actual fossil fuel costs **fluctuations are not captured** in the analysis, there is a recent surge in FF costs;

- Difference in LCOE of solar PV between countries within the same region has to be interpreted with caution as **analysis only takes into account the country specific WACC values** as discount rate and **relies heavily on regional values for investment cost and capacity factor for solar PV**. Same applies to LCOE of fossil fuel-based technologies.

- Analysis **does not factor the country policies or pledges** towards clean energy transitions and predictions over investment cost of fossil fuel-based technologies and solar PV technology.

Subsequent work and timelines

- MP seeks guidance from the Board whether to:

  a) **Retain** solar PV under the positive list of technologies in TOOL32; **or**

  b) **Exclude** solar PV from the positive list of technologies in TOOL32.

Recommendations to the Board

- MP recommended that the **Board consider the information note and provide further guidance**.