CLEAN DEVELOPMENT MECHANISM

CDM-SSCWG49-A06

Information note

Analysis and recommendation for graduation and expansion of positive list under small-scale additionality tool

Version 01.0

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of the Clean Development Mechanism (CDM) (hereinafter referred to as the Board) approved a positive list of technologies at its sixty-third and sixty-eighth meeting. Positive lists are defined as automatically additional for projects and component project activities (CPAs) of sizes up to the small-scale CDM thresholds i.e. up to 15 MW installed capacity of renewables, 60 GWh per year of energy savings and 60 kt CO_2 per year emission reductions.

2. The Board, at its seventy-seventh meeting (EB 77 meeting report, para 63) requested the SSC WG to reassess the positive list every three years and recommend modifications to the Board where necessary.

3. The Board at its eighty-first meeting (EB 81) considered the information note titled "Criteria for graduation and expansion of positive list of technologies under the small-scale CDM", as contained in annex 23 to the report of the 46th meeting of the small scale working group (SSC WG) and agreed to the respective criteria and timelines recommended by the SSC WG to reassess the validity of the positive list of technologies.

2. Purpose

4. The purpose is to inform the Board about the recommendation of the SSC WG on the graduation of the positive list of technologies in response to the EB 81 mandate indicated in paragraph 2 above.

3. Key issues and proposed solutions

5. The Board at its eighty-first meeting agreed to the respective criteria and timelines to reassess the validity of the positive list of technologies. These criteria take into account the type of end users (e.g. households, communities, small and medium scale enterprises (SMEs)), levelized costs of service, penetration rates of technology and capital cost of technologies.

6. In case of global penetration rates of technologies, the Board requested the SSC WG to use the global penetration rates applicable to non-Annex I countries where such data is available.

7. The analysis conducted did not indicate that any of the technologies currently included in the positive list would graduate due to changes on account of costs, penetration rates, barriers or other conditions.

4. Impacts

8. The positive lists facilitate the development of CDM project activities and programme of activities particularly in the area of renewable energy and energy efficiency.

5. Subsequent work and timelines

9. The SSC WG agreed to carry out further work in the context of the new mandate (i.e., EB 85 (para 42)), which is to streamline the various provisions for automatic additionality (e.g., based on size of a unit) contained in “Demonstration of additionality of small-scale projects” and “Demonstration of additionality of micro-scale projects” currently available.

10. The SSC WG while considering the analysis under this information note noted there are areas where the positive list could be expanded. The SSC WG agreed to make recommendations in that regard also, while responding to EB 85 mandate mentioned above.

6. Recommendations to the Board

7. The SSC WG recommends the Board to retain the positive list of technologies as contained in the methodological tool “Demonstration of additionality of small-scale projects” and summarized below:

Table 1. Positive list of technologies currently defined under small scale additionality tool

1	**Renewable energy technologies**
	Aggregate installed capacity up to 15 MW, limited to following renewable energy technologies: (a) Solar PV and Solar-thermal electricity generation; (b) Off-shore wind; (c) Marine technologies (e.g. wave and tidal); (d) Building integrated wind turbines or household roof top wind turbines (unit size =< 100 kW) (e) In the case of countries with less than 20 per cent rural electrification rate all renewable energy technologies are eligible
2	**Renewable energy technologies (Off-grid only)**
	Aggregate installed capacity up to 15 MW, limited to following RE technologies: (a) Micro/pico-hydro (unit size =< 100 kW); (b) Micro/pico-wind turbine (unit size =< 100 kW); (c) PV-wind hybrid (unit size =< 100 kW); (d) Geothermal (unit size =< 200 kW); (e) Biomass gasification/biogas (unit size =<100 kW)
3	**Distributed technologies for households/communities/SMEs**
	Aggregate installed capacity up to 15 MW or annual energy savings of 60 GWh or annual emission reduction of 60 kt and unit size less than or equal to 5 per cent of SSC thresholds (=< 750 kW, =< 3 GWh/y or 3 ktCO_2e/y)

TABLE OF CONTENTS **Page**

1. Introduction

1. The Executive Board of the Clean Development Mechanism (CDM) (hereinafter referred to as the Board) approved a positive list of technologies at its sixty-third and sixty-eighth meeting. Positive lists are defined as automatically additional for projects and component project activities (CPAs) of sizes up to the small-scale CDM thresholds i.e. up to 15 MW installed capacity of renewables, 60 GWh per year of energy savings and 60 kt CO_2 per year emission reductions (refer to Table 1 for the current approved positive list).

2. The Board, at its seventy-seventh meeting (EB 77 meeting report, para 63) requested the SSC WG to reassess the positive list every three years [1] and recommend modifications to the Board where necessary.

3. The Board at its eighty-first meeting (EB 81) considered an information note titled "Criteria for graduation and expansion of positive list of technologies under the small-scale CDM", as contained in annex 23 to the report of the 46th meeting of the SSC WG and agreed to the respective criteria and timelines recommended by the SSC WG to reassess the validity of the positive list of technologies.

2. Purpose

4. The purpose is to inform the Board about the recommendation of the SSC WG on the graduation of the positive list of technologies in response to the EB 81 mandate indicated in paragraph 2 above.

3. Key issues and proposed solutions

3.1. Graduation criteria

5. Table 1 below provides an overview of current positive list of technologies.

Table 1. Positive list of technologies currently approved under small scale additionality tool

1	**Renewable energy technologies**
	Aggregate installed capacity up to 15 MW, limited to following renewable energy technologies: (a) Solar PV and Solar-thermal electricity generation; (b) Off-shore wind; (c) Marine technologies (e.g. wave and tidal); (d) Building integrated wind turbines or household roof top wind turbines (unit size =< 100 kW) **(e)** In the case of countries with less than 20 per cent rural electrification rate all renewable energy technologies are eligible
2	**Renewable energy technologies (Off-grid only)**

[1] The last update to the positive list was at EB 68 in 2012.

	Aggregate installed capacity up to 15 MW, limited to following RE technologies: (a) Micro/pico-hydro (unit size =< 100 kW); (b) Micro/pico-wind turbine (unit size =< 100 kW); (c) PV-wind hybrid (unit size =< 100 kW); (d) Geothermal (unit size =< 200 kW); (e) Biomass gasification/biogas (unit size =<100 kW)
3	**Distributed technologies for households/communities/SMEs**
	Aggregate installed capacity up to 15 MW or annual energy savings of 60 GWh or annual emission reduction of 60 kt and unit size less than or equal to 5 per cent of SSC thresholds (=< 750 kW, =< 3 GWh/y or 3 ktCO_2e/y)

6. The Board at EB 81 agreed to the respective criteria and timelines (refer to Table 2 below) to reassess the validity of the positive list of technologies. These criteria take into account the type of end users (e.g. households, communities, small and medium scale enterprises (SMEs)), levelized cost of service, penetration rates of technology and capital cost of technologies.

Table 2. Recommendation on graduation criteria

Positive list Currently defined under small-scale additionality tool	**Validity**[2]	**Graduation criteria (where mentioned all criteria shall be used)**			
		End users type /nature	Levelised cost of service	Penetration rate	Capital cost of technology
Grid connected renewable electricity generation technologies					
All renewable energy technologies in the current positive list	3 years	-	At least 50 per cent higher compared to all fossil fuel technologies	Global average penetration rate < 3%	-
Off- grid renewable electricity generation technologies					
All off-grid renewable technologies in the current positive list	3 years	-	-	-	At least 3-times higher compared to all fossil fuel technologies
Distributed technologies for households/communities/SMEs					
All distributed unit technologies/measures, eligible under Type I/II/III small-scale methodologies and providing services to households/communities/SMEs	3 years	Assess appropriateness of types of users, where required redefining of SMEs, Communities	-	Global average penetration rate < 3%	At least 3-times higher compared to all plausible baseline technologies identified by the group

[2] From the date of adoption by the Board.

7. In case of global penetration rates of technologies, the Board requested the SSC WG to use the global penetration rates applicable to non-Annex I countries where such data is available.

4. Analysis

4.1. Grid connected renewable electricity generation technologies

8. The criteria that were previously used to arrive at the positive list of grid connected technologies (Table 3 below) up to 15 MW were based on higher levelised cost of electricity generation compared to alternative fossil fuel technologies.[3]

Table 3.Positive list of renewable energy technologies defined under small scale additionality tool

Renewable energy technologies
(a) Solar PV and Solar-thermal electricity generation; (b) Off-shore wind; (c) Marine technologies (e.g. wave and tidal);

9. The analysis and recommendation presented below are based on the criteria adopted by the Board for assessing the technologies to be considered graduated. That is, if the levelised cost of electricity (LCOE)[4] of a specific renewable energy technology (RETs) is 50 per cent or higher compared to counterpart fossil fuel electricity generation technologies and its penetration rate is less than 3 per cent, the technology is deemed not graduated and should be retained on the positive list.

4.1.1. Analysis on graduation

10. Analysis of LCOEs of renewable and fossil fuel electricity generation technologies is carried out using recent information from IEA (2015)[5], IRENA (2015)[6] and REN 21(2015)[7] and IPCC (2014)[8]. It is found that the global average LCOEs of specific renewable energy technologies in the positive list (i.e. Solar, Ocean, Off-shore Wind) in all cases are at least 2 times higher (well above 50 per cent) compared to the average LCOE of fossil fuel electricity generation technologies (refer to Table 1, Appendix 1).

11. There are only four non-Annex 1 countries with combined penetration rate of specific renewable energy technologies in the positive list (i.e. Solar, Ocean and Off-shore wind)

---

3 Refer annex 06 of SSC WG 33 available at: <http://cdm.unfccc.int/Panels/ssc_wg> and EB 63 presentation: <http://unfccc4.meta-fusion.com/kongresse/cdm63/pdf/4.1_c_65-70_EB63%20SSC%20standards_final.pdf>.

4 The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation, both of which are discounted back to a common year using a discount rate that reflects the average cost of capital

5 IEA. 2015. Projected Cost of Generating Electricity, International Energy Agency

6 IRENA. 2015. Renewable Power Generation Costs in 2014, International Renewable Energy Agency

7 REN 21. 2015. Renewables 2015 Global status report;

8 IPCC. 2014. Annex III – “Technology-specific cost and performance parameters”, Working Group III IPCC 5th Assessment Report "Climate Change 2014: Mitigation of Climate Change"

greater than 1 per cent. This implies that penetration rate of the individual technology is far below the specified threshold of 3 per cent in non-Annex I countries[9] (refer to Table 2, Appendix 1).

12. In the particular case of Solar technologies, the SSC WG noted from reports for example from IRENA (2015), that average installed costs in the case of solar PV system (both small and large)[10], particularly utility-scale, has declined more than one-third between 2011 and 2014.

13. However, according to IEA (2015), despite significant declines in solar PV module costs in recent years, prices for entire PV installations vary significantly among countries for similar system types; the gap is more due to cost associated with grid interconnection and financing costs, especially for small systems.

14. Further analysis on LCOEs for Solar PV technology by regions and size was carried out. It is found that average LCOEs of Solar PV technologies in all regions/countries are above 50% as compared to average LCOE of fossil fuel technology, specifically in the case of small sized solar PV, LCOE is well above 50% even with higher capacity factor[11]. The analysis also showed that smaller the size higher the LCOE (refer to Table 3, Appendix 1).

15. It is to be noted that though LCOE is used to assess economic competitiveness of technologies, it however does not include other dimensions such as cost of grid integration [12] nor it takes into account differences in the production profile of variable/intermittent renewable energy (VRE) versus dispatchable technologies (e.g., Coal, CCGT) and the associated market value of the electricity that VRE supply[13] (IEA (2015), Joskow (2011)[14]). LCOE of VREs could be much higher if such aspects are taken into account[15].

[9] Serbia being an exception with share of 5.3%

[10] Size less than 5 MW is indicated as “small” and greater than 5 MW as “large” in IRENA (2015). As per the same source, “PV plants with capacity above 2 MW do not appear to offer significant economies of scale (e.g. the capital cost of a 20 MW is not significantly lower than a 2 MW plant).” So the cost data for small scale solar PV from IRENA is assumed to be valid up to 15 MW (small scale CDM Threshold).

[11] The global average capacity factor is 19%, however for conservativeness, higher capacity factor is applied. This is because higher the capacity factor lower is the LCOE (refer to Table 3, Appendix 1).

[12] Grid integration cost is additional system cost for example a) back up capacity would be required due to variability/uncertainty of energy being produced by new renewables and b) VREs are located far from load centers and large investments in transmission /distributions might be necessary.

[13] For example to produce equivalent electricity from 1 MW CCGT (85% capacity factor), 3 MW capacity of VRE (25% capacity factor) would be required. This means much higher capital investment would be required in terms equivalent service level of VRE as compared to CCGT. This is one of the key barriers in capital-scarce developing countries.

[14] Joskow, P. (2011), “Comparing the Costs of Intermittent and Dispatchable Electricity Generating Technologies”, American Economic Review Papers and Proceedings, Vol. 100(3), pp. 238-241.

[15] For example, IEA’s Mid-term renewable energy market report-2015 asserts that improving cost trend does not automatically imply that solar PV are competitive or cost-effective versus alternatives because competitiveness also depends on the value of the generation and the system costs associated with integrating higher shares of variable renewables.

4.1.1.1. Conclusion

16. Based on the above findings, the SSC WG concluded that there is no evidence to support the graduation of these technologies (i.e. Solar-PV, Off-shore Wind and Ocean) in the positive list.

4.1.2. Off-grid renewable electricity generation technologies

17. The criteria that were used earlier by the SSC WG to recommend the positive list of off-grid technologies as listed in Table 4 below are that these technologies are generally dispersed in nature and that there are obvious barriers due to high initial investment cost as compared to the baseline alternatives (i.e. diesel units of equivalent capacity). This was informed by literature review which showed that due to its high initial investment costs and/or due to low energy prices (subsidized fossil fuel or electricity) in many developing countries off-grid renewable energy systems are financially not attractive compared to the baseline diesel generation technologies. The SSC WG thus proposed to include into the positive list those off-grid technologies with a capital costs at least three times higher than that of a diesel generator of a comparable size (based on projected cost to 2015).[16]

Table 4. Positive list of off-grid renewable energy technologies defined under small scale additionality tool

Renewable energy technologies (Off-grid only)
(a) Micro/pico-hydro (unit size =< 100 kW);
(b) Micro/pico-wind turbine (unit size =< 100 kW);
(c) PV-wind hybrid (unit size =< 100 kW);
(d) Geothermal (unit size =< 200 kW);
(e) Biomass gasification/biogas (unit size =<100 kW)

18. The criterion adopted by the Board and to be used for considering technologies as graduated is that the capital investment cost of the proposed renewable energy technology is at least three times higher than that of a diesel generator of a comparable size.

4.1.2.1. Analysis on graduation

19. The following elements are taken into account for analysis:

(a) Review of recently published literature to assess cost and barrier of off-grid renewable energy technologies;

[16] The various criteria that were used to derive a positive list are explained in detail in annex 12 and 13 of the annotations to the agenda of the sixty-eighth meeting of the Board namely “Draft guidelines on the demonstration of additionality of small-scale project activities” and “Information note on the extension of simplified modalities for the demonstration of additionality of small-scale CDM project activities” respectively. Available at: <http://cdm.unfccc.int/Meetings/MeetingInfo/DB/Y5JBDO6K1WSUC29/view>.

(b) Analysis of data from registered projects and PoAs, and CDM pipeline involving off-grid renewable energy technologies that have applied positive list;

20. Based on the recently published literature (REN 21 (2015); Frankfurt School – UNEP Collaborating Centre (2015))[17], no substantial changes to the investment costs of the renewable off-grid technologies have been found when compared with the baseline technology (i.e., diesel generator) since the date of original publication of the positive list. In other words, the average investment costs of these technologies are still at least three times higher compared to diesel generator (refer to Table 4, Appendix 1).

21. The existence of high initial investment cost as a key barrier for deployment of off-grid renewable energy technologies have also been highlighted in other sources. For example:

(a) IRENA (2015) [18] acknowledges the declining cost of renewable energy technologies, however also asserts that upfront capital cost of these technologies are still substantially high in developing countries and thus highlighted the need for continued investment and support for renewables in order to further drive down capital costs.

(b) Alliance for rural electrification (ARE, 2015) [19] demonstrated that renewable energy technologies up to capacity less than or equal to 1000 kW for off-grid rural electrification has high upfront capital costs and faces financial barriers in developing countries. Further, IEA (2014)[20] and UNDP (2014)[21] also indicated high upfront capital cost as key barriers faced by the rural households and SMEs in rural areas.

22. Moreover, the analysis of CDM pipeline (projects and PoAs at validation and registered) shows that only 4 PoAs and 1 project appeared to have used off-grid positive list.

4.1.2.2. Conclusion

23. The literature review consistently indicated that high capital cost of off-grid renewable energy technology is a barrier to its deployment.

24. Based on the above analysis the SSC WG concluded there is no evidence to support the graduation of off-grid technologies in the positive list.

---

[17] Frankfurt School – UNEP Collaborating Centre for Climate and Sustainable Energy Finance, 2015. Renewable energy in hybrid mini grids and isolated grids: Economic benefits and business cases Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_FS_UNEP_Hybrid_Minigrids_2015.pdf

[18] IRENA. 2015. IRENA off grid renewable energy systems: Status and methodological issues (p. 25 and p. 145), International Renewable Energy Agency ;

[19] ARE, 2012. The potential of small and medium wind energy in developing countries: A guide for energy sector decision-makers, Alliance for Rural Electrification.

[20] IEA. 2014. Africa World Energy Outlook, International Energy Agency

[21] UNDP. 2014. “Discussion Paper Integrated Sustainable Rural Development: Renewable Energy Electrification and Rural Productivity Zones An integrated approach to tackle the challenge of rural development by bringing access to renewable energy for income generation and social development, United Nations Development Programme

4.1.3. Distributed technologies for households/communities/SMEs

25. The technologies/measures are considered automatically additional that satisfy the dual conditions as below:

(a) Dispersed units less than or equal to **5 per cent** of small-scale thresholds (i.e.=< 750 kW for Type I, =<3 GWh per year for Type-II and 3 ktCO_2e per year for Type-III); and

(b) Provide services to households/communities/SMEs.

26. The SSC WG had proposed these distributed technologies together with applications (e.g. households) due to scale and application related barriers taking into account data from CDM pipeline at the time of recommendation.

4.1.3.1. Analysis on graduation

27. The following elements are considered for analysis:

(a) Analysis of data from registered CDM projects and PoAs to identify technologies/measures that frequently apply the provision;

(b) Assess publicly available literature [22] on the technology to assess market penetration and installation/deployment cost for identified technology/measure;

28. Commonly used technologies/measures in PoAs and projects under this category involve distributed energy projects for households/communities such as biogas digesters for household energy supply, efficient cook stoves, efficient lighting, water purification; solar water heater and micro irrigation (refer to Appendix 2 for details).

29. In the case of cook stoves for household/communities, the data on market penetration is not readily available in public domain. It is however found from CDM pipeline analysis that these projects are implemented mostly in under-developed regions (Refer to table 2 of appendix 2) with a view to increase the access to clean energy. According to recent report (IEA 2014)[23], 2.7 billion people still rely on the traditional use of biomass for cooking. According to the same source, four out of five people in Africa rely on the traditional use of solid biomass (which accounts nearly 70% of region's current total energy consumption), mainly fuelwood, for cooking and more than one-third of its population still cook with biomass in an inefficient and hazardous way and practice will continue in future.

30. Based on the information provided in IEA (2014), it is inferred that efficient cooking technologies face investment cost barriers and need financial support for their deployment as the cost of efficient cooking technologies is substantially higher (more than 3 times) than the cost of traditional cook stoves, i.e. the investment cost of traditional cook stoves using firewood or charcoal as fuel varies between 0 to 6 USD while the cost for efficient cook stove using same fuel varies between 14 to 15 USD (refer to Table 5, Appendix 1). It is also seen the cost of biogas digesters is substantially higher than the traditional cookstoves.

[22] CDM pipeline data available with IGES (<http://pub.iges.or.jp/modules/envirolib/view.php?docid=968>) and UNEP Riso (<http://cdmpipeline.org/>).

[23] IEA Africa Energy Outlook (2014)

31. It is also to be noted that the Panel/WG process is ensuring that any potential for free riders are identified early and excluded from the positive list. For example the Board, based on the recommendation from the SSC WG, at its 43rd meeting, agreed to remove CFL from the positive list. It was considered graduated based on the recent information provided by UNEP lighting initiative[24] showing that this technology is rapidly expanding in many countries including least developed countries (LDCs).

4.1.3.2. Conclusion

32. The present analysis has not found evidence that would merit revision of the positive list under this criteria, however the SSC WG agreed to carry out further work in the context of the new mandate (i.e., EB 85 paragraph 42 reproduced below) to streamline these provisions for automatic additionality that rely on size of the unit.

(a) Secretariat should look further into the issue in consultation with the SSC WG and the MP with the view to assess whether other criteria than unit size may be used to establish positive lists;

(b) Assess the feasibility of merging the tool for demonstration of additionality of microscale activities with the tool for demonstration of additionality of small-scale project activities and make a recommendation for the consideration of the Board at a future meeting.

5. Recommendation

33. The SSC WG recommends the Board to retain the positive list of technologies as contained in the methodological tool "Demonstration of additionality of small-scale projects" and summarized below:

Table 5: Positive list of technologies currently defined under small scale additionality tool

1	**Renewable energy technologies**
	Aggregate installed capacity up to 15 MW, limited to following renewable energy technologies: (a) Solar PV and Solar-thermal electricity generation; (b) Off-shore wind; (c) Marine technologies (e.g. wave and tidal); (d) Building integrated wind turbines or household roof top wind turbines (unit size =< 100 kW) **(e)** In the case of countries with less than 20 per cent rural electrification rate all renewable energy technologies are eligible
2	**Renewable energy technologies (Off-grid only)**

[24] Efficient Lighting Policy Status Map developed by UNEP and available at <http://www.enlighten-initiative.org/ResourcesTools/GlobalPolicyMap.aspx>.

	Aggregate installed capacity up to 15 MW, limited to following RE technologies: (a) Micro/pico-hydro (unit size =< 100 kW); (b) Micro/pico-wind turbine (unit size =< 100 kW); (c) PV-wind hybrid (unit size =< 100 kW); **(d)** Geothermal (unit size =< 200 kW); e. Biomass gasification/biogas (unit size =<100 kW)
3	**Distributed technologies for households/communities/SMEs**
	Aggregate installed capacity up to 15 MW or annual energy savings of 60 GWh or annual emission reduction of 60 kt and unit size less than or equal to 5 per cent of SSC thresholds (=< 750 kW, =< 3 GWh/y or 3 ktCO_2e/y)

Appendix 1. Levelised cost of electricity generation

Table 1: LCOE of electricity generation technologies

Technologies	Global Average LCOE (USD_{2015}/MWh)
SOLAR	
PV- utility-scale	261
PV - commercial rooftop	286
PV - large, ground-mounted	183
PV - residential rooftop	251
CSP no storage	385
CSP storage 6h	207
CSP molten salt storage	243
WIND	
Offshore	174
OCEAN	
Wave, Tidal, Ocean thermal energy conversion and salinity gradients.	358
Fossil Fuel Average	83
Coal	85
Combined Cycle Gas Turbine (CCGT)	82

Source: Based on IPCC (2014), IEA (2015), IRENA (2015) and REN 21(2015)

Note: a) LCOE of renewable electricity generation technologies are compared with base and intermittent load fossil fuel electricity generation technologies i.e., Coal and CCGT respectively; b)LCOE for Coal and Gas are the average LCOE cost from IPCC (2014) and IEA (2015) based on projected cost of fossil fuel prices until 2020.

Table 2: List of Countries with combined share of Solar, Wave, Tidal and Off-shore Wind greater than or equal to 3 per cent

Country	Total Installed of Solar, Ocean and Off-shore wind Capacity (MW)	% Share in total installed capacity
Cyprus	17	1.0
Djibouti	1.4	1.1
Israel	275	1.9
Malta	16	2.7
Serbia	468	5.3

Source: Based on EIA (2015)[25]

[25] International Energy Statistics, US Energy Information Administration. Retrieved on Sept10, 2015: http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=7#

Table 3: Levelised cost of electricity generation of Solar PV by regions (USD_{2015}/MWh)

Countries	Total Capital Cost (USD/kW)	Capacity factor (%)	LCOE (USD/MWh)	per cent higher compared to fossil fuel
Africa	3100	22%	**188**	125%
China	1600	17%	**136**	63%
Europe	1900	15%	**175**	109%
Central and South America	2200	24%	**127**	53%
Middle East	4300	20%	**282**	238%
North America	2300	22%	**145**	74%
Oceania	2700	21%	**173**	107%
Other Asia	2600	15%	**233**	179%
Small scale	**2900**	**24%**	**161**	**93%**
Large scale	2100	24%	**120**	43%
LCOE of Fossil fuel (USD/MWh)			83	

Source: Based on IRENA (2015), IEA (2015) and IPCC (2014)

Note: a) LCOE is based on 10% discount factor and lifetime of twenty-five years; b) The global average capacity factor for small and large scale solar PV systems is 19%. However, for conservativeness 24% is used which is highest value reported in the table; c) LCOE for Coal and Gas are the average cost from IPCC (2014) and IEA (2015) which are based on projected cost of fossil fuel prices until 2020

Table 4. Investment costs of off-grid renewable energy generation technologies

Renewable-Energy Technology	Installed Capacity	Capital cost in 2015 (USD/kW)
Geothermal*	1 – 200 kW	6410
Micro hydro	0.1 – 1000 kW	1175 – 6000 (Avg: 4175)
Wind turbine (on shore)	< 100 kW	1900 – 5870 (Avg: 3885)
Wind turbine (household system)	0.1 – 3 kW	1000–10000 (Avg: 5500)
Solar PV roof top (residential)	3 – 5 kW	2200 – 7000 (Avg: 4600)
Solar PV roof top (commercial)	5 – 100 kW	2900 – 3800 (Avg: 3350)
Diesel generator	0.8 – 3.1 MW	475 – 480 (Avg: 478)

** For Geothermal plants up to 200 kW recent capital cost is not available and projected cost reported in ESMAP 2007[26] for year 2015 is considered.*
Source: For capital cost in 2015 - REN21 (2015) and Frankfurt School – UNEP Collaborating Centre (2015)

[26] ESMAP.2007 "Technical and Economic Assessment of Off-grid, Mini-grid and Grid Electrification Technologies". Energy Sector Management Assistance Program, 2007World Bank

Table 5. Investment costs of cooking technologies in African continent

Type of cookstoves	Investment Cost ($)	Efficiency (%)
Traditional cookstoves		
Charcoal	3 – 6	20
Fuelwood, straw	0 – 2	11
Alternative cookstoves		
Kerosene	30	45
LPG	60	55
Electricity	300	75
Biogas digesters	600 –1500	65
Improved cookstoves		
Charcoal	14	26
Fuelwood	15	25

Source: IEA (2014)

Appendix 2. PoAs and project activities applying automatic additionality

1. PoAs applying small scale or micro scale additionality tool for automatic additionality

Table 1. Number of registered PoAs involving distributed units

Sr. No.	Technology type	Number of PoA	Region		
			Asia-Pacific	Africa	Latin America
1	Biogas digester for heat generation at households	17	11	5	1
2	Efficient lighting	23	14	9	0
3	Cook-stove	33	5	23	4
4	Water purification*	7	4#	4#	1#
5	Solar water heater	1	0	1	0
6	Micro-irrigation	1	1	0	0
7	Energy efficient technologies in production line	1	1	0	0
	Total	83	36	41	6

* The 2 PoAs are disseminating water purifiers together with cook-stoves
# One PoA implemented in all the three regions
Source: Based on CDM database

2. Regular CDM Projects applying small scale or micro scale additionality tool for automatic additionality

Table 2. Number of registered regular CDM projects

Sr. No.	Technology type	Number of projects	Region		
			Asia-Pacific	Africa	Latin America
1	Biogas digester for heat generation at households	39	35	4	0
2	Biogas digester for heat generation for SMEs	6	4	0	1
3	Biomass heat generation at SMEs	6	4	2	0
4	Efficient lighting	4	0	4	0
5	Cook-stove	29	27	2	0
6	Micro-irrigation	1	1	0	0
	Total	84	71	12	1

Source: Based on CDM database

Table 3. Number of registered CDM projects applying specific small-scale additionality criteria of unit size less than 5 per cent of small-scale threshold

Sr. No.	Technology type	Number of projects using 5 per cent criteria
1	Biogas digester at households	32
2	Efficient lighting	3
3	Cook-stove	2
4	Fuel switch	2

\- - - - -

Document information

Version	*Date*	*Description*
01.0	21 October 2015	SSC WG 49, Annex 06 To be considered by the Board at EB 87.

Decision Class: Regulatory
Document Type: Information note
Business Function: Methodology
Keywords: additionality, data collection and analysis, positive list, recommendations from executive advisory bodies