Carbon accounting & market opportunities for the electricity sector

OOCUR 12th ANNUAL CONFERENCE

19-21 November 2014

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Promoting clean technologies & opportunities under the carbon market

Stakeholder engagement

Government level - ministries of environment and energy

Private – developers, investors/entrepreneurs

International level – donors, technology providers

CDM support

To project participants in the CDM cycle

To governments

To CDM process, providing inputs to improve the CDM

To link buyers-sellers of carbon credits

Renewable energy (not limited)

Determining sectoral baselines for countries and grid emission factors

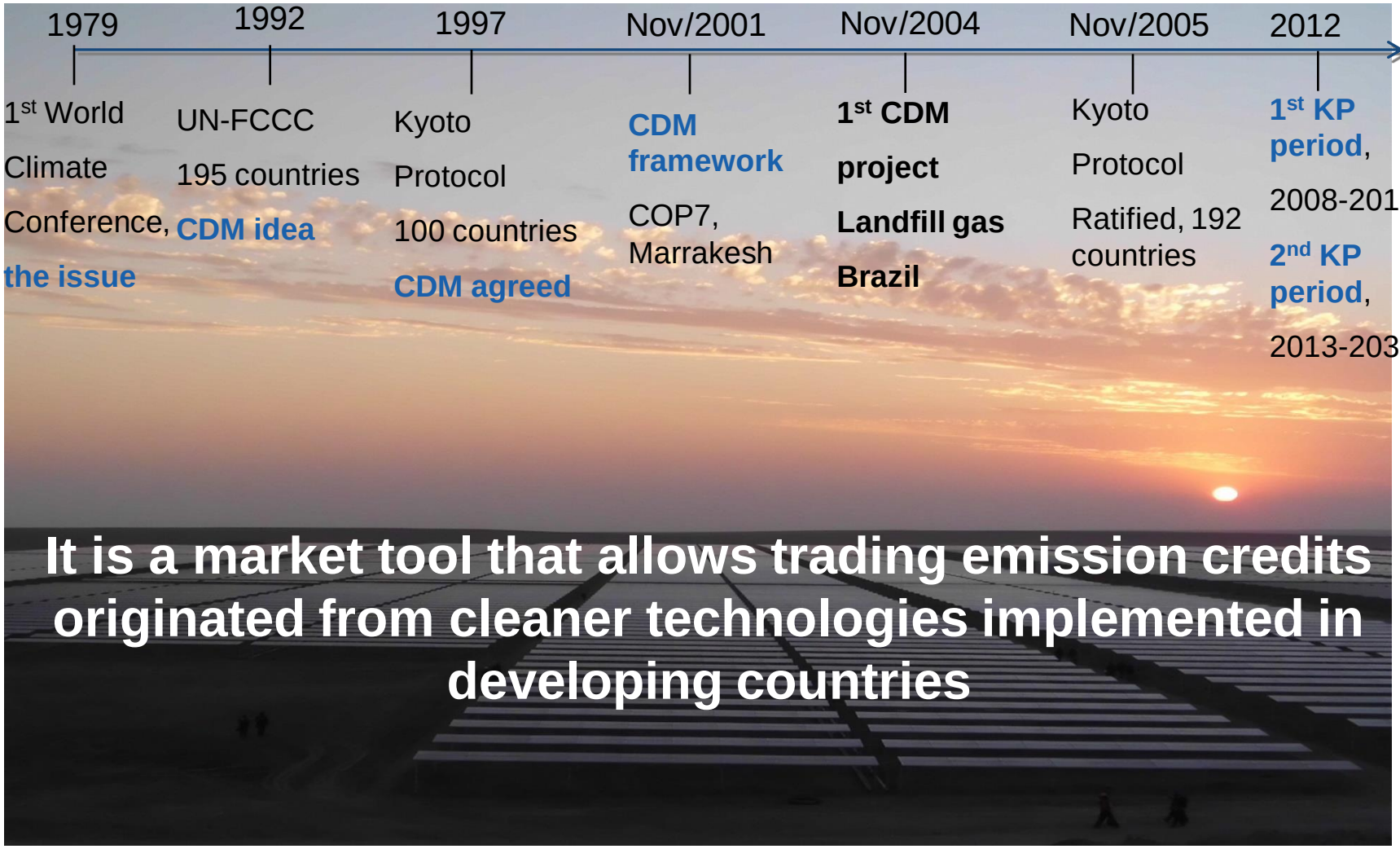
Drafting CDM proposal at programme level, PoA

Capacity building: designing & delivering trainings, promoting success stories, sharing information, & answering technical queries

OUTLINE

1) Carbon accounting under the CDM
2) CDM tools for carbon accounting
3) Case study – Geo? Small (10 MW)
4) Funding opportunities
5) Final remarks

1) What is the CDM, Clean Development Mechanism?



1) The CDM in numbers

> 7,500 projects

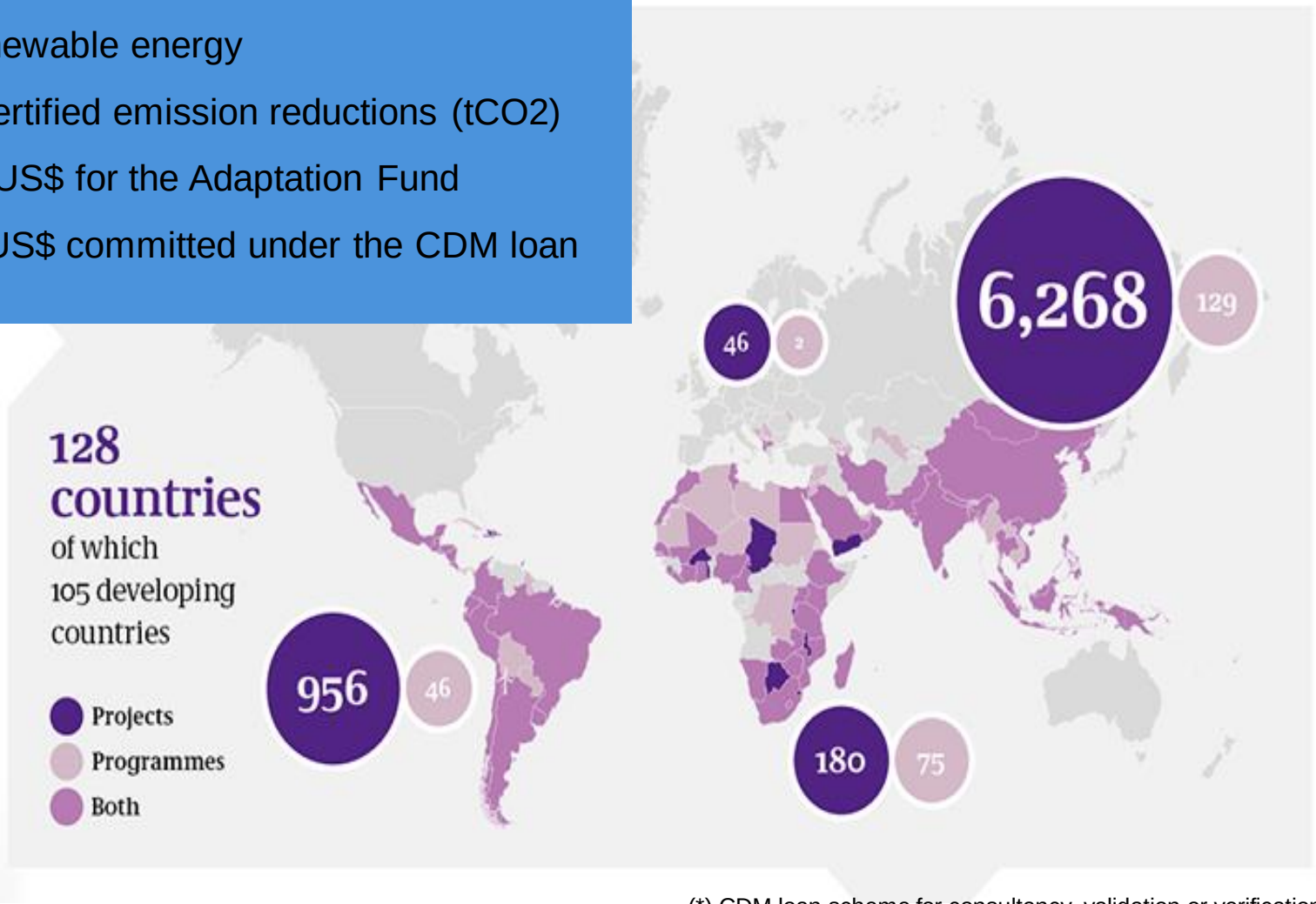
315 billion US$ invested

110 GW renewable energy

2.2 billion certified emission reductions (tCO2)

188 million US$ for the Adaptation Fund

> 5 million US$ committed under the CDM loan scheme (*)



(*) CDM loan scheme for consultancy, validation or verification

1) CDM created institutional frameworks that …

a) Developed **200+ tools (methodologies)** in 15 different sectors

b) Established **125+ national authorities, 16 in the Caribbean**

c) Accredited **40+ validators/verifiers (certifiers)**

d) Involved **4,500+ institutions** in CDM projects

e) Developed **countless CDM development experts** worldwide

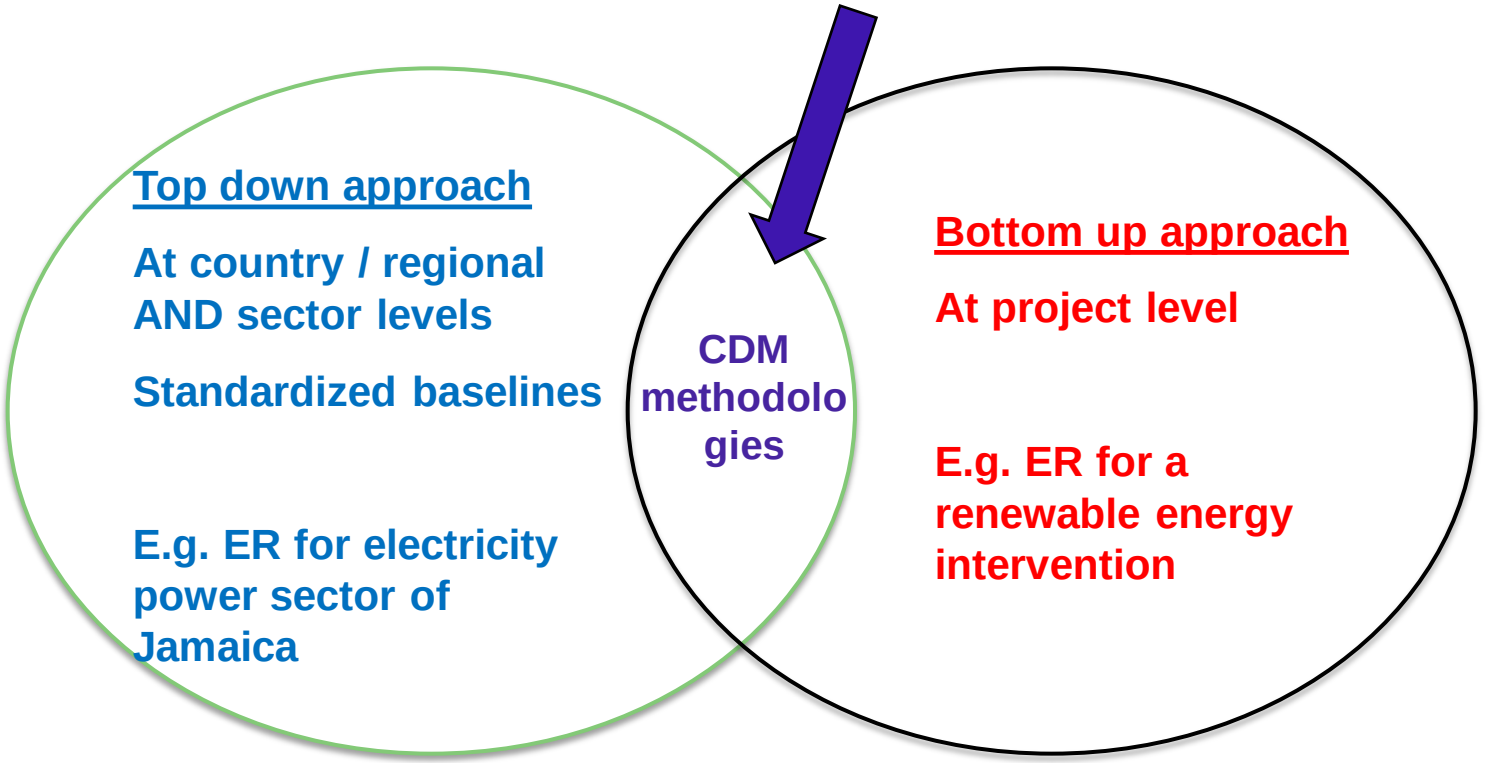
f) Created CDM Board, expert panels, & UNFCCC CDM unit

2) CDM tools for carbon accounting

Methodologies

Grid emission factors

2) CDM tools – top down & bottom up approaches



2) CDM tools

What are they used for?

1. Account emission reductions (ER) (tCO2/year)
    - E.g.: 20 MW Solar PV → **27,000 tCO2/year**
2. Establish baseline technology scenario(s)
    - E.g.: current mix (fossil fuel + other sources) grid
3. Monitor, report and verify (MRV)
    - E.g.: systems for monitoring plans, reports and accredited certifiers

What are they characterized for?

1. Developed following an stringent approval process
    - Consultants → Public input → Expert panels → CDM Board
2. Mature as they have undergone trials
3. Flexible as they are applicable to a wide range of interventions
4. Widely recognized/applied. Other carbon crediting systems such as voluntary carbon market (Gold Standard) used them

2) CDM methodologies (~250) – by size and type of activity

By size

1. Small-scale (~150)
    - AMS – Approved Methodology for Small-scale
        i. Type I – renewable energy <15MW
        ii. Type II – energy efficiency, reductions <15 GWh/year
        iii. Type III – others, reductions < 60 ktCO2/year
2. Large- scale (~100)
    - AM – Approved Methodology
    - ACM – Approved Consolidated Methodology

By type of activity

- **Renewable energy** (~50% total CDM) → hydro, wind, solar, biomass
- Energy efficiency → E.g. efficient refrigerators, AC, CFL, etc.
- Fuel or feedstock switch→ from coal to natural gas
- GHG destruction →E.g. landfill gas, N2O destruction
- GHG avoidance → E.g. reduction of fertilizer use
- GHG removal by sinks → afforestation/reforestation

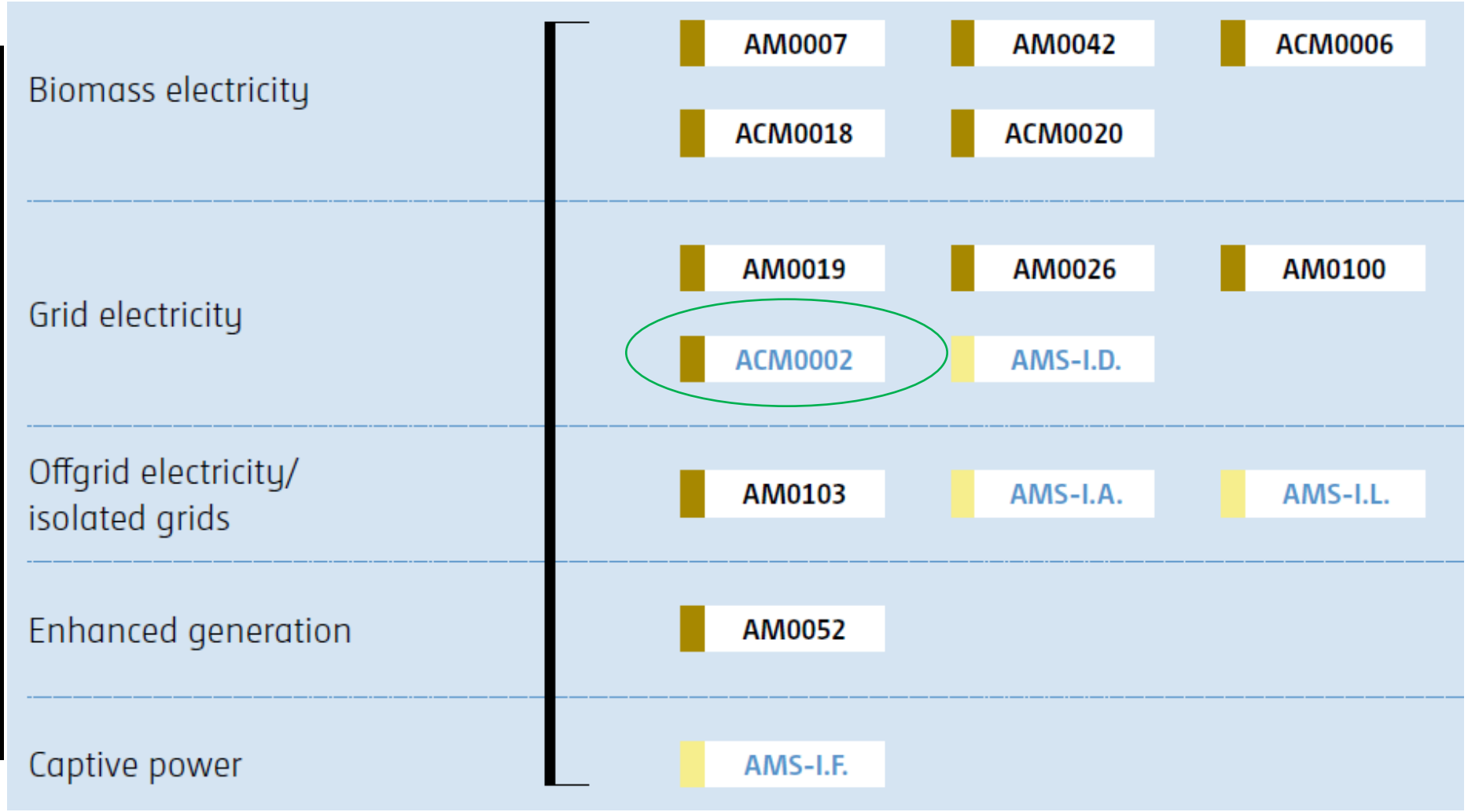
2) CDM methodologies – by sectoral scope (15)

Sectoral scope	Type	Electricity generation and supply	Energy for industries	Energy (fuel) for transport	Energy for households and buildings
1 Energy industries (renewable-/ non renewable sources) (continued)	Fuel/feedstock switch	AM0049 ACM0006 ACM0011 ACM0018 AMS-III.AG. AMS-III.AH. AMS-III.AM.	AM0049 AM0056 AM0069 AM0081 ACM0006 ACM0009 ACM0018 AMS-III.AM.		AM0081
2 Energy distribution	Renewable energy	AMS-III.AW. AMS-III.BB.	AM0069 AM0075		AMS-III.AW.
	Energy efficiency	AM0067 AM0097 AMS-II.A. AMS-III.BB.			
	Fuel/feedstock switch	AMS-III.BB.	AM0077		
3 Energy demand	Renewable energy				AMS-III.AE. AMS-III.AR.
	Energy efficiency	AMS-III.AL.	AM0017 AM0018 AM0020 AM0044 AM0060		AM0020 AM0044 AM0046 AM0060 AM0086 AM0091 AMS-II.C. AMS-II.E.

CDM Methodology booklet, 5th edition, 2013 → 250 pages

<https://cdm.unfccc.int/methodologies/>

2) CDM methodologies - Renewable electricity (15)

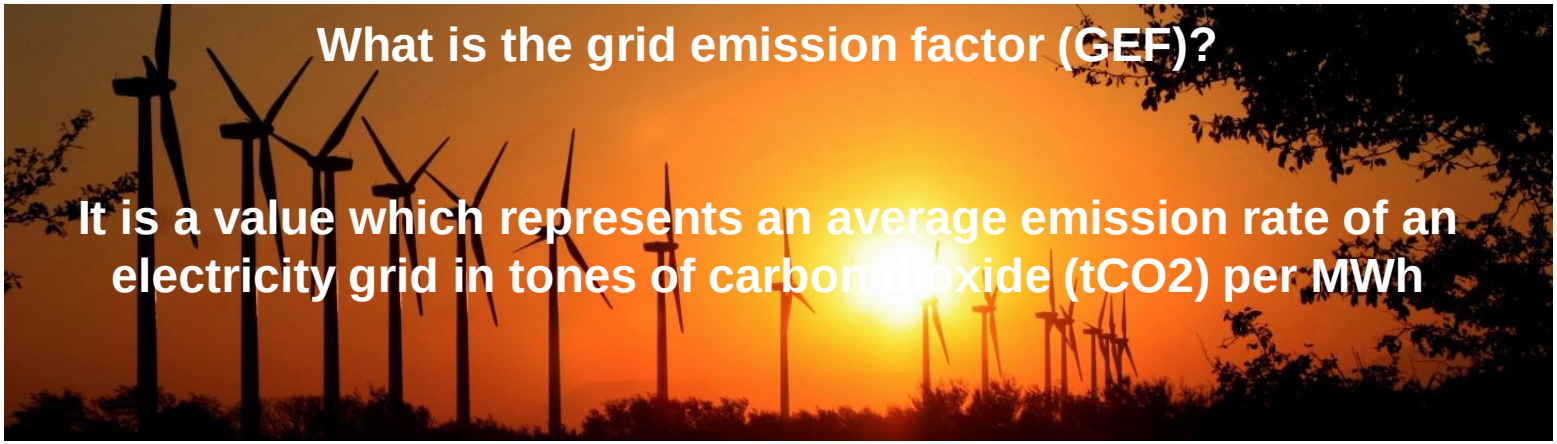


(*) Benefiting women and children

2) Renewable energy, ACM0002 & GEF

Emissions reductions (tCO2) = Baseline emissions – project emissions

Emission reductions (tCO2) = XXX MWh/year * **grid emission factor** (tCO2/MWh) - 0

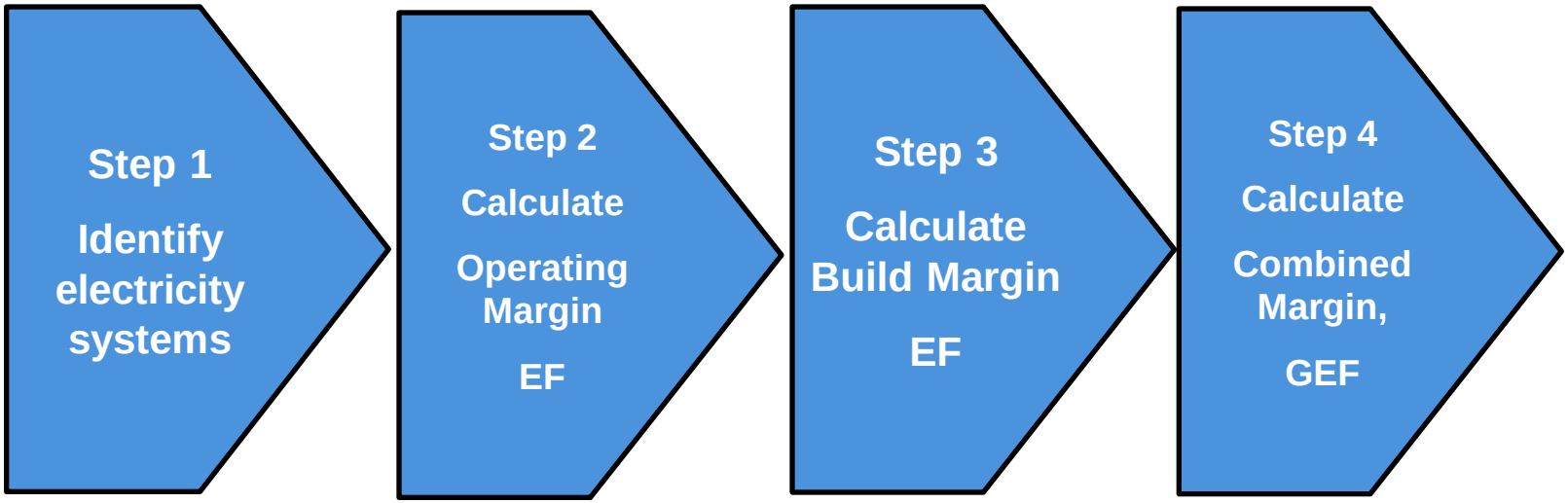


2) ACM0002 – How is GEF estimated?

Why is the GEF important? **To plan**

- ✓ As it allows estimating emission reductions of energy activities
- ✓ Facilitates decision making process to select interventions subject to GHG reductions
- ✓ Forecasts future emission reductions

How is the GEF estimated?



2) ACM0002 – How is GEF estimated?

Step 1 – Electricity system –

- Interconnected grid system of the country or region

Step 2 – Operating Margin EF (tCO2/MWh)- displacement of power in the grid which is generated by power plants operating on the margin

Data needed (year): fuel consumption, net calorific value and emission factor; electricity generated (at unit 'i' level)

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

2) ACM0002 – How is GEF estimated?

Step 3- Build margin EF (tCO2/MWh)– *It is the generation-weighted average emission factor of all power units during the most recent year for which electricity generation data is available.* → *E.g.: set of 5 power units recently built or power capacity additions that account for 20% of electricity generation*

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Step 4 - Combine margin EF or GEF (tCO2/MWh)– weighted average of operating and build margins

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

- For wind and solar weighing average OM and BM is 0.75 and 0.25
- For other technologies is 0.5 each

2) Model – Grid emission factor calculation

EMISSION FACTOR DETERMINATION - SIMPLE OM - OPTION A

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

2008	$EF_{grid,OMsimple,y}$ =	0.5433	[tCO_2/MWh]	Option A
2009	$EF_{grid,OMsimple,y}$ =	0.5433	[tCO_2/MWh]	Option A
2010	$EF_{grid,OMsimple,y}$ =	0.5433	[tCO_2/MWh]	Option A

False

year	unit type	unit number	[illegible]me	net electricity	fossil fuel type	unit fuel type	amount fuel type	net calorific value		fuel CO2 EF			
y		m		EG_{my}	i		$FC_{i,my}$	factor for NCV	$NCV_{i,y}$	factor for EF	$EF_{CO2,i,y}$ or $EF_{CO2,m,i,y}$	Partial E_{my}	$EF_{El,my}$
				[MWh]			[unit]		[GJ/unit]		[tCO2/GJ]	[tCO2]	[tCO2/MWh]
2009	Grid	1	Coal	[illegible]82399.677	Coal	t	795737.531		22.609		0.124	2230452	1.41
2009	Grid	2	Fuel Oil	[illegible]725.141	Fuel Oil	t	1602871.439		38.937		0.082	5124380	0.85
2009	Grid	3	Natural Gas	4[illegible]45.64	Natural Gas	m3	12566536831		0.035		0.055	24517313	0.49
2009	Grid	4	Gas Oil	395[illegible]325	Gas Oil								
2009	Grid	5	Impo	204[illegible]									
2010	Grid	1	Coal	1582399.6[illegible]	Coal								
2010	Grid	2	Fuel Oil	6021725.141	[illegible]uel Oil								
2010	Grid	3	Natural Gas	49783545.64	[illegible]al Gas								
2010	Grid	4	Gas Oil	3951440.325	[illegible]il								
2010	Grid	5	Impo	2040098									
2008	Grid	1	Coal	1582399.677	Coal								
2008	Grid	2	Fuel Oil	6021725.141	Fuel Oil								
2008	Grid	3	Natural Gas	49783545.64	Natural Gas								
2008	Grid	4	Gas Oil	3951440.325	Gas Oil								
2008	Grid	5	Impo	2040098									

PROJECT TITLE

OPERATING MARGIN (OM) OPTIONS

1. **Simple OM**
   - (•) Option A — Data | Calculation
   - ( ) Option B — Data | Calculation
2. **Simple adjusted OM** — Data | Calculation
3. **[illegible]patch data analysis OM**
   - ( ) Option 1 — Data | Calculation
   - ( ) Option 2 — Data | Calculation
4. **Average [illegible]**
   - ( ) [illegible]ion A — Data | Calculation
   - ( ) [illegible]ion B — Data | Calculation

BUILD MARGIN (BM)

Data | Calculation

WEIGHT OM & BM

- ( ) Solar Projects
- ( ) Wind Projects
- (•) Other Projects
- ( ) User Specified
- ( ) Simplified

- (•) First Credit Period
- ( ) Subsequent

OM [tCO_2/MWh] =	0.5433	w_{OM} =	0.50
BM [tCO_2/MWh] =	0.3507	w_{BM} =	0.50

Combined Margin [CM = OM x w_{OM} + BM x w_{BM}] [tCO_2/MWh] = 0.4470

2) GEFs in the region

Member state	GEF, tCO2/MWh (CDM projects) *	GEF, tCO2/MWh (RCC St. George's) **
Antigua & Barbuda	-	*In progress*
Bahamas	*0.723 (CDM 5620)*	-
Belize	-	0.2278 (PSB0006)
Grenada	-	0.585 (PSB0023)
Guyana	*0.948 (CDM 1458)*	*In progress*
Jamaica	*0.834 (CDM 0239)*	Data gathering
St Vincent & the Grenadines	-	0.7309 (PSB0021)
Trinidad & Tobago	*0.666 (CDM 9358)*	*In progress*

*) https://cdm.unfccc.int/Projects/projsearch.html

**) https://cdm.unfccc.int/methodologies/standard_base/new/sb8_index.html

3) Case studies:

Wigton wind farm, Jamaica

Geothermal, El Salvador

Wigton Wind Farm, Jamaica, CDM 0239

Capacity, 20.7 MW, 23 turbines of 900 kW each.

Grid connected and estimates generation of enough electricity to feed 25,000 homes.

Annual generation, 41,800 MWh/year,

GEF, 0.834 tCO2/MWh

Emission reductions, 52,540tCO2/year.

CER revenues/year, 260,000 US$ (5 US$/tCO2)

Geothermal, El Salvador, CDM 1218

Capacity 9.2 MW

Grid connected

Annual generation, 63,695 MWh/year,

GEF, 0.693 tCO2/MWh

Emission reductions, 44,141 tCO2/year.

CER revenues/year, 220,000 US$ (5 US$/tCO2)

4) Funding opportunities

Opportunities for SIDS under the carbon market

Government calls:

- Norwegian Carbon Procurement Facility (*)
  - Targets 30 million CERs. **5 December 2014**
- UN-OPS
  - Targets CERs issued . 5 November 2014
- Swedish Energy Agency (**)
  - Targets renewable energy, energy efficiency and waste management projects. February 2014
- German Development Bank, kfW (***)
  - Targets Programme of Activities and standardized baselines. On going call for proposals.

(*) http://www.nefco.org/financing/norcap_call_for_proposals

(**)http://www.energimyndigheten.se/en/Cooperation/For-a-better-climate/Flexible-mechanisms-for-monitoring-green-house-gas-emissions/Swedish-CDM-and-JI-climate-programmes-/Call-for-CDM-proposals-/

(***)https://www.kfw-entwicklungsbank.de/International-financing/KfW-Entwicklungsbank/Environment-and-climate/Klima%C2%ADschutzfonds/PoA-F%C3%B6rderzentrum-Deutschland/

Opportunities for SIDS outside the carbon market

Nationally Appropriate Mitigation Actions are activities carried out by governments to reduce GHG emissions while addressing sustainable development priorities.

- Austrian NAMA initiative, for SIDS, grants up to 500 kUS$
- NAMA Facility (*)
  - First call 2013: Mexico, Costa Rica, Chile, Colombia and Indonesia
  - > 40 proposals 2nd call, funds of 50 million EUR. 15 July 2014
- >50 proposals, NAMA registry (**)
  - Dominica, Low Carbon Strategy
  - Barbados, Renewable and energy efficiency
  - Dominican Republic, Tourism and Cement Sector

(*) http://nama-facility.org/news.html

(**) http://namapipeline.org/; http://www.nama-database.org/index.php/Main_Page

5) Final remarks

1. CDM tools are **widely applied** and freely available →Flexible and cost effective

2. Accurate GEF values supports (part of) the **decision making process** to achieve renewable energy targets under country or regional plans by
   - **Selecting** type/size of interventions based on emission reductions
   - Providing **Monitoring Reporting & Verification frameworks** that have been already applied

3. GEFs are used to estimate carbon reductions for any type of intervention that **reduces electricity consumption**. E.g. energy efficiency

4. Funding is **available** for CDM implementation and NAMA development

5. RCC St George's provides *in-kind* **assistance** to regional stakeholders in
   - Preparing proposals for CDM/NAMA development
   - Carbon accounting for electricity sector interventions; e.g. renewable energy and energy efficiency technologies
   - Estimating/updating GEFs

References

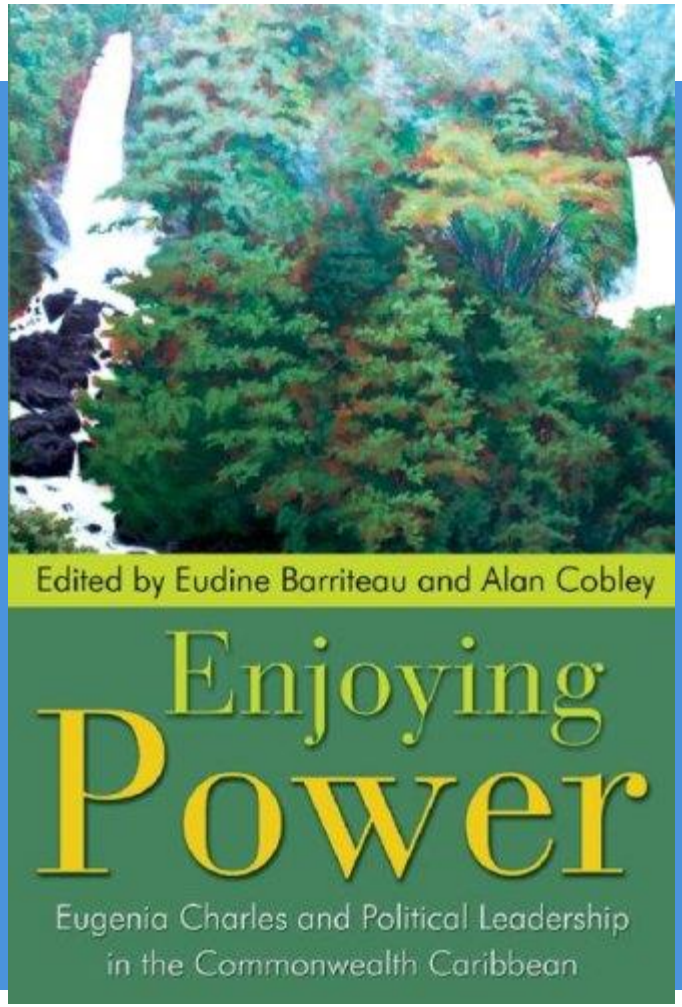
- CDM methodology booklet, 5th Edition, 2013
  http://cdm.unfccc.int/methodologies/

- Grid Tool – ACM0002
  Model for grid emission factor calculation (spreadsheet)
  http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf/history_view

- Project search by country, sectoral scope, methodology code, etc.:
  http://cdm.unfccc.int/Projects/projsearch.html

- Standardized baselines
  https://cdm.unfccc.int/methodologies/standard_base/new/sb8_index.html

- Regional collaboration centre (see *More information* for CDM materials)
- http://cdm.unfccc.int/stakeholder/rcc/index.html


Edited by Eudine Barriteau and Alan Cobley
Enjoying Power
Eugenia Charles and Political Leadership in the Commonwealth Caribbean


Eugenia Charles
Dominica Prime Minister, 1980-1995

THANK YOU!

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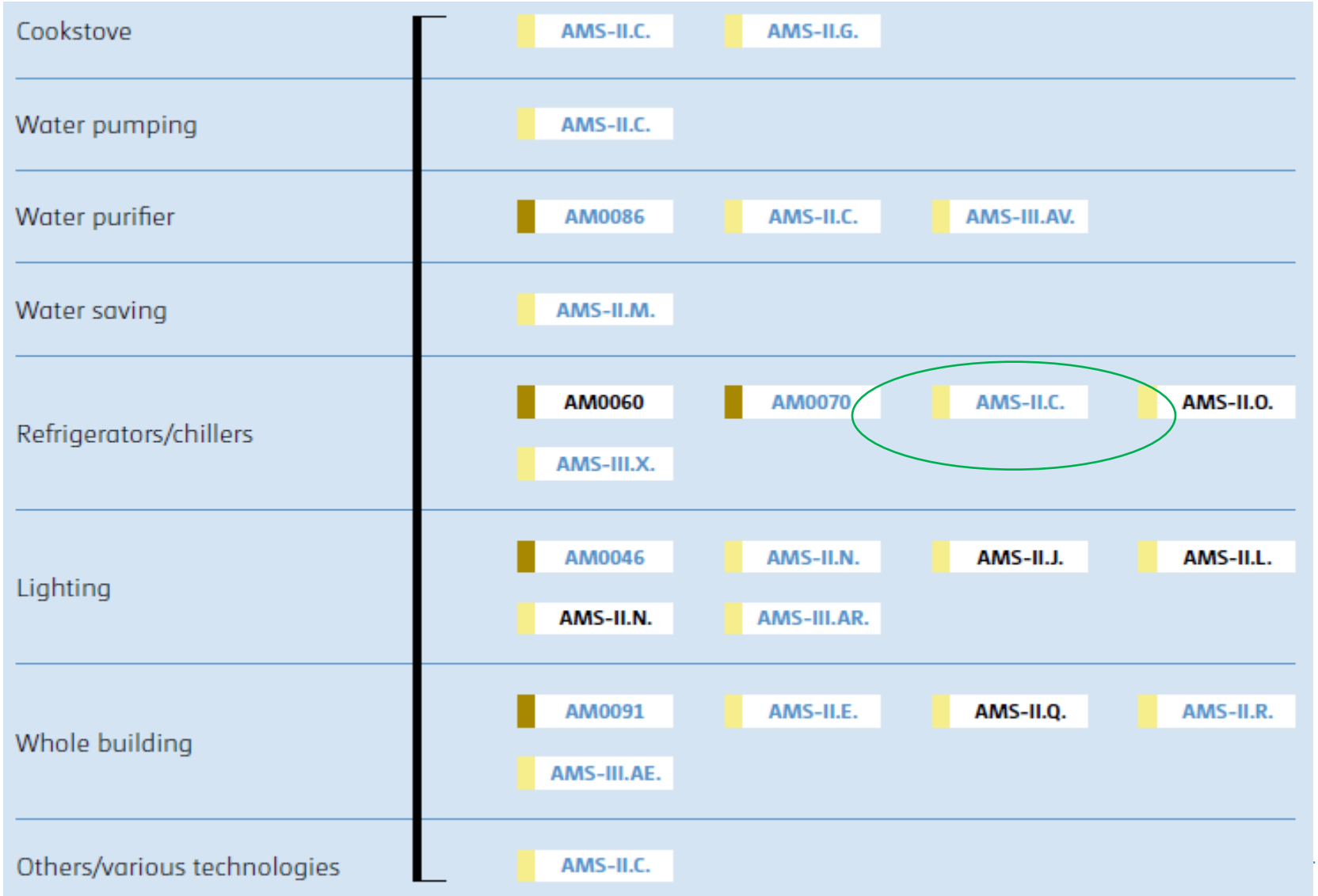
2) Household and building energy efficiency – CDM methodologies (24)



RCC St George's activities 2013-2014

Activities	Products
Stakeholder engagement	1. Cooperating with governments- Belize, St Vincent, Dominican Republic, Grenada, Trinidad, **Antigua & Barbuda**, Haiti (baselines for waste and electricity sectors) 2. Cooperating with international organizations-UNEP Risoe, IDB, WBI, EU, GIZ/REETA 3. CDM technical training [Dominican Republic]
CDM support	1. Report , Analysis of CDM activities in region 2. Support to 30 projects CDM offices 3. Internal CDM policy input for SIDS/LDCs
Renewable energy PoA	1. Country baselines for electricity sector 2. PoA proposal 3. Solar NAMA – MRV framework, World Bank Institute
Landfill gas sites-waste	1. Assessment of regulation 2. Country baselines landfill gas incineration projects

2) Sectoral standardized baselines – top down approach

This approach allows establishing **baselines** for countries or group of countries in a specific sector