

Clean Development Mechanism Projects for Developing Countries: Potential for Carbon Emissions Mitigation and Sustainable Development

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Outline

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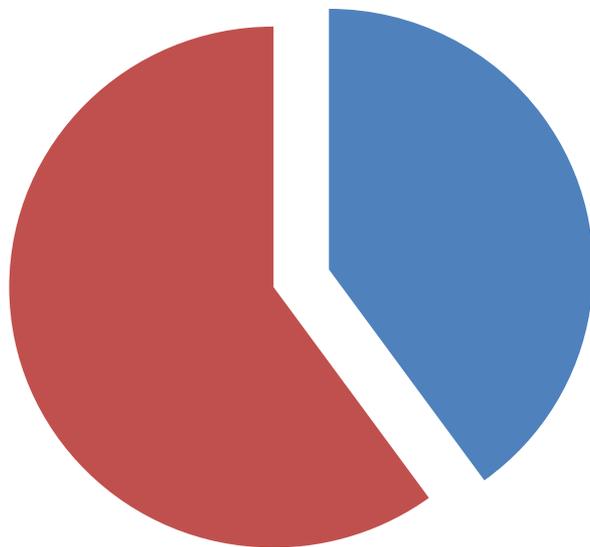
Objective

- The paper focuses on the benefits of CDM projects to developing countries, with emphasis on Nigeria



Problems & Opportunities in Nigeria

- Nigeria's generation capacity <5GW



- About 68 million people with access to electricity
- About 102 million people without access to electricity

- Nigeria is one of the world's highest emitters of flare gas
- Increased use of diesel/petrol generators
- Disastrous experience of climate change in recent times

Source:

D. O. Akinyele and R. K. Rayudu , "Distributed Photovoltaic Power Generation for Energy-Poor Households: The Nigerian Perspective", *IEEE Asia Pacific Power and Energy Engineering Conference (APPEEC 2013)*, 8th -11th December 2013, Hong Kong.

R. Podmore, R. Larsen, H. Louie, P. Dauenhauer, W. Gutschow, P. Lacourciere, R. Parigoris and S. Szablya, "Affordable energy solutions for developing communities," *IEEE PES Magazine April 2012* issue

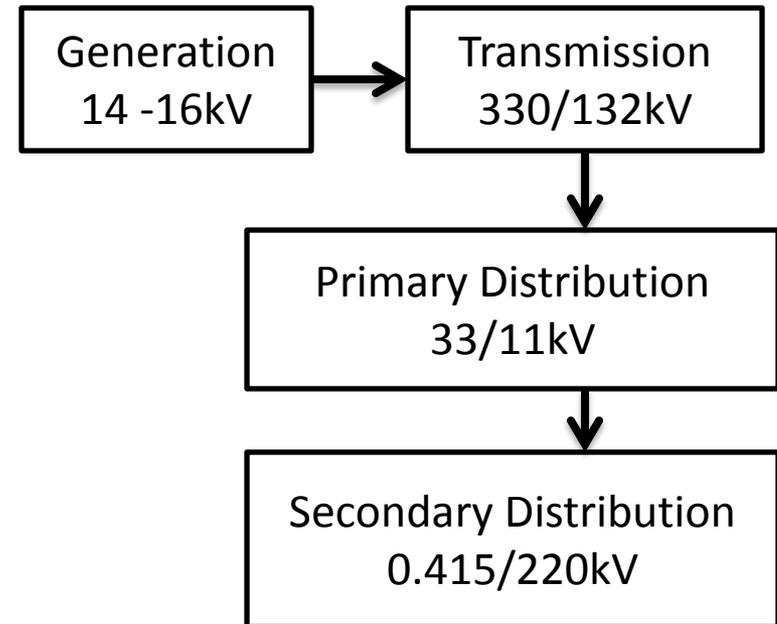
D. O. Akinyele, R. K. Rayudu, N. K. C. Nair, B. Chakrabarti, "Decentralised Energy Generation for End-use Applications: Economic, Social and Environmental Benefits Assessment, *IEEE ISGT May, 2014, Malaysia*.

S. O. Oyedepo, "Energy and Sustainable Development in Nigeria: The Way Forward", *Energy, Sustainability and Society*, vol. 2, issue 15, 2012.

www.resilience.org/stories/2013-09-03/gas-flaring-the-burning-issue

Nigeria's Electricity System

Generating Plant	Type	Installed Capacity (MW)
Jebba	Hydro	570
Shiroro	Hydro	600
Kainji	Hydro	760
Geregu	Thermal	434
Afam	Thermal	776
Ughelli	Thermal	972
Sapele	Thermal	1020
Egbin	Thermal	1320
		> 6000 MW



❑ Geregu plant is one of the 10 National Integrated Power Project (NIPP) - new plants. The government is to commission the remaining 9 plants in the future

Source: Nigeria's Generation Companies
 (energycouncil.gov.ng/download.aspx)

CDM - Background

- It a partnership structure specified by Kyoto protocol to encourage the implementation of projects that can lead to reduction of GHGs.
- Two parties are involved:
 - an investor from a developed country
 - a host country (developing country)
- This partnership aims at reducing GHG emissions at an optimum cost, and can also lead to sustainable development in developing countries
- The industrialized countries or companies in industrialized countries that invest in GHG emission reduction projects in developing countries gain credits (CERs) from these projects

Source:

www.retscreen.net

Climate Change: Guide to the Kyoto Protocol Project Mechanisms <wbcarbonfinance.org/docs/b_en_cdm_guide_ld.pdf>

Features of CDM

- It must meet the criteria of the host country
- A CDM project must demonstrate “ADDITIONALITY” – it must lead to a reduction of GHG emissions that would not occur in its absence
- Emissions reduction must be based on a realistic data
- A baseline has to be set
- Emissions Reduction is given by:

$$E = B - V \text{ (t CO}_2\text{)}$$

B is the baseline emissions,

V is the verified CDM project emissions

Sectors for Potential CDM projects in Nigeria

- Industrial production such as cement manufacturing, oil and gas industries;
- Energy generation such as bio-fuels development, wind, solar, hydro, biomass , geothermal, methane capture systems, etc.
- Integrated waste and compost management, landfills etc.
- Sustainable land management practices such as afforestation and reforestation, agro forestry, improved rangeland management, and a host of innumerable others.

Source:

S. A. Adejuwon, “Nigerian Designated National Authority (DNA): An overview of CDM Implementation in Nigeria”, 2012

Existing CDM Projects in Nigeria

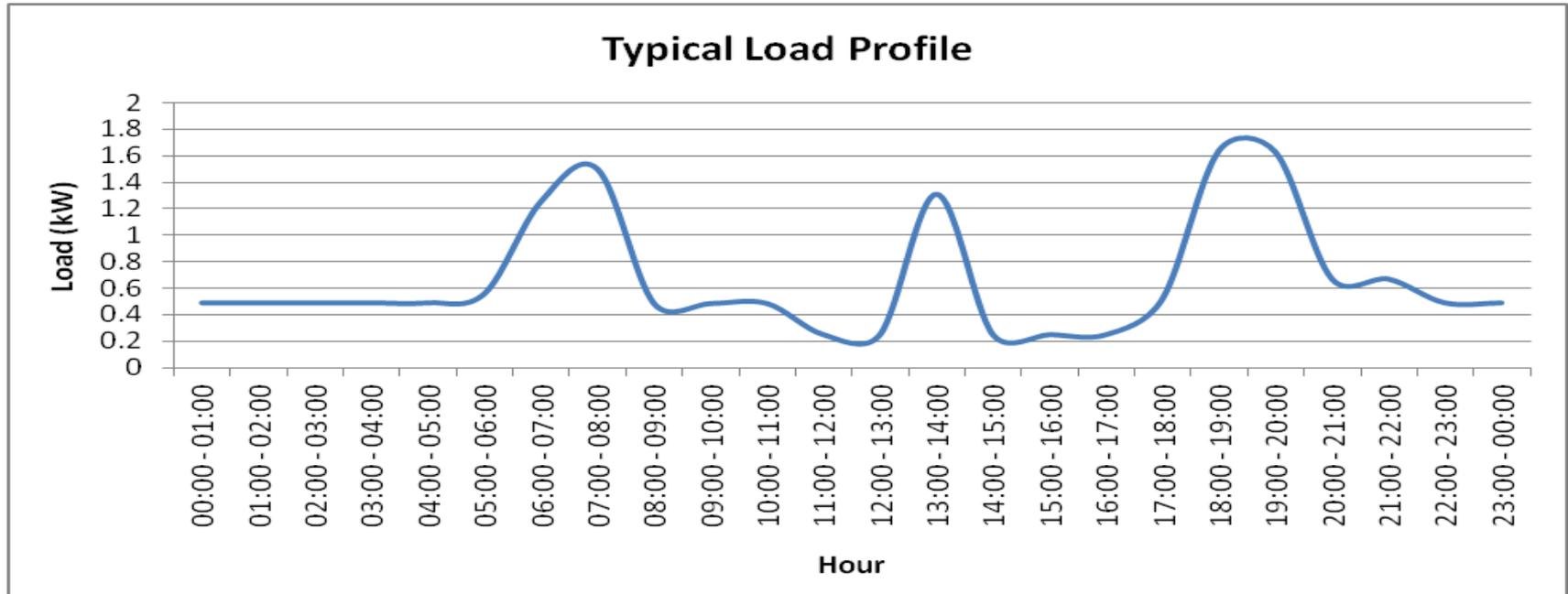
S/No.	CDM Project	Type	Annual CERs	Date of Registration
1.	Recovery of Associated Gas that would otherwise be flared at Kwale Oil-Gas processing plant, Nigeria	Waste gas/heat utilization	1, 496, 934	Nov., 2006
2.	PanOcean Gas Utilization	Waste gas/heat utilization	2, 626, 735	Feb., 2009
3.	Efficient Fuel Wood Stoves for Nigeria	Energy Efficiency	31, 309	Oct., 2009
4.	Recovery and Marketing of Gas that would otherwise be flared at the Asuokpu/Umutu marginal field, Nigeria	Waste gas/heat utilization	256, 793	Oct., 2010
5.	Municipal Solid Waste Composing in Ikorodu, Lagos	CH ₄ recovery and utilization	281, 781	Dec., 2010
6.	Improved Cooking Stoves for Nigeria Programme of Activities	Energy Efficiency	8, 912	Nov. , 2011
7.	Multi-Country Small-scale CDM Programme for Reduction of Emission from Non-Renewable Fuel from cooking at household level	Renewable Energy	51, 385	Nov., 2012



Scenarios

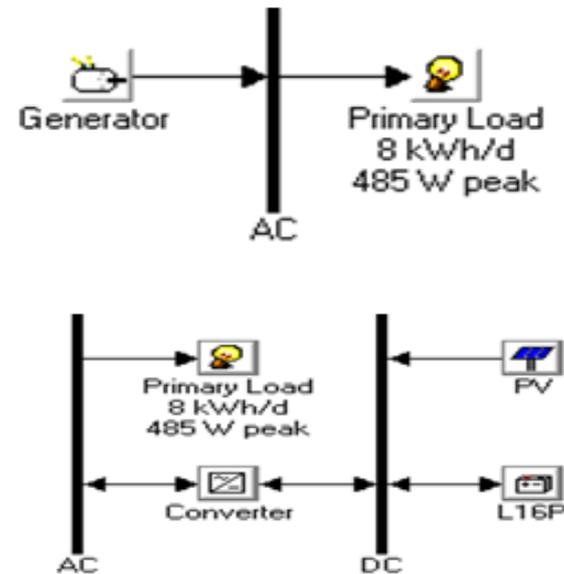
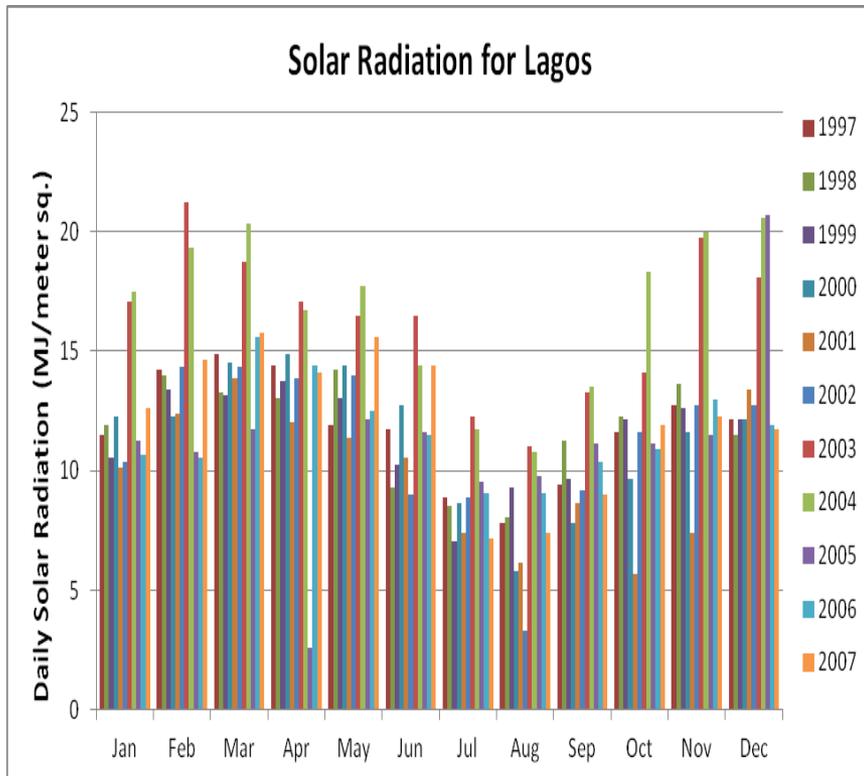
- Solar PV generation for:
 - 3 Bedroom Flat
 - 3 Bedroom Flat (in Lagos)
 - Remote Household
 - Street Lighting (in Bauchi)

Demand Model for a – 3 Bedroom Flat



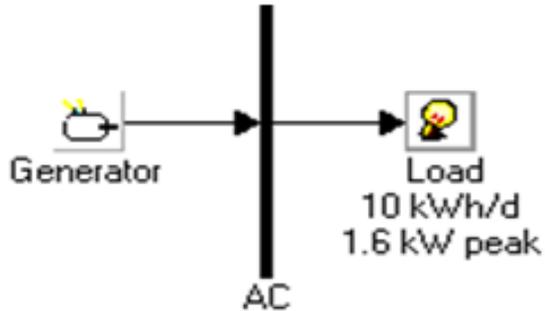
- Daily demand and peak load of 16kWh and 1.64kW when supplied by the utility
- Loads include lighting bulbs, LCD-TV, DVD, fans, fridge, electric cooker, electric kettle

Generation Model: Scenario 1

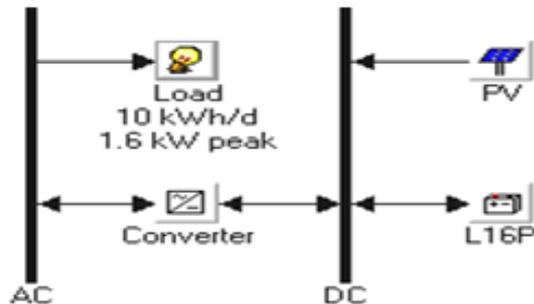


- A PV system solution is considered for the loads excluding electric cooker and electric kettle
- Kerosene or gas is used for cooking
- Daily electricity demand and peak load are 8kWh and 0.485kW respectively

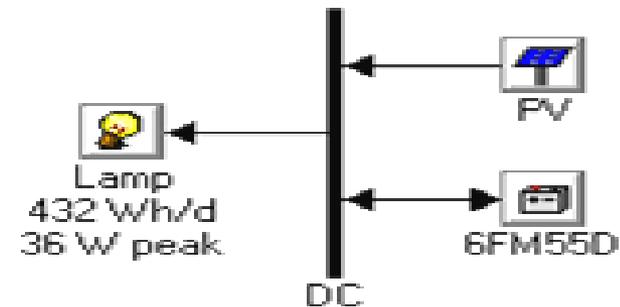
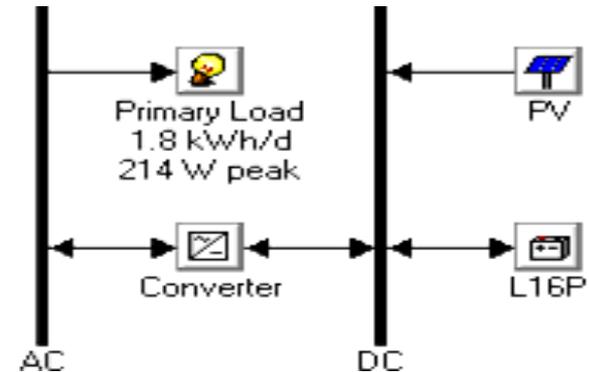
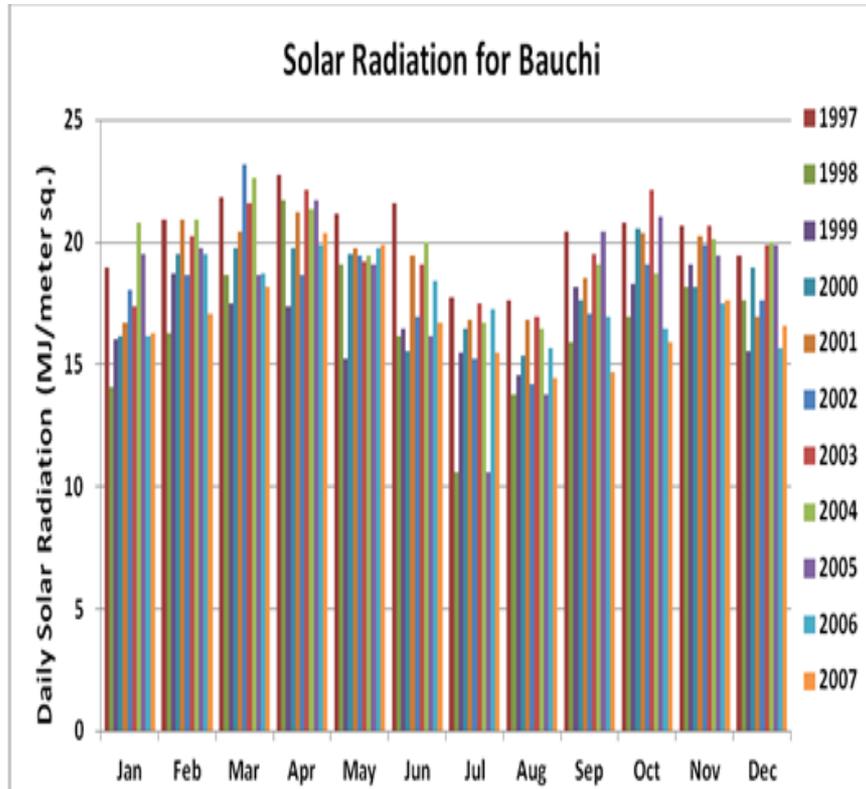
Generation Model: Scenario 2



- A 1.5h.p water pumping machine is included to scenario 1
- Daily demand and peak load are 10kWh and 1.6kW respectively



Generation Model: Scenario 3 and 4



Simulation Results

Scenario	Demand (kWh/yr)	Gen (kW)	PV (kW)	PV (kWh/yr)	Capital Cost(USD)	Emissions (tons/yr)
1	2,920	1	-	-	344	4.000
		-	4	3,958	16,442	-
2	3,650	2	-	-	516	5.917
		-	5	4,947	20,115	-
3	657	0.5	-	-	172	1.238
		-	0.6	823	2,870	-
4	157.7	0.1	-	-	34	0.196
			0.17	233	960	-

Some challenges of CDM projects

- High cost and accessibility of technology
- Lack of skilled manpower to manage the continuous operation of the project
- Poor capacity by designated authority in the host country
- Too much time for processing the project documentation
- Difficulty in evaluating the CDM's "additionality"
- Lack of awareness and information etc

Conclusions

- CDM projects have the potential to mitigate carbon emissions
- Renewable energy systems could earn higher incentives (CERs) because they are clean technologies
- The developed countries or agents/companies from developed countries can meet their emissions reduction targets at an optimum cost
- Independent power producers, private sectors, individuals, community development association, local and state governments could invest in renewable energy-based CDM which in the long-term will not only reduce carbon emissions, but also address energy shortage problem and lead to sustainable development

Thank You

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