

# Application of CDM to Renewable Energy Projects in Emerging Market Countries

## A Case Study of Methane-to-Markets

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# What is CDM?

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*Clean Development Mechanism (CDM)* is one of the cooperative mechanisms in the Kyoto Protocol of the Framework Convention on Climate Change (UNFCCC).

Two main goals:

- Contribute to achieving sustainable development in Non-Annex I countries (developing countries).
- Assist Annex I countries (industrialized countries) in achieving their emission reduction targets in a cost-efficient manner in exchange of Certified Emission Reductions (CERs).

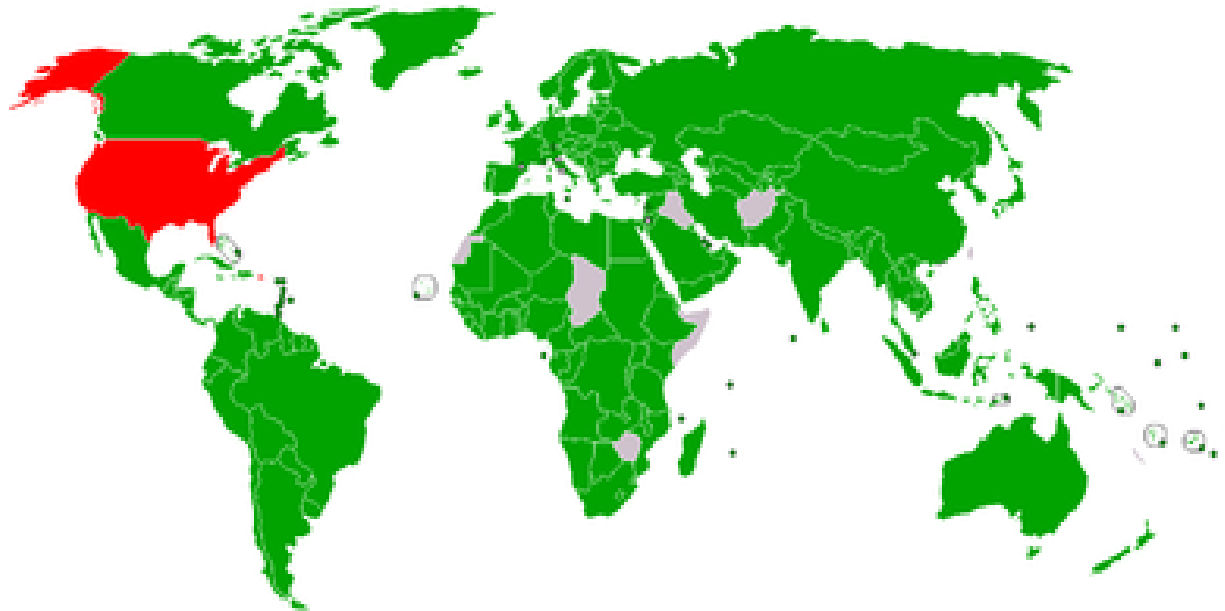
As of 2008, there are currently 978 registered CDM projects all over the developing world.



# What countries are participating in CDM...

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The Clean Development Mechanism (CDM) is one of the three flexible mechanisms contained in the Kyoto Protocol. It allows a country with an emission-reduction or emission-limitation commitment (Annex B Party) to implement an emission-reduction project in developing countries.



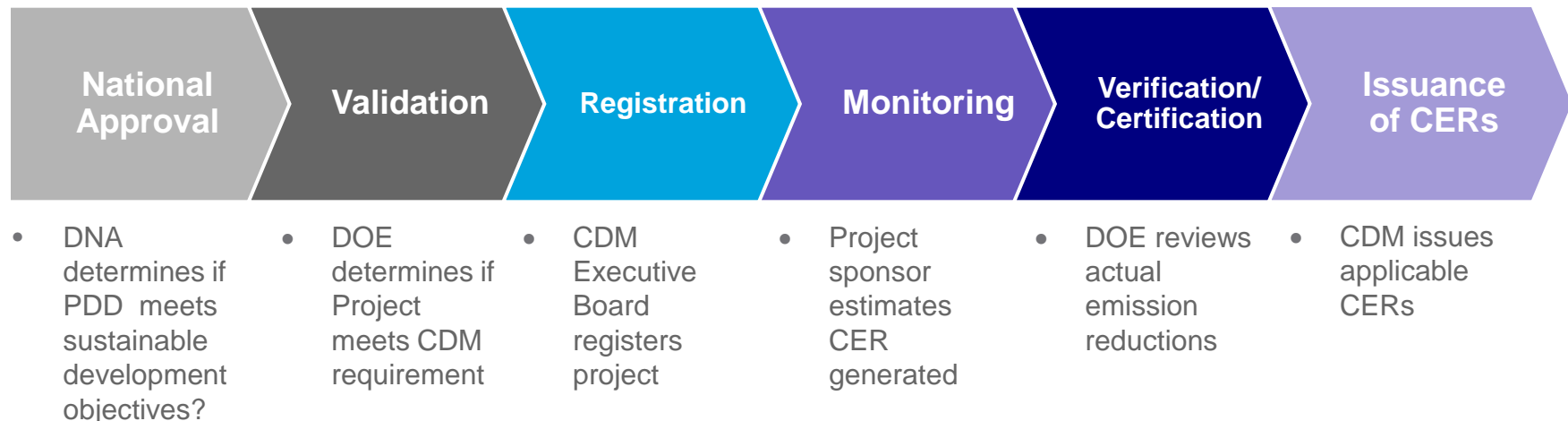
Participation in the Kyoto Protocol, green indicates countries that have signed and ratified the treaty, yellow is signed, but not yet ratified, grey is not yet decided and red is no intention of ratifying.

# What are the main steps in the CDM project cycle...

The process begins with the submission of a **Project Design Document**

- General description of the project
- Proposed baseline methodology
- Timeline and crediting period
- Monitoring methodology
- Calculation of GHG emissions by source, and
- Stakeholder comments.

...and ends with the issuance of Carbon Emission Reduction units (CERs).



# What are the criteria for CDM projects to qualify for CERs...

In reviewing the PDD, the following four criteria must be met:

- [Sustainability](#) – host country determines whether project meets “sustainable development” criteria
- [Environmental additionality](#) – the project would not exist without CDM financing, i.e., additional emission reductions, and therefore not “[business-as-usual](#)”
- [Financial additionality](#) – Carbon Emission Reduction units (CERs) are not financed with Official Development Assistance (ODA)
- [Governmental approval](#) – both host and buyer country Designated National Authorities (DNA)s must approve CDM project activity



# What are the different categories of CDM projects...

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CDM projects typically fall into one of the following categories

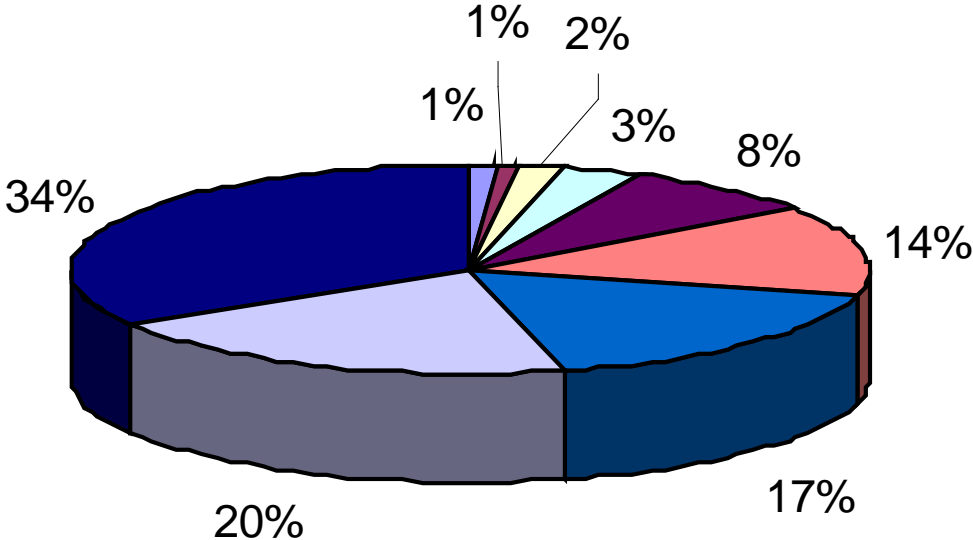
- Small-scale project activities: projects meeting the small-scale project eligibility criteria
  - (i) renewable energy <15 MW,
  - (ii) energy efficiency improvement < 60 GWh/yr,
  - (iii) other projects < 60 kt CO<sub>2</sub>e

Small-scale CDM projects are entitled to use simplified procedures

- Large-scale project activities: non small-scale project. An environmental impact assessment is required for large-scale projects
- Programme of Activities (PoA) (often called Programmatic CDM): voluntary action, implementing a policy, measure or stated goal, coordinated by a public or private entity, resulting in additional emission reductions.

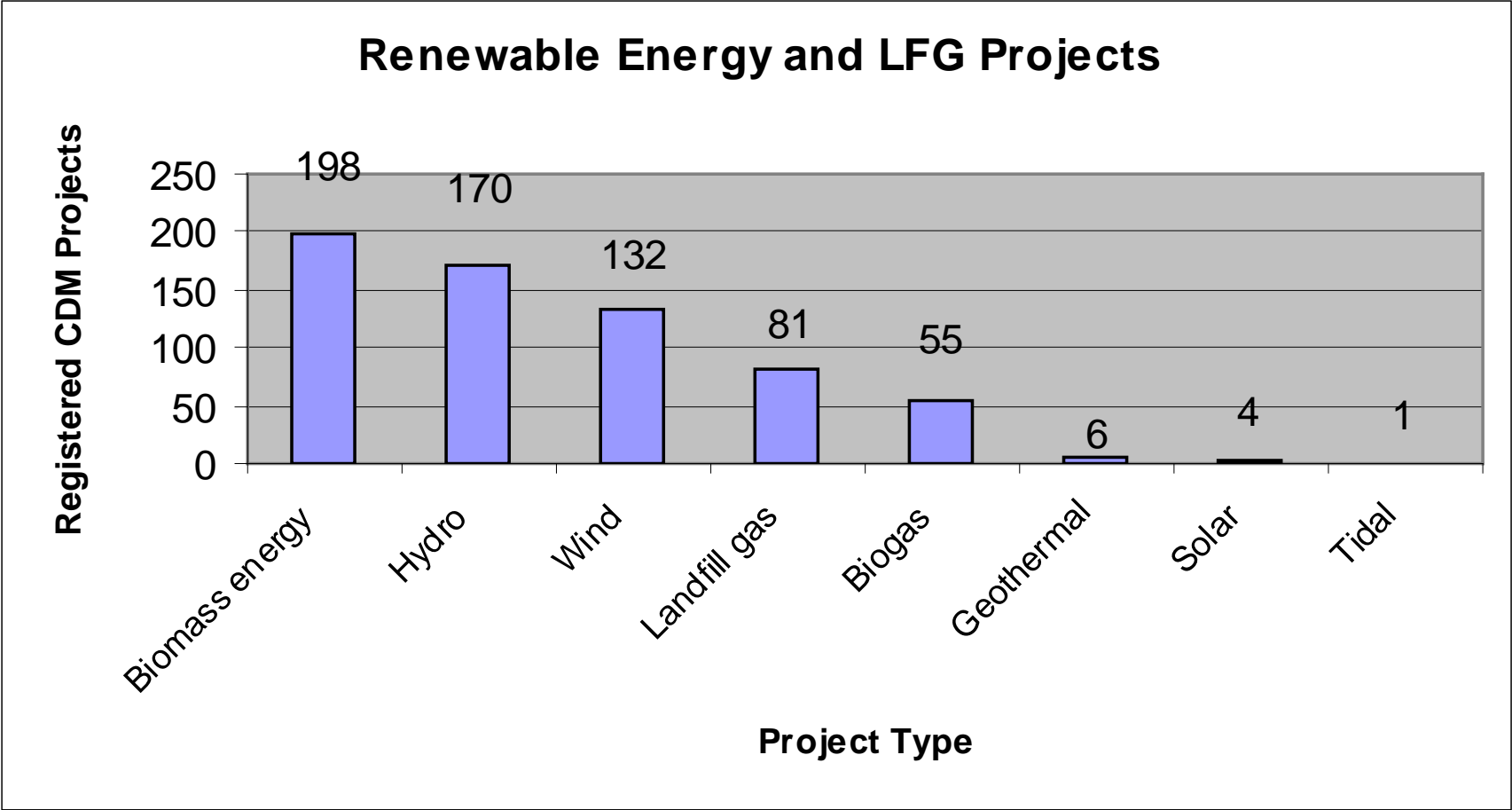
# Where are the current CDM projects located...

## Geographic Distribution of CDM Projects



- Others
- Central Asia
- Middle East
- Africa
- East/South East Asia
- Central America
- China
- South America
- India

# What are the most common types of CDM projects...



# What are the financial benefits of CDM...

- 0.5 – 7% points Internal Rate of Return (IRR) boost or US\$5-16 /MWh for renewable energy projects from CDM financing
- 5 – 60% points IRR boost for landfill gas and other methane reduction projects, depending upon the project type and emissions factor (baseline)
- Up-front payments for CERs possible to improve project cash flow
- CDM projects may help developer to obtain conventional financing (bank loans, etc) or qualify for concessionary financing from the new Carbon Investment Fund administered by The World Bank



# What is the cost related to the registration of CDM projects...

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<b>Average tons of carbon dioxide equivalent reductions per year over the crediting period</b>	<b>US Dollars</b>
< 15,000	\$5,000
15,000 – 50,000	\$10,000
50,000 – 100,000	\$15,000
100,000 – 200,000	\$20,000
> 200,000	\$30,000

Indicative prices compiled by UNFCC

# What is the Methane-to-Markets Partnership...

The M2M Partnership is an initiative led by the U.S. Environmental Protection Agency to reduce global methane emissions to:

- enhance economic growth,
- promote energy security,
- improve the environment, and
- reduce greenhouse gases



M2M Partner countries are:

- Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Ecuador, European Commission, Finland, Germany, India, Italy, Japan, Kazakhstan, Mexico, Mongolia, Nigeria, Pakistan, Philippines, Poland, Republic of Korea, Russia, Thailand, Ukraine, United Kingdom, United States, Vietnam.

# Why is methane important as a Greenhouse Gas...

Greenhouse gas: gas present in the atmosphere, which is transparent to incoming solar radiation but absorbs the infrared radiation reflected from the earth's surface.

Greenhouse gas	Main sources	Atmospheric lifetime	Equivalent CO <sub>2</sub>
Carbon Dioxide (CO <sub>2</sub> )	burning of fossil fuels and deforestation	Variable	1
Methane (CH <sub>4</sub> )	livestock enteric fermentation, manure management, landfills	12 years	21
Nitrous Oxide (N <sub>2</sub> O)	agricultural activities	114 years	310
Fluorinated Gases	refrigeration systems	Up to 50,000 years for tetrafluoromethane	Up to 23,900 for sulphur hexafluoride

As shown in the table above, one ton of methane has the Greenhouse Gas equivalent of 21 tons of carbon dioxide

# What are the main M2M sectors...

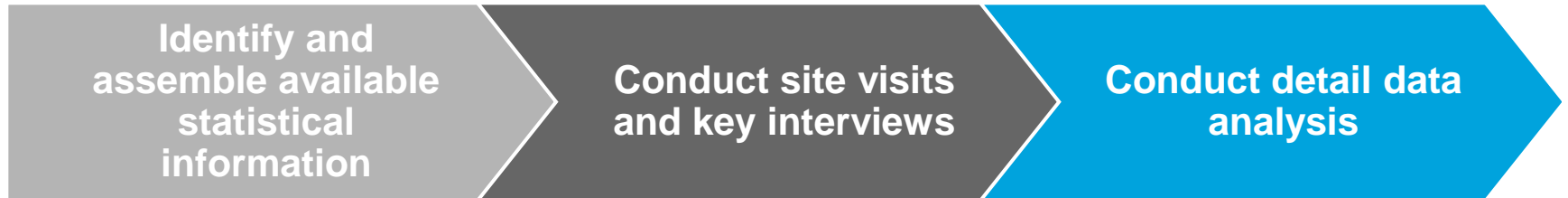
The M2M Partnership focuses on four key sectors; PA is currently working in the first three:

- Agriculture
  - Livestock (e.g. dairy, feedlots)
  - Agro-industry:
    - Distilleries/ethanol plants,
    - Sugar mills,
    - Fruit and juice processing
    - Starch (cassava, corn)
    - Palm oil
    - Slaughterhouses
- Landfills
- Oil and Gas (flaring)
- Coal mines (coal bed methane)



# Developing a resource assessment: a step-by-step approach

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- Country profiles
- Global databases and publications
- Country reports on specific sectors
- Multilateral banks studies (e.g., WB, IADB, ADB)

- Based on major sectors identified
- Representative sites
- Key players from each sector
- Associations (national and regional)

- Based on insights and information from key players
- Industry-specific databases and publications
- Sector-specific information from key government institutions

# Results of the Philippines Resource Assessment

PA performed a resource assessment of the methane emissions and recovery potential in the agriculture sector

Industry/ Sector	Geographical Coverage	Carbon Emission Reduction (MT CO <sub>2</sub> e /year)	Emission Reduction From Fossil Fuel Replacement (MT CO <sub>2</sub> e /year)	Total Emission Reduction (MT CO <sub>2</sub> e /year)
Swine Farming	Regions III, IV-A, VI	1,541,000	247,500	1,788,500
Alcohol Distillery	Nationwide	478,000	84,000	562,000
Coconut processing	Region IV, X, XI	162,500	28,500	191,000
Slaughterhouse	Nationwide	10,500	1,800	12,300
Total		2,192,000	361,800	2,553,800

# Landfill Example: Nuevo Laredo Landfill, Mexico

PA advised the city of Nuevo Laredo in developing a landfill gas recovery project.



## Characteristics of the landfill

- Period of operation: 1994 – 2010
- Total capacity: 2.62 million MT
- Waste disposal rate: ~500 MT/day
- Population: 355,000

## Results of the study

- Gas recovery: ~1,083 m<sup>3</sup>/hr, increasing to a maximum of ~1,332 m<sup>3</sup>/hr in 2011, following site closure and expansion of the well field into all areas of the landfill.
- Power plant sizing: 1.70 MW power plant (consisting of two (2) 0.85 MW engines).
- Projection of methane emissions reduction: 831,210 MT CO<sub>2</sub>e, plus 133,057 MT CO<sub>2</sub>e by displacing electricity produced via other sources.

# Landfill Example: Economic opportunities of the project

Project Period	Emission Reduction Price (\$/MT)	Equity Investments (%)	Net Present Value (x1,000 \$)	Internal Rate of Return (%)
2007 - 2021	6	100	\$1,668	19.8%
2007 - 2021	10	100	\$2,685	29.6%
2007 - 2021	6	25	\$1,576	46.6%
2007 - 2021	10	25	\$2,593	89.6%

- Cost of project (flaring only): \$900,000
- Cost of energy generation: \$2,500,000
- Benefits from CERs: ~\$350,000/yr @ \$6/MTCO<sub>2</sub>e

