



Renewable Energy: Opportunities and Challenges in addressing energy poverty

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Scaling up Renewable Energy

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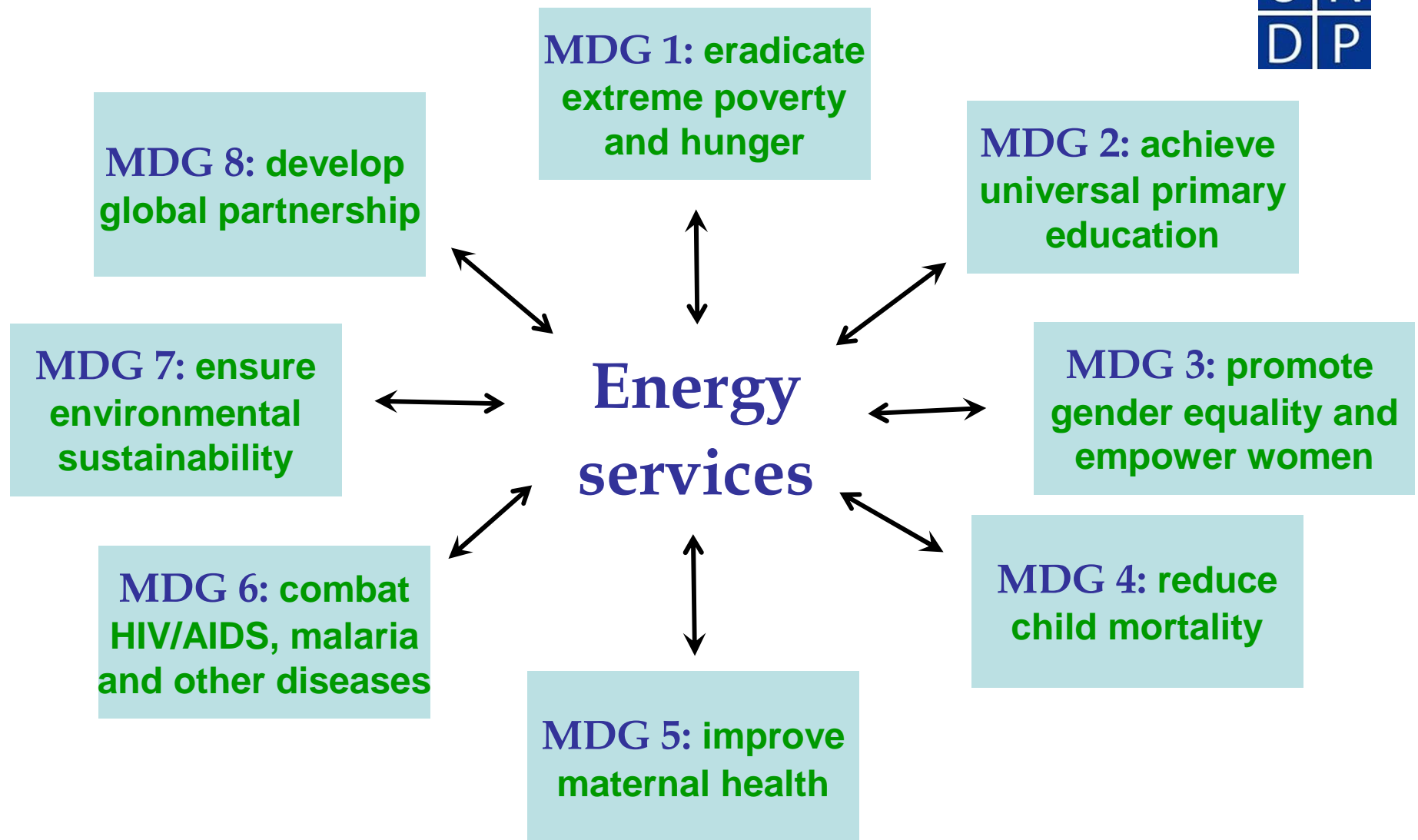


- **The MDGs and access to energy services**
- **Energy services for basic needs**
 - **Lighting and communication**
 - **Cooking and heating**
 - **Productive end-uses**
- **Renewable energy technologies in remote/rural areas**
 - **Electricity for lighting and communication**
 - **Energy for cooking and heating**
 - **Mechanical power for productive end-uses**
- **Key messages**

The MDGs and access to energy services



● Access to modern energy services is a fundamental prerequisite for achieving the MDGs and reducing poverty.



Energy services for basic needs

Lighting and communication



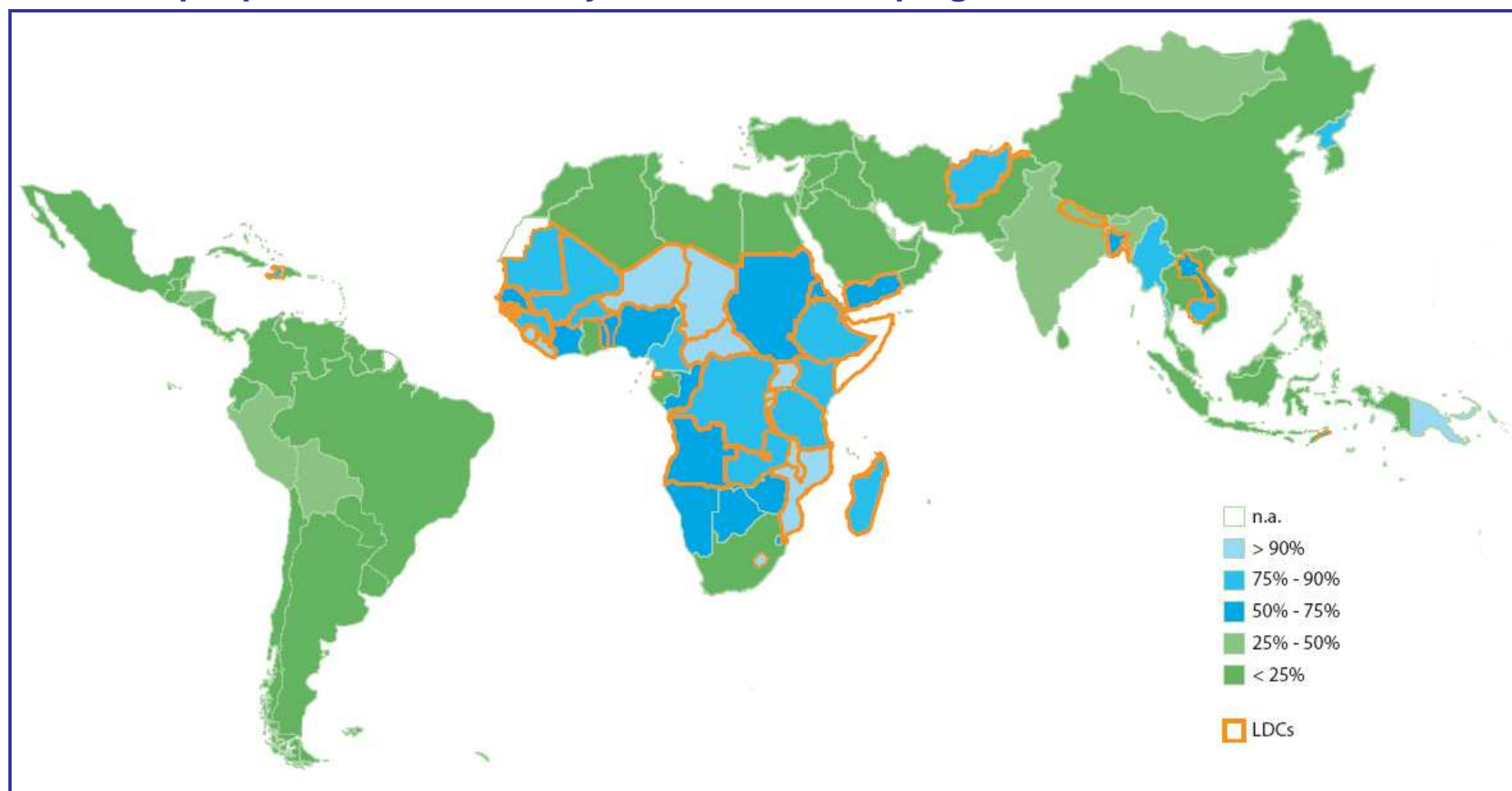
- In developing countries, **electricity** is needed for **lighting** and for **communication devices** (modern information and communication systems).
- Currently about **1.6 billion** people in developing countries do not have access to electricity.
- Electricity access reaches **76% of people in developing countries**, but only about **25% in the Least Developed Countries**.
- While about **93%** of the population in **urban areas** have access to electricity, they are only **65% in rural areas** (60% and 13% in the LDCs).

Energy services for basic needs

Lighting and communication



Share of people without electricity access in developing countries, 2007



Source: UNDP, 2009 (forthcoming publication)

Energy services for basic needs

Cooking and heating



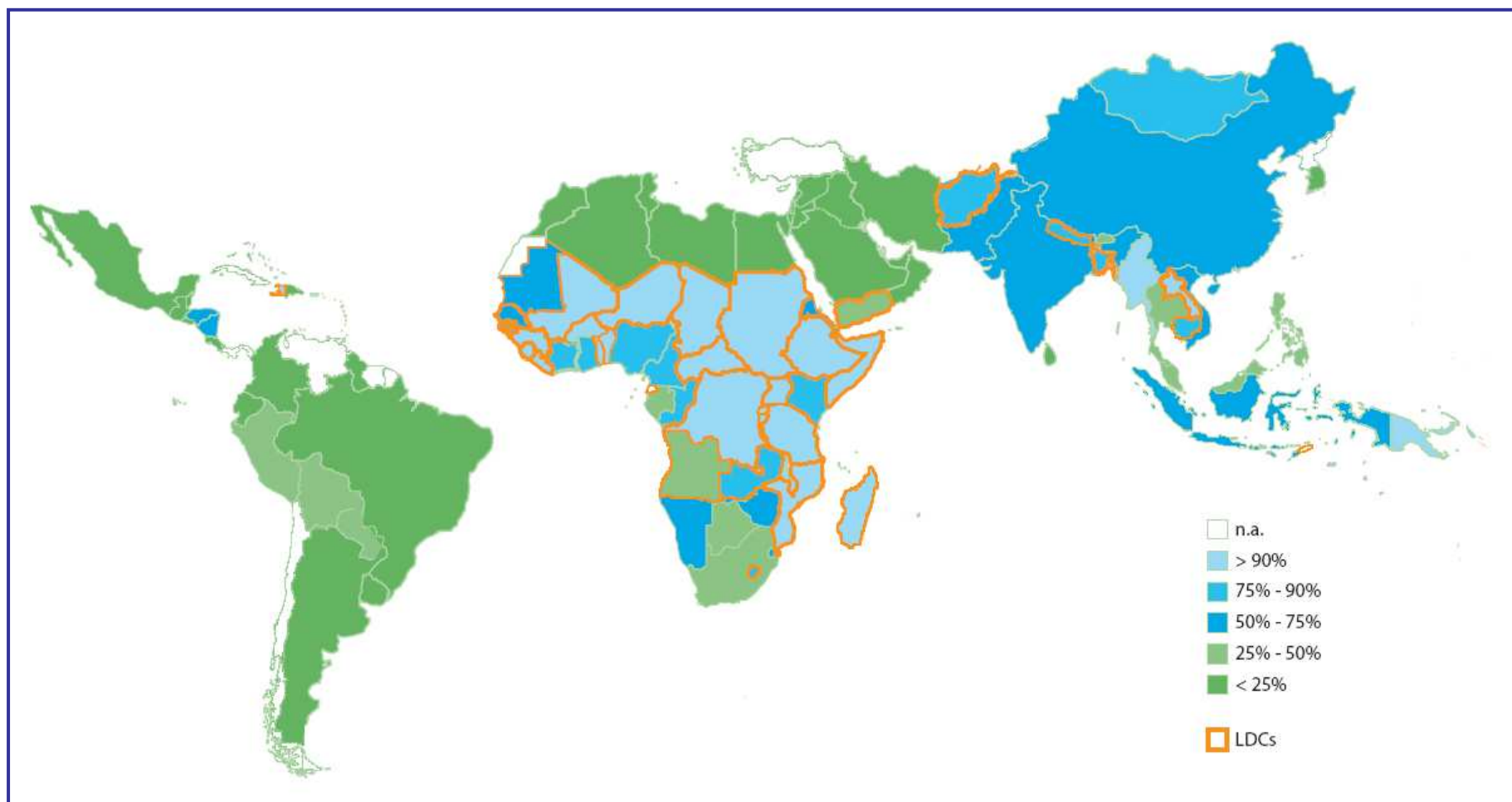
- **Cooking** is the major energy end-use among poor families in developing countries, accounting for **90 to 100% of household energy consumption** in most countries
- **Heating** goes hand in hand with cooking in developing countries and energy is primarily used for **space heating**.
- Currently, about **2.5 billion people** rely on **traditional biomass** for cooking and heating.
- About **62% of people** in developing countries rely on **solid fuels**, and only **9% of them** —roughly 300 million people—are estimated to use **improved cooking stoves**. In the **Least Developed Countries**, more than **90% of people** rely on solid fuels.
- Some **75% of people living in rural areas** use **traditional biomass** for cooking, primarily wood (**97% in LDCs**), while **65% of those living in urban areas** rely on **modern fuels**, especially **LPG (27% in LDCs)**.
- **Globally 1.5 million people per annum**, mostly women and children, succumb to premature death due to exposure to **indoor air pollution**.

Energy services for basic needs

Cooking and heating



Share of population relying on solid fuels in developing countries, 2007



Source: UNDP, 2009 (forthcoming publication)

Energy services for basic needs

Productive end-uses



Mechanical power for productive end-uses

	Services	Examples of mechanical power use
Water supply	Drinking – Irrigation - Livestock rising	Rope pump, Persian wheel, river turbine, wind pump
Agricultural services	Tillage, ploughing – Harvesting - Seeding	Power tiller/two-wheel tractor – Harvester - Bed planter, row planter, seed drill
Agro-processing	Milling, pressing - Cutting, shredding - Decorticating - Spinning - Drying	Powered mill, oil expellers - Saw mills, powered shredder, shaker, grinder, spinner - Powered fan
Natural resources extraction	Drilling, crushing, hole enlarging - Washing minerals - Grading minerals - Sawing timbers	Powered drill - Fuel/water powered jet - Fuel/water powered shaker - Powered saw
Small scale manufacturing	Metal/wood working – Briquetting - Textile/paper making - Pottery - Packaging	Sheet metal/pipe bender - Powered pressers - Treadle loom, pulp mill - Treadle pottery wheel - Bottle cappers
Lifting and crossing	Lifting - Crossing	Chain/rope hoist - Gravity ropeway, Tui

- Mechanical power increases the efficiency and effectiveness of productive activities and to meet basic human needs.
- Only 3 out of 140 developing countries provide data on access to mechanical power:- Mali, Central African Republic and Benin.

Renewable energy technologies in remote/rural areas

Electricity for lighting and communication



- Renewable energy - mostly hydro and wind power - accounts for about 18% of electricity generation in the world in 2006. (IEA, WEO 2008)
- Various RETs are capable of supporting lighting, ICT and other social services for rural communities.

Technology	Rated Output kW	Levelized Capital Cost	O&M Costs	Fuel Costs	Average Levelized Costs
Renewable power technology generating costs (US¢ / kWh)					
Solar PV	0.050 – 0.300	46	16- 10	0	62 - 56
	25	43	8.5	0	51.5
Wind	0.300	26.2	8.4	0	34.6
	100	13.5	6.2	0	19.7
PV-wind hybrid	0.300	31.4	10.4	0	41.8
	100	22.	8.5	0	30.5
Biomass Gasifier	100	4.4	1.9	2.7	9
Pico / micro hydro	0.300 - 1	14 - 12	0.9 – 0.5	0	15 – 12.7
	100	9.5	1.5	0	11
Conventional power technology generating costs (US¢ / kWh)					
Diesel/Gasoline Generator	0.300 - 1	5 – 3.8	5 - 3	54.6 – 44.4	64.6 – 51.2
	100	1	5	14	20
Microturbine	150	1.5	3.5	27	32

Source: adapted from ESMAP, 2007, Technical and Economic Assessment of Off-grid, Mini-grid and Electrification Technologies. Costs estimated for 2005

Renewable energy technologies in remote/rural areas

Electricity for lighting and communication



- Cost of RETs vary depending on geographical location, access infrastructures, quantity of energy needed, and capacity development costs.

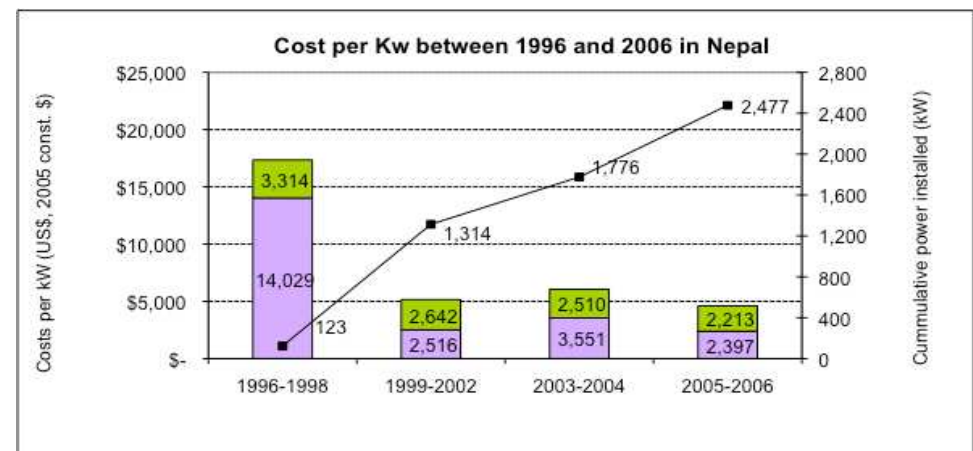
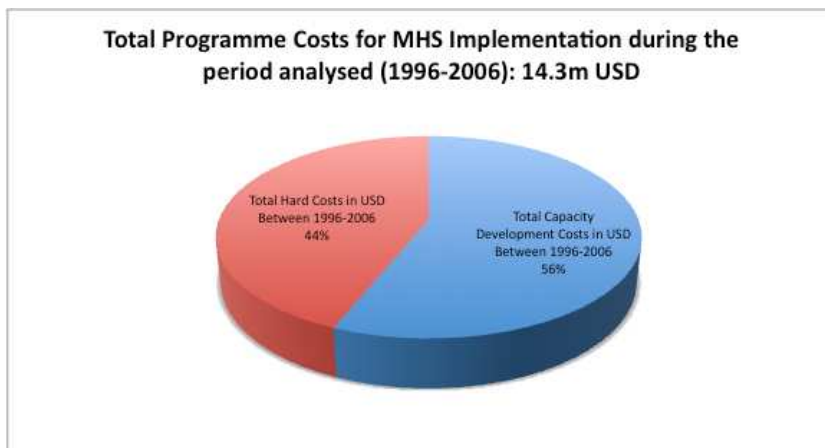
	Capital costs* (US\$ / beneficiary)		
	Hard costs	CD costs**	Total
Solar PV	36	74-131	110-167
Hybrid systems (solar/hydro)	40	80-160	120-200
Micro hydro	60	53-90	113-150
Biomass gasifiers	40	40-60	80-100

* This refers to programmatic costs

** Capacity development costs for small-scale projects (local level) and large programmes (national level)

- Capacity development cost for RETs is quite high. However, it decrease over time as scaling up occurs.

Example of Micro Hydropower in Nepal



Renewable energy technologies in remote/rural areas

Energy for cooking and heating



- Use of renewable energies for cooking and heating might not always be suitable because of relatively high capital costs, cultural reluctances and/or lack of resources.
- Biogas has shown some promise in terms of cost in places where dung and water is easily available. However, up-front investment in capacity development is a prerequisite.

	Capital costs* (US\$ / beneficiary)			Fuel costs
	Hard costs**	CD costs***	Total	
Renewable energy technologies				
Biogas	15	20-38	35-53	0
Solar cookers	11	59-95	70-106	0
Solar Water heaters	17	13-28	30-45	0
Improved traditional technologies				
Improved cooking stoves	3	3-8	6-11	0 or +
Conventional energy technologies				
LPG	8	3-8	11-16	\$0.4-\$1 per kg
Kerosene	6	3-8	9-14	\$0.2-\$1.2 per litre

* This refers to programmatic costs, excluding recurrent cost.

UNDP estimates

* Costs of digester, stove, cylinder.

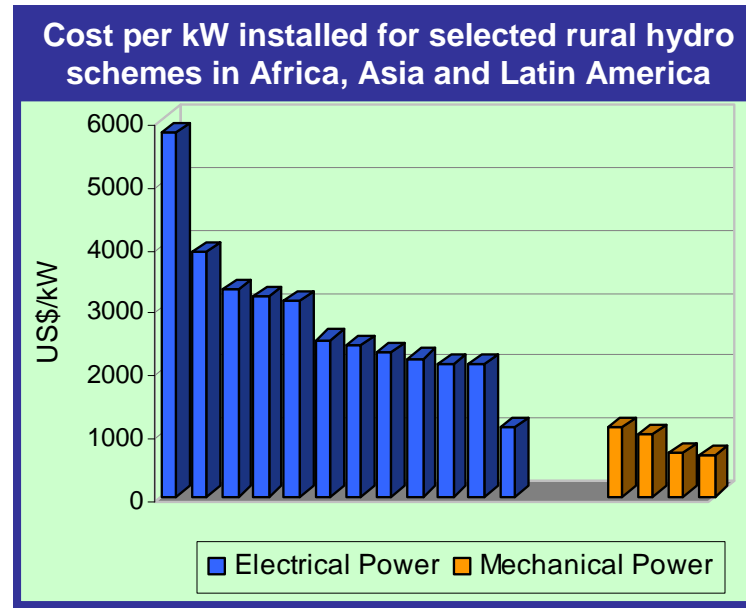
** Capacity development costs for small-scale projects (local level) and large programmes (national level)

Renewable energy technologies in remote/rural areas

Mechanical power for productive end-uses



- Compared to most other RETs, micro-hydro systems have a high power capacity and thus can support multiple end-uses.
- Micro-hydro compares well with fossil fuels such as diesel when it comes to providing decentralized mechanical and electrical power.
- However, water and required head for power generation is not always available.



Source: UNDP and Practical Action, 2009 Expanding Energy Access in Developing Countries – Role of Mechanical Power

Technology	Generating costs (US¢ / kWh)			
	Capital	O&M	Fuel	Global average
Pico / micro hydro (100 kW)	9.5	1.5	0	11
Diesel/Gasoline Generator (100 kW)	1	5	14	20

Source: adapted from ESMAP, 2007. Costs estimated for 2005

Example of suitability of energy technology to meet the basic energy needs in remote/rural areas



Multifunctional Platforms (MFPs)

Bringing energy services to rural communities and creating multiple development benefits

- About 2 million rural people in developing countries have gained access to mechanical power through MFPs.
- In Mali, where the programme is most advanced, about 10% of the rural population is benefiting from MFPs.
- The programme accelerates the achievement of the MDGs and improves human development:
 - Rural women's income increased;
 - Girl-to-boy enrolment ratios in schools goes up;
 - Women visited doctors more often;
 - Local livelihoods and job opportunities improves.

MFPs are built around a simple diesel engine that can power various tools, such as mill, husker, battery charger, pump, carpentry equipment...



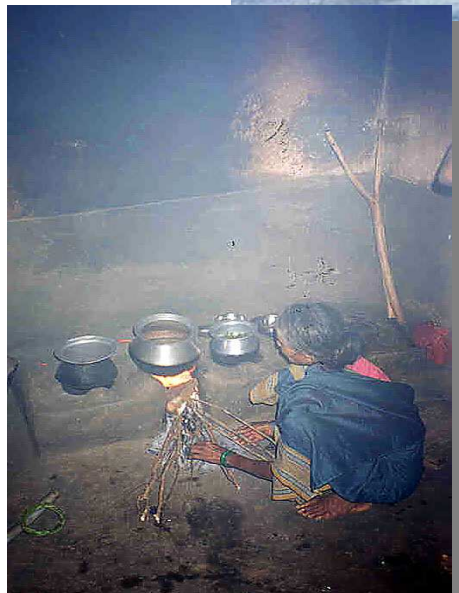
Besides diesel fuel, the engine can also run on biofuels, including plant oil or biodiesel.

Key messages



- Currently **2.5 billion people** do not have **access to modern energy services**. If current trend continues, this number will increase to **2.7 billion by 2030**.
- Renewable energy is not a panacea to tackle the needs of the energy poor. Various energy technological options (**renewable, clean and conventional**) needs to be considered as a part of the solution.
- Energy technologies should be deployed based upon the **services** they provide and the **development outcomes** they support.
- The global community must commit itself to **end energy poverty by 2030**.









Thank you



The MDGs and access to energy services



● Access to modern energy services is a fundamental prerequisite for achieving the MDGs and reducing poverty.

MDG	Energy linkages
1. Eradicate extreme poverty and hunger	 <p>Energy inputs such as electricity and fuels are essential to generate jobs, industrial activities, transportation, commerce, micro-enterprises, and agriculture outputs. Most staple foods must be processed, conserved, and cooked, requiring energy from various fuels.</p>
2. Achieve universal primary education	 <p>To attract teachers to rural areas, electricity is needed for homes and schools. After dusk study requires illumination. Many children, especially girls, do not attend primary schools because they have to carry wood and water to meet family subsistence needs.</p>
3. Promote gender equality and empower women	 <p>Lack of access to modern fuels and electricity contributes to gender inequality. Women are responsible for most household cooking and water boiling activities. This takes time away from other productive activities, as well as from educational and social participation. Access to modern fuels eases women's domestic burdens and allows them to pursue educational, economic, and other opportunities.</p>
4. Reduce child mortality	 <p>Diseases caused by un-boiled water, and respiratory illnesses caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child diseases and mortality.</p>
5. Improve maternal health	 <p>Women are disproportionately affected by indoor air pollution, and water or food-borne illnesses. Lack of electricity in health clinics, lack of illumination for nighttime childbirth, and the daily drudgery and physical burden of fuel and water collection and transport, all contribute to poor maternal health conditions, especially in rural areas.</p>
6. Combat HIV/AIDS, malaria, and other diseases	 <p>Electricity for communication equipment, such as radios and televisions, can spread important public health information to combat deadly diseases. Health care facilities, doctors, and nurses, all require electricity (for illumination, refrigeration, sterilization, etc.) to deliver effective health services.</p>
7. Ensure environmental sustainability	 <p>Energy production, distribution, and consumption have many adverse effects on the local, regional, and global environment. These effects include: indoor, local, and regional air pollution; local air-borne particulates; land degradation; acidification of land and water; and climate change. Cleaner energy systems are needed to address all of these effects and to contribute to environmental sustainability.</p>
8. Develop a global partnership for development	 <p>The World Summit for Sustainable Development (WSSD) called for partnerships between public entities, development agencies, civil society, and the private sector to support sustainable development, including the delivery of affordable, reliable, and environmentally sustainable energy services.</p>