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Widening Energy Access and Enhancing Energy Security to Achieve the Millennium Development Goals in Asia and the Pacific

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AGECC	Advisory Group on Energy and Climate Change
BEE	Bureau of Energy Efficiency, India
BSP	Biogas Support Programme, Nepal
CBO	Community-based organization
CDM	Clean development mechanism
DPBURC	Promotion of Biogas Utilization in Rural China Project
EAP	East Asia and Pacific
EDI	Energy Development Index
EGM	expert group meeting
ESMAP	Energy Sector management Assistance Programme, World bank
EVN	Viet Nam Electricity (utility)
GACC	Global Alliance on Clean Cookstoves
	GDP gross domestic product
GERES	Groupe Energies Renouvelables, Environnement et Solidarités
GVEP	Global Village Energy Partnership
	IDCOL Infrastructure Development Company Limited
IEA	International Energy Agency
LABL	Lighting a Billion Lights programme
LED	light emitting diode
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MEPI	Multidimensional Energy Poverty Index
MFI	Microfinance Institution
NGO	non- governmental organization
	OECD Organization for European Economic Co-operation
PIC	Pacific island countries
PPP	public private partnership
	PV photovoltaic
RERED	Renewable Energy for Rural Economic Development, Sri Lanka
REREDP	Rural Electrification and Renewable Energy Development Project, Bangladesh
RET	Renewable Energy Technology
SEEDS	Sarvodaya Economic Enterprise Development Services, Sri Lanka
SELCO	Solar Electric Light Company
	SHS – Solar Home Systems
	SNV – Netherlands Development Organisation
TERI	The Energy and Resources Institute
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund

UNIDO	United Nations Industrial Development Organization
VBARD	Viet Nam Bank of Agriculture and Rural Development
VWU	Viet Nam Women Union
	WEO World Energy Outlook
WHO	World Health Organization

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EXECUTIVE SUMMARY

In 2013, ESCAP will convene the Asian and Pacific Energy Forum a ministerial- level event to facilitate dialogue among member States towards promoting energy security and sustainable development. This assessment report presents an overview of the energy access situation in the Asia-Pacific region, including prevalent policies and programmes to address them, with the view to identify common challenges that could be addressed through regional cooperation, and a plan of action towards the Forum.

Key trends and developments in expanding energy access for the poor in Asia and the Pacific

- In the Asia-Pacific region, almost two billion people are dependent on the traditional use of biomass and almost 700 million have no access to electricity. In South Asia as a whole, some 50 per cent of the rural population, or over 300 million people, have no access to electricity.
- Electrification, especially grid-based electrification, continues to be the backbone of energy access efforts in Asia and the Pacific, both in terms of investment and the number of people reached. Thus far, the results of large-scale electrification programmes have been mixed so far.
- Biomass accounts for more than 30 per cent of total energy consumption in many developing countries, and in some Asia-Pacific countries its share stands as high as 95 per cent. Traditional use of biomass for cooking and heating has serious impacts on health and well-being of people, especially of women and children. However, despite its relevance, cooking energy has attracted relatively less attention from policymakers. In 2009, a majority of countries had set ambitious targets for supplying electricity to its people, but few had set targets for improved cooking fuels.
- In financing energy access, funding from government and donors continues to form the core of energy access projects. Equipment subsidies, financed through public finances from governments and development partners remain the primary financing mechanisms for energy projects.
- Carbon finance instruments, such as the clean development mechanism and voluntary carbon markets, have not been very effective in financing energy access projects for the poor and present considerable challenges including high transaction costs and lengthy complex processes.
- Oil has been an important fuel for expanding energy access in the region, and most countries have subsidized the supply of petroleum products for the poor. Countries in the region consume around three times more oil than they produce, and consumption is increasing twice as fast in the region as in the world as a whole.
- With the existing policies, the future scenario is not likely to be very different. In 2030, one billion people globally are still projected to be without electricity. The number of people without access to electricity in developing Asia is likely to decrease by almost 45 per cent, from 675 million people in 2009 to 375 million in 2030. In developing Asia, the number of people without access to clean cooking facilities will decline from 1.9 billion in 2009 to about 1.7 billion in 2030.

Policy and strategic directions to achieve universal energy access goals

The United Nations General Assembly designated 2012 as the "International Year of Sustainable Energy for All". As a result, three goals have been set to be achieved by 2030,

namely ensure universal access to modern energy services, reduce global energy intensity by 40 per cent and increase renewable energy use globally to 30 per cent.

At this juncture, in addition to the need for an increased level of financing, a number of policy imperatives and functional partnerships must be undertaken in order to meet universal energy access. They are as follows:

- National governments must provide an enabling environment for expanding energy access at scale, which includes:
  - Adopting a clear and consistent statement that modern energy access is a political priority; and incorporating explicit energy access commitments into national development strategies in terms of national energy access targets and investments.
  - Creating a supportive investment climate to the private sector to invest in energy access by implementing strong governance and regulatory reforms and setting of standards for energy products and services.
  - Adopting a process of collaborative policymaking process that includes the private sector as well as civil society organizations.
- Multilateral and bilateral institutions need to use their funds to:
  - Leverage greater private sector involvement and encourage the development of replicable business models and energy service delivery models.
  - Support piloting and fine-tuning innovative energy access initiatives that incorporate good practices in energy service delivery and financing mechanisms.
  - Provide additional focus on those difficult areas of access which do not initially offer adequate commercial returns.
  - Mobilize additional investment in universal access of around $34 billion per year, a sum equivalent to around 3 per cent of global energy infrastructure investment over the period.
- Countries and energy access programmes and projects must develop and put in place mechanisms for collection of robust, regular and comprehensive data to quantify the outstanding challenge on energy access and monitor progress towards universal energy access.

Potential role of International cooperation in achieving universal access to modern energy services

- Engage and support national governments to make long-term policy commitments backed by explicit targets and financial allocations for energy access and to develop enabling frameworks in terms of regulations and legislation tariff structures and incentives to support these targets and participation from the private sector and programmatic capabilities.
- Mobilize financing to the tune of an annual capital investment of $35 billion per year.
- Develop capacities to expand energy access at all levels: subnational, national and regional.
- Benchmark and track progress in achieving universal energy access, building a credible database on energy access in the region.

- Assist countries to improve efficiency of operations, especially those of public utilities and incorporate good practices in energy service delivery and financing within access projects and programmes.

Priority areas of action for international cooperation

- Launch an initiative to measure, benchmark and monitor progress on energy access. This would provide the much needed baseline on energy access in various countries, help develop credible "energy access road maps" and structures to reduce dependency on fossil fuel and allow for intertemporal comparisons to track the progress towards universal energy access.
- Create a database on energy services for livelihoods including motive power
- Carry out systematic documentation of innovative processes and practices in energy access and set up an information hub on good practices, action that would be useful in establishing the links between various existing centers, networks and organizations.
- Develop capacity e of national policymakers to help translate the stated political support towards energy access into concrete actions.
- Promote a regional oil strategy, including working towards building up and maintaining oil storage facilities, and coordinate the maintenance of emergency stockpiles among countries in the region.

Working towards the Asian and Pacific Energy Forum

On the issue of energy access, the proposed primary objective of the Asian and Pacific Energy Forum is "to promote greater understanding of the issues surrounding energy access for the poor; to work towards a renewed focus on energy access as a key outcome of the Forum and to promote inclusion of energy access initiatives in national plans for achieving the Millennium Development Goals". Most importantly, the run-up to the Forum must be focused on building a consensus on the importance of the issue of energy access for the poor.

- Develop a policy agenda and action note on energy access, which can be used as a tool for advocacy at the Forum and afterwards at national and subnational levels.
- Conduct a preparatory meeting for the Forum with participation from senior government officials and others who can influence national policies. This meeting can share concrete evidence from developing countries to demonstrate successful energy access strategies and their contribution to poverty reduction, and inform policymakers about ways to develop such strategies, policies and programmes in a more systematic, cost-effective and culturally harmonious manner.
- Based on the outcomes of the preparatory meetings, production of "priorities for action" can be presented for deliberations at the Forum in 2013.

INTRODUCTION

Background

Recent international developments have seen a growing momentum to accelerate energy access efforts in developing countries. In 2010, the United Nations Secretary-General's Advisory Group on Energy and Climate Change (AGECC) called for universal access to modern energy services by 2030[1]. Subsequently, in September 2010, at the Millennium Development Goals (MDGs) review meeting, the International Energy Agency (IEA), in collaboration with United Nations Development Programme (UNDP) and United Nations Industrial Development Organization (UNIDO), released a special section on 'Energy poverty: How to make modern energy access universal?', as an special early excerpt of the 2010 World Energy Outlook. Most significantly, 2012 has been declared as the "International Year for Sustainable Energy for All" by the United Nations General Assembly. In his keynote address to the World Future Energy Summit in January 2012, which acted as the global launch of the International Year of Sustainable Energy for All, the United Nations Secretary-General called on governments, business and the civil sector to support his "Sustainable Energy For All" initiative, which includes three interlinked objectives to be achieved by 2030: to ensure universal access to modern energy services;[2] to double the global rate of improvement in energy efficiency; and to double the share of renewable energy in the global energy mix.[3]

In 2013, ESCAP will convene the Asian and Pacific Energy Forum a ministerial level event to discuss the progress made in the region in addressing the energy security challenges at the regional, national and household levels and to facilitate dialogue among member States with a view to enhancing energy security and working towards sustainable development.[4] In working towards this, an expert group meeting (EGM) was held in Bangkok in September 2011. With the central objective to define the scope of and develop a strategy towards the organization of the Forum, the discussions at the EGM were centred on broad areas of issues in the context of energy security and sustainable development by assessing the status, challenges, and scope for regional cooperation in enhancing energy security.

Purpose and objectives of the assessment report

This assessment report presents an overview of the energy access situation in the Asia-Pacific region, including prevalent policies and programmes to address them, with the view to identify common challenges that could be addressed through regional cooperation. It presents a summary of recent literature on energy access issues in terms of how notions of energy access/energy poverty are being defined, what have been the key achievements in expanding energy access in Asia and the Pacific, what challenges need to be overcome and the

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[1] The high-level Advisory Group on Energy and Climate Change (AGECC), comprising representatives from business, the United Nations system and research institutions, was set up in 2009 by the Secretary General of the United Nations to provide recommendations on energy issues in the context of climate change and sustainable development.

2 Modern energy services are defined to include (a) electricity; (b) modern fuels (electricity, liquid fuels including LPG, natural gas, kerosene, ethanol and biofuels, but excluding traditional biomass such as firewood, charcoal, dung, crop residues and coal) to meet cooking needs and (c) mechanical power for productive, non-industrial applications such as water pumping, and small scale agro processing (UNDP 2009).

[3] http://www.energymatters.com.au/index.php?main_page=news_article&article_id=2990

[4] In May 2011, at its 67th session of the Social and Economic Commission for Asia and the Pacific, ESCAP adopted the Resolution 67/2 on *Promoting regional cooperation for enhanced energy security and the sustainable use of energy in Asia and the Pacific.*

opportunities ahead. It analyses existing energy technologies, policies, as well as good practices and lessons learned towards enhancing access to energy. Focusing on energy access issues for the poor, this report is based on a review of available literature on energy access, and discussions with some policymakers and practitioners.

This report is developed for national governments, experts from national, international and regional organizations, practitioners working on issues surrounding energy access, development planners, women's groups, non-governmental organizations (NGOs), plus the wider audience reviewing national and regional publications on energy access.

Structure of the report

This document is structured in three sections and eight chapters. After the Introduction, Section I focuses on **"Energy Access: Existing and persistent challenges in enhancing Energy Access in Asia and the Pacific"**. It starts with defining energy access in chapter 1, which also presents an overview of linkages between energy access and poverty, followed by a discussion on the prevalent notions of energy access and energy poverty, including various indicators to capture energy access. This chapter also introduces the notion of the Multi-Dimensional Energy Poverty Index, the MEPI, which has been used in this report for mapping energy access for the Asia- Pacific countries. Chapter 2 contains an outline of the existing policies and practices in the area of energy access, starting with mapping the energy services being used by the poor. Chapter 3 provides a description of the ongoing efforts on expanding energy access in terms of national policies on electrification and on clean cooking, and prevalent implementation and financing models. It also documents the achievements made by energy access initiatives. Using the indicators identified, it maps the current situation in Asia and the Pacific in terms of the numbers of people affected by energy poverty. It also highlights the present gaps in energy access efforts, including the projected future trends in the region. Chapter 4 presents selected cases of energy access programmes in Asia- Pacific, covering various technologies, end-uses and countries, that demonstrate promising approaches, in areas of government policy, product, delivery approaches, financing and private-public partnerships, and a synthesis of good practices and lessons learned.

Section II focuses on **Present Opportunities in expanding energy access**, notably the Universal Access to Energy by 2030. Chapter 5 presents an overview of existing opportunities at the international level for expanding energy access for the poor. Chapter 6 identifies the policy imperatives for achieving universal energy access in the region, in terms of policy directions as well as the financing requirements. It also makes suggestion for the role of International Cooperation in achieving these targets.

Section III presents a Way Forward to the Asia-Pacific-Energy-Forum including an agenda for action for international cooperation and a work plan for ESCAP in preparation for the Forum.

SECTION I
ENERGY ACCESS: EXISTING AND PERSISTENT CHALLENGES IN ENHANCING ENERGY ACCESS IN ASIA AND THE PACIFIC

1. Defining energy access

1.1 Energy services and poverty

For the poor, lack of access to modern energy has wide-ranging ramifications on the way they live. Across most of Asia and the Pacific, energy services for the rural poor means using kerosene or paraffin lamps for illumination, cooking with firewood, waste and animal dung, and using batteries for communication and entertainment. Poor urban households are only marginally better, using low-grade fuels in poorly ventilated shanties and slums, and often with unreliable and dangerous informal hook-ups to a grid. For poor people, not having access to energy services also means not being able to keep shops open in the evenings, the fear of accidents when children read with kerosene wick-lamps, and in majority of cases, ending the day with sundown. In summary, not having affordable and efficient energy services is a barrier to the most basic kind of development.

In other words, energy services make possible basic human needs to be met: cooked food, comfortable living temperatures, lighting, use of appliances, piped water and sewage systems, modern health care, educational and communication aids and swift transportation. Energy is essential for production, income, and employment generation in agriculture, manufacturing, commerce, mining, and service industries. The vast majority (86 per cent) of the world's population living with little or no access to modern energy services are the 2.8 billion rural poor in developing countries (Masud, 2007). Four out of every five people of the 1.6 billion in the world today without access to electricity live in rural areas, mainly in South Asia and Sub-Saharan Africa. The link between energy poverty and income poverty is apparent in that (Masud 2007):

- The poor typically pay more for their daily energy needs in the form of inefficient and potentially harmful fuels, and are therefore less able to accumulate the financial resources to graduate up to efficient fuels or devices that have higher upfront or capital costs. Poor people in developing countries are known to spend up to a third or a quarter of their cash income on meeting their rudimentary daily energy needs.

- Traditional biomass fuels, favored by the poor because of their lower first-use costs, can have deleterious health effects when used indoors for cooking purposes and are time and labour intensive to procure and use. Currently, it is estimated that 2 million lives—mostly women and children—are lost annually, resulting from exposure to indoor biomass cooking smoke (World Bank 2011a).

- Biomass use can lead to unsustainable harvesting practices and environmental consequences, effects that are more immediately felt by the poor besides also driving up their future fuel costs further.

- Women bear the brunt of inefficient energy use, as they are often the main users of fuel for cooking and invariably responsible for its laborious collection. Children, especially girls, deprived of proper care and often co-opted into fuel gathering, are even more susceptible to poor health as well as being unable to have the time and facilities for education, such as proper lighting, thus greatly reducing their future prospects for gainful employment.

Table 1. The energy needs of the poor: A case of India

Market segment	Energy use	Energy supply
Household	Lighting (3-4 hrs/ day) TV, radio, CD/ cassette players (3-4 hrs/ day) Mobile recharge (once a week)	Kerosene lanterns and lamps (2 to 3 liters/month) Diesel based generator sets Rechargeable batteries Mobile recharge (INR 2 to 5 per charge)
Agricultural	Irrigation needs; typically 3 kW, required for about 90 to 100 days a year Harvesting and processing: 3.5 kW to 7 kW, varying seasonally	Irrigation from diesel or electric based pumps Pedal pumps or manual labour based pumps (used by very small land holding farmers, < 0.3 to0.5 acres) Diesel powered processing units
Micro and small enterprises	Machine operation: 2KW to 3.5 kW Lighting: Less than 1 kW	Own diesel engines to run machinery Lighting from diesel generator (small shops)

Source: Bairiganjan, 2010 and Would Resources Institute 2010

1.2 What constitutes energy access

In the last decade or so, there has been considerable discussion on the notions of energy poverty and energy access (Reddy, 2000; Saghir, 2004; Pachauri, S. et al., 2004; Sagar 2005; Buzar, S., 2007; Kanagawa, Makoto; Nakata, Toshihiko, 2008; Bazilian, M. et al., 2010; Pereira, M.G. et al., 2010; IEA 2009a, 10b and 11; Brew-Hammond, 2010; Pachauri, 2011, Nussbaumer et al 2011, Nussbaumer 2012). "Access" (energy access) refers to a household's ability to obtain a modern energy service, should it decide to do so. Access is then a function of availability and affordability, where energy is considered to be *available* if the household is within the economic connection and supply range of the energy network or supplier, and *affordable* when the household is able to pay the up-front connection cost (or first cost) and energy usage costs.

According to Patil 2011 conceptually, having energy access means that modern energy services should be physically accessible and available to the people; should be of acceptable quality, reliability and preference; should be affordable both in terms of capital and operating cost and in the context of income levels; and finally should be adequate in terms of abundance. Thus, lack of energy access could be due to any of the following reasons or a combination thereof:

- Lack of physical access because the villages remain unelectrified, or the house is not connected to the grid in an electrified village or the house is unfit for electricity connection. In the case of cooking energy, lack of access could be due to absence of liquefied petroleum gas (LPG) or public distribution system outlets selling kerosene in the vicinity.

- Lack of physical availability because of non-availability of local energy resources to produce required energy carriers, lack of adequate generation capacity resulting in power blackouts, power cuts, and load shedding, diversion of energy carriers to other

sectors or un-intended end-uses, stock-outs, non-availability of skilled human resources for operation and maintenance and repairs.

- Lack of acceptability due to low quality of electricity supply with frequent interruptions and voltage fluctuations.

- Lack of convenience in use of fuel and inability to perform activities in a desired way, need for changes in conventional cooking habits, technological complexities and extra effort to procure the energy carrier, reluctance due to the influence of behavioral /social/information factors like lack of awareness, indifference, and lack of information; and unwillingness to shift from free to priced energy carriers.

- Lack of affordability due to high initial cost of connectivity and income poverty resulting in inability to pay for the energy carriers and to invest for connectivity.

- Lack of adequacy due to energy resource constraints and inadequate production capacity resulting in energy shortages, financial resource constraints preventing construction of new production facilities, transmission and distribution systems, and transport infrastructure.

Pachauri 2011 additionally highlights the improvements in quality of life that energy access can bring about and hence is an important aspect of access; ensuring adequate energy for a healthy life implies that the types and amounts of energy should meet basic minimum needs without adverse health impacts, in which minimum needs might be defined locally and could include both consumptive and productive end-uses. Adequacy can also be defined in terms of security and quality of supplies, that is, for energy to be available regularly, reliably, and be of standard quality such that supplies are uninterrupted and unadulterated.

While all of these converge around the notions of not *having access to adequate, reliable and efficient energy services,* there are significant differences in these as well. Based on a literature review, this section maps the various definitions, and proposes one which would best represent energy access in the Asia-Pacific region. For the purpose of this discussion, the following can be taken as guiding principles to define what qualifies as "energy access". Energy access then should:

- contribute towards Sustainable Development[5] and the achievement of the MDGs,

- not have significant negative environmental or social impacts,

- directly contribute towards all dimensions of human development.

1.3 Defining energy poverty

The various approaches to define energy poverty/ energy access can be classified as follows:[6]

- Physical availability of an energy carrier;

[5] A term coined by the Brundtland Commission, Sustainable development is defined as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development (the Brundtland Commission), Our Common Future, Oxford University Press, 1987). Sustainable development can be broken into three constituent parts: environmental sustainability, economic sustainability and socio-political sustainability.

[6] http://www.energyfordevelopment.com/2010/06/energy-poverty.html

- Minimum amount of physical energy necessary for basic needs such as cooking and lighting
- Type and amount of energy that is used for those at the poverty line
- Households that spend more than a certain percent of their expenditure on energy
- The income point below which energy use and or expenditures remains the same, implying this is the bare minimum energy needs.

Physical availability of carriers: Energy access, at an international level, is most often defined in terms of the physical availability of modern energy carriers, including electricity and modern fuels for meeting basic household needs. While physical availability provides a simple metric for capturing one dimension of access, it ignores several other dimensions or attributes associated with access and can leave room for ambiguity as regards the spatial scale at which access is defined, such as at a community level or household level. Physical availability includes a geographical dimension: it deems that supplies should be available in proximity to where a household is located or within a certain community. However, beyond a coverage and supply element, it does not provide any guidelines regarding other specific dimensions such as accessibility, adequacy, affordability acceptability and reliability or indeed even how sustainable the supply may be (Pachauri, 2011).

Minimum amount of physical energy necessary for basic needs: This definition assumes that energy poverty is the point at which people use the bare minimum energy (derived from all sources) needed to sustain life. Above this point, energy contributes to greater welfare and increasingly higher levels of economic well-being (as electricity and other modern energy sources become more available). Below this point people are not using enough energy to sustain normal lives (Barnes et al. 2010). An example of this measure is the government of India's Rural Electrification Policy 2006, which aims at provision of electricity access to all households by 2009 and a minimum lifeline consumption of one unit per household/day as a merit good by the year 2012 (or 365 kWh/ year for each household). Measures based on minimum level need the calculation to rest on a number of assumptions regarding the type of energy consuming equipment, such as stoves and light bulbs, their sizes, efficiencies and intensity of use. In addition, the approach requires, as a first normative step, defining a set of basic needs. This in itself can be contentious since basic needs vary with climate, region, period in time, age and sex (Pachauri, 2011).

There have also been some attempts at defining access in terms of providing minimum thresholds not in energy terms but in terms of actual service levels. In the *Poor People's Energy Outlook Report 2010*, Practical Action suggested using a multidimensional and multi-tier framework for defining energy access, which includes household electricity, cooking/heating applications and mechanical power as the three dimensions. Practical Action defines three principal aspects of energy access – household fuels, electricity and mechanical power. Each aspect is further measured on a five point scale ranging from the lowest level of access to the highest, as shown below (Practical Action, 2010).

Table 2. Practical Action's Energy Access Index

Energy Supply	Level	Quality of Supply
Household Fuels	1	Collecting wood or dung and using a three-stone fire
	2	Collecting wood or dung and using an improved stove
	3	Buying wood and using an improved stove
	4	Buying charcoal and using an improved stove
	5	Using a modern, clean-burning fuel and stove combination
Electricity	1	No access to electricity at all
	2	Access to third party battery charging only
	3	Own low-voltage DC access for home applications
	4	240 V AC connection but poor quality and intermittent supply
	5	Reliable 240 V AC connection available for all uses
Mechanical Power	1	No access to mechanical power. Hand power only with basic tools
	2	Mechanical advantage devices available to magnify human/animal effort
	3	
	4	Powered (renewable or fossil) mechanical devices available for some tasks
	5	Powered (renewable or fossil) mechanical devices available for most tasks
		Mainly purchasing mechanically processed services

The WEO 2011 assumes the initial threshold level of electricity consumption for rural households to be 250 kilowatt-hours (kWh) per year and for urban households it is 500 kWh per year. This definition of energy access also includes provision of cooking facilities which can be used without harm to the health of those in the household and which are more environmentally sustainable and energy efficient than the average biomass cookstove currently used in developing countries. This definition refers primarily to biogas systems, LPG stoves and advanced biomass cookstoves that have considerably lower emissions and higher efficiencies than traditional three-stone fires for cooking.

Expenditure based indicators: The rationale of using such an indicator is that when this ratio falls below a certain threshold, it signifies that energy is affordable and people are not spending excessive amounts on energy or having to reduce their expenditures on other essential commodities. When it exceeds an established threshold, it implies that energy is not affordable and people are having difficulty obtaining enough to meet their needs. While an energy budget share based definition can be useful in the case of some countries where most energy transactions take place in formal markets, in the case of many developing countries, this is not the case. In particular, in the rural areas of many developing countries, households collect fuel wood and biomass wastes themselves rather than purchasing these on the market. The noncommercial nature of most of the energy they consume makes using monetary indicators of the kind described above, less useful in such a context.

1.4 Multifaceted nature of energy access: Composite indicators

Potential candidate indicators to measure the level of energy access in any country can be the following:

- Per-capita commercial energy consumption, which serves as an indicator of the overall economic development of a country
- Per-capita electricity consumption in the household sector, which serves as an indicator of the reliability of, and consumer's ability to pay for, electricity services
- Share of population with access to electricity
- Share of modern fuels in total residential sector energy use, which serves as an indicator of the level of access to clean cooking facilities (LPG/ electricity)
- Share of population using LPG/electricity/improved cookstoves/ biogas plants
- Access to thermal energy and mechanical power for productive uses

As against energy access, **energy poverty**, which is a measure of deprivation, can be measured through the following:

- Clean Cooking: The implications of the use of traditional biomass in open fires or charcoal are well covered in literature. As a proxy for lack of clean cooking, the use of solid fuels such as traditional biomass and coal measure deprivation of cleaner cooking services provided by more modern fuels.
- Lighting: Kerosene-based lighting is frequently the primary source of lighting for the poor. In such circumstances households' expenditures for kerosene does not provide the quality and intensity of light that an equivalent expenditure on electricity could if one had access to electricity at prices that those who do have access pay. The use of kerosene for lighting therefore represents an energy access deprivation. Hence, a proxy for the lack of access to modern energy for lighting could be households reporting kerosene as the primary source of lighting.
- Mechanical power: Commercial energy consumed in rural agriculture has been suggested as a proxy for mechanical power.

For most countries, statistical data on access to electricity and modern fuels (or conversely reliance on solid fuels) are relatively available and accessible, although issues surrounding data consistency (exact definitions/ years of data collection/ methodologies for data collection etc) are common. In particular, data on improved cooking stoves (numbers disseminated, usage and functionality) is conspicuous by its absence. Another area for which data are lacking is on the use of mechanical power. Data on these aspects for selected countries in the Asia-Pacific region are presented in annex 1 to this report.

There is growing consensus that energy poverty needs to be viewed as a diverse set of symptoms rather than a singularly defined issue. Numbers on access to electricity, for example, do not reveal the quality of supplies which is often poor, especially in rural areas, and issues such as connection times, supply disruptions, outages, the value of lost output, voltage quality, frequency stability, and the need for on-site generation that influence the use of electricity, are typically missing from the energy access data (Barnes et al 2010). This is

probably symptomatic of the emphasis they receive in programme planning and implementation.

Given the multifaceted nature of the concept of access, certain fundamental questions need to be answered for reaching a common understanding on access, access for what purposes (whether to improve welfare or to enhance incomes which will determine what is included in the minimum needs basket and whether and which consumptive and/or productive needs should be included), access to what (whether carriers only or end-use devices as well, what types of carriers and devices should be classified as modern) (Pachauri, 2011). Given the heterogeneity in circumstances and priorities of different nations, the mix of energy carriers and technologies used to satisfy basic needs are probably best decided locally.

A number of composite indicators that deal with a mix of energy carriers and technologies have been developed. Significant and recent among these are the ones proposed in 2010 (IEA, UNDP and UNIDO 2010a; Bazilian et al 2010). The report of the AGECC has taken a staggered approach to defining levels of energy access and breaks down energy access into incremental levels of basic human needs; productive uses and modern society needs.

- "Basic human needs" is the level that is used for forecasts of costs for universal energy access. This includes "electricity for lighting, health, education, communication and community services (50-100 kilowatt hours per person per year)" and "modern fuels and technologies for cooking and heating (50-100 kilograms of oil equivalent of modern fuel or improved biomass cook stove)".

- "Productive uses includes "electricity, modern fuels and other energy services to improve productivity," "agriculture: water pumping for irrigation, fertilizer, mechanized tilling," "commercial: agricultural processing, cottage industry," and "transport: fuel".

- "Modern society needs", includes "modern energy services for many more domestic appliances, increased requirements for cooling and heating (space and water), and private transportation, with an electricity usage of around 2000 kilowatt hours per person per year".

IEA has developed the Energy Development Index (EDI), which is derived from four indicators – per capita commercial energy consumption, per capita electricity consumption, share of modern fuels in residential energy use and share of population with access to electricity, and more recently a composite index, the Multidimensional Energy Poverty Index (MEPI) has been proposed (Nussbaumer et al 2011, Nussbaumer 2012).

1.5 The Multidimensional Energy Poverty Index: A multidimensional mapping of energy poverty in Asia and the Pacific

For mapping energy poverty in the Asia-Pacific region, this report applies the concept of MEPI. As mentioned earlier, MEPI is a metric to measure and report on energy poverty, which combines supply-side input-oriented data with aspects related to the quality of energy services delivered and/or their reliability, as well as to the notion of affordability (Nussbaumer et al 2011). In suggesting indicators, this metric takes into consideration the limitations on data availability in various countries. In contrast to other tools, it focuses on quantifying energy deprivation, as opposed to energy access. MEPI focuses on household needs exclusively, while acknowledging that other energy needs exist for a society to develop and thrive. Common energy services demanded in households include: cooking; space heating/cooling; lighting, entertainment/education (radio, TV, computer); and services

provided by means of household appliances, telecommunications, and mechanical power. Specifically, MEPI includes the following:

- Cooking: Type of stove used (with or without hood/chimney) as a proxy to capture elements of energy poverty related to cooking by including the type of fuel used, keeping the notion of convenience in mind, indoor pollution from incomplete combustion.

- Electricity access: In addition to electrification (a supply-side parameter), it considers access to services that electricity offers, such as entertainment, education and communication, using proxy indicators related to the ownership of appliances, thereby also bringing in the notion of affordability. Indeed, the access to electricity, or modern fuels, is of limited use if the user has no financial means to pay for the fuel or to invest in the appliance to deliver the desired service. It also includes an indicator for telecommunication, highlighting the role of the use of phones and mobile phones, which require the availability of energy, for socioeconomic development.

Mechanical power, while important, is not included in the analysis because of the lack of reliable data. MEPI, as developed, originally includes the following dimensions, their indicators and the respective weights.

Table 3. Dimensions and respective variables with cut-offs, including relative weights

Dimension	Indicator (weight)	Variable
Cooking	Modern cooking fuel (0.2)	Type of cooking fuel
	Indoor pollution (0.2)	Food cooked on stove or open fire (no hood/ chimney) if using any fuel beside electricity, LPG, natural gas or biogas
Lighting	Electricity access (0.2)	Has access to electricity
Services provided by means of households appliances	Household appliance ownership (0.13)	Has a fridge
Entertainment/ education	Entertainment/ education appliance ownership (0.13)	Has a radio or television
Communication	Telecommunication means (0.13)	Has a phone (landline or mobile phone)

Based on data availability in the Asia-Pacific region, however, MEPI has been modified, and the following indicators are used, which are weighed and the composite MEPI developed.

Table 4. Variables used for assessing energy poverty in Asia and the Pacific

Dimension	Variable	Indicator (weight)
Cooking	Type of cooking fuel	Population without access to modern fuels (0.3)
	Exposure to indoor air pollution	Population relying on solid fuels and not using improved stoves (0.1)
Lighting and electricity based services	Access to electricity	Population without access to electricity (0.4)
	Telecommunication and access to information services	Population without telephone (0.1)

The MEPI methodology provides a number of advantages. Notably, it focuses on the energy services and is based on data related to energy deprivations, as opposed to deriving information indirectly through variables that are presumed to be correlated, such as energy or electricity consumption. Additionally, it captures both the incidence (number of energy poor people) as well as the intensity (how energy poor they are).

2. Energy access for the poor in Asia and the Pacific: Policy and practice

2.1 Mapping the energy services used by the poor

For the poor, energy use patterns can broadly be divided into three major categories, those for basic needs, those for productive use or income generation and those for community services (see table 5) (Kaygusuz, 2011 and 2012). Among others, a recent field study that interviewed rural households in India reported that people want energy supply to not only cater to lighting needs, but also for water for irrigation and specifically for flour mills, tailoring, small drying equipment for agro products, and refrigeration, particularly for dairy communities and fishing communities (Bast, (2011).).

Table 5. Typical end uses by energy source in developing countries

Typical end uses	Income level		
	Low	**Medium**	**High**
Household			
Cooking	Wood, residue, dung	Wood, charcoal, residues, dung	Wood, charcoal, LPG, coal
Lighting	Candles, kerosene	Candles, kerosene	Kerosene, electricity
Space heating	Wood, residue, dung	Wood, residue, dung	Wood, residue, dung, coal
Radio/ TV	None	Grid electricity, batteries	Grid electricity, batteries
Space air conditioning	None	Electricity (fans)	Electricity, kerosene, LPG
Agriculture			
Tilling	Human labour	Draft animals	Animal, gasoline, diesel
Irrigation	Human labour	Draft animals	Diesel, grid electricity
Processing	Human labour	Draft animals	Diesel, grid electricity
Industry			
Milling/ mechanical	Human labour	Human labour, draft animals	Grid electricity, diesel
Process heat	Wood/ residues	Coal, charcoal, wood, residues	Coal, charcoal, wood residue
Cooling/ refrigeration	None	None	Electricity, LPG, kerosene
Services			
Transport	Human labour	Draft animals	Diesel, gasoline
Telephone	None	Batteries	Grid electricity

2.1.1 Energy for basic needs

Cooking

In rural households, energy is needed to meet basic subsistence needs essential for a minimum level of human comfort. These needs consist of cooking, lighting, space-heating, and the operation of basic household appliances and devices. Of these, cooking energy needs constitute about 80 per cent of the household energy needs in rural areas (Kaygusuz, 2011). Rural households use different energy services at the same time. In China, households are seen to use a solar cooker, biogas plant, both coal and residue-burning stoves, all in combination. Even though more than 9 per cent of the Chinese villages and 96 per cent of the rural population are electricity connected, a reliance on biomass for cooking and heating continues. Similarly, in India, while majority of rural households rely predominantly on fuelwood, even those that use LPG and kerosene also use fuelwood extensively (see figures 1 and 2).

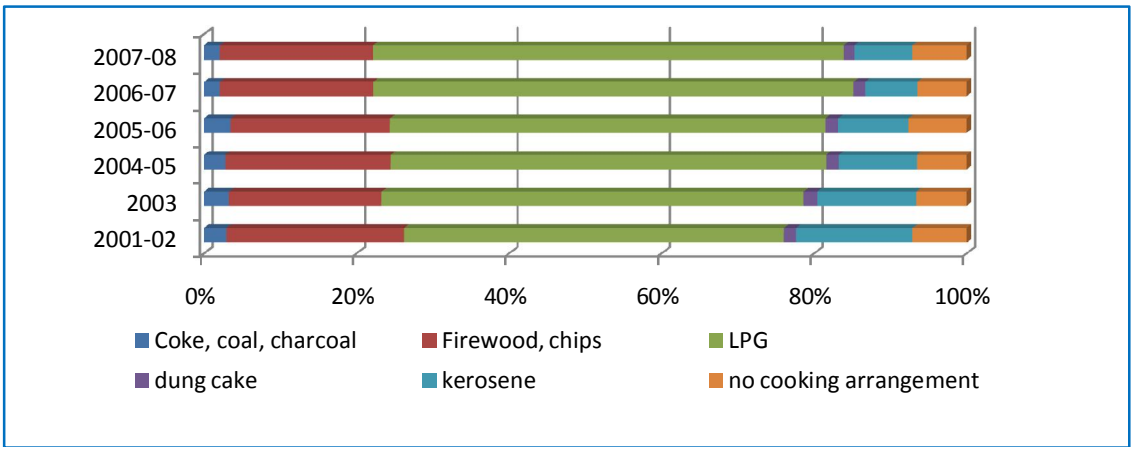


Figure 1. Energy for cooking in India – urban households

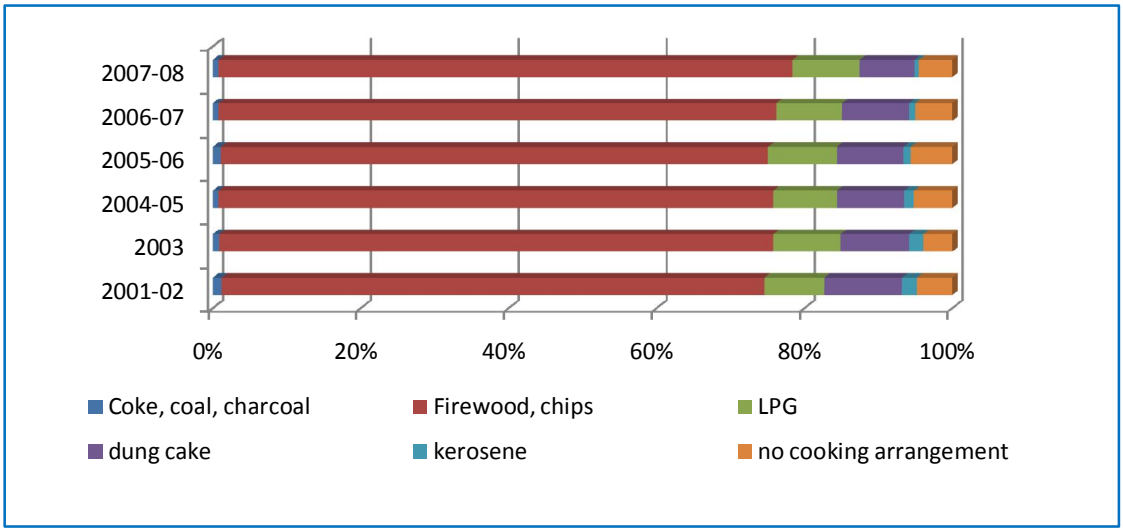


Figure 2. Energy for cooking in India– rural households

Source: Government of India 2010

Biomass, either from crop residues or in the form of locally collected fuelwood, provides a cash-free option to the rural poor, whereas electricity may cost as much as 10 times more than in urban areas. All through developing countries of Asia, a variety of traditional cookstoves fired by fuelwood, agricultural residue, animal dung, and charcoal are used, with fuelwood being the principal source of supply. The efficiency of traditional cookstoves using fuelwood is low, on average only about 10 per cent.

Biomass use affects all facets of life for the poor. An example of such a correlation is shown in the following figure (ADB, 2007). Even though this is not a proof of causality, some relationship does seem evident.

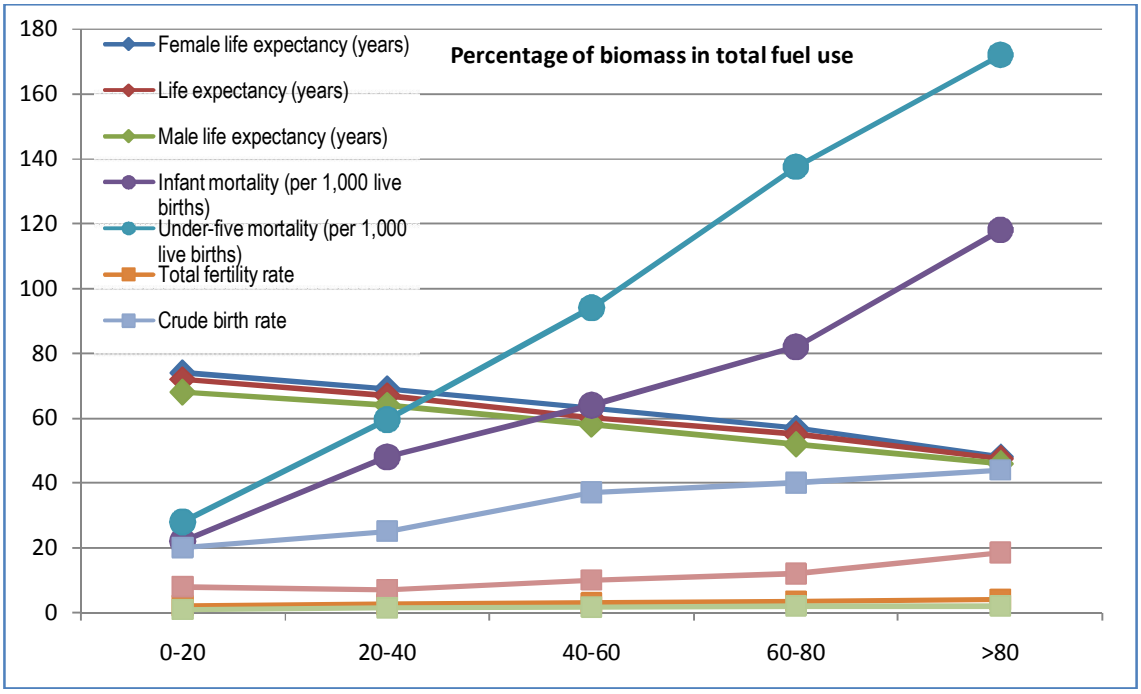


Figure 3. Biomass use and demographic indicators

Fuel and device efficiency considerations play a major role in meeting rural cooking energy needs. These could be promoted by upgrading to more efficient fuels, such as biogas, kerosene, LPG, and electricity; by improving the efficiency of current wood stoves (ranging from artisanal or semi-industrially produced clay and metal wood fuel stoves); and by introducing more efficient appliances (the experience with these options is discussed later in the report). Promotion of biogas digesters and improved cookstoves, with efficiencies of up to three times that of traditional stoves is a common feature in the rural energy programs across Asia. Due to the easy availability of wood fuels, stoves for firewood and charcoal are the most common ones. An industrial production of efficient stoves has just started in the last years, but in many cases, these products are far too expensive for poor people.

Box 1. Improved stoves: Technologies and usage

The development of improved biomass stoves has witnessed several overlapping stages over the last 30 years. In the 1980s, dissemination strategies mainly focused on self- help approaches or distribution of stoves for free, which were not always supportive for the construction of high quality stoves thus evoking a negative image of stoves that break easily. In recent years, commercialization is considered to be a more sustainable approach wherein professional stove producers build and sell stoves according to certain design standards. At the same time, there are programmes that promote inexpensive, locally made improved stoves. Such stoves are very inexpensive at less than $10 each and sometimes even less than $5. These artisan-made stoves provide relatively good performance when new, but the performance degrades quickly with use. The second type of stove involves manufactured parts, which are assembled on site with local materials. These stoves are still inexpensive but are a bit more expensive and more durable than the artisan stoves.

Recently, there has been a surge of "next generation" stoves that are manufactured in factories and workshops. They include, among others, efficient biomass stoves, alcohol stoves and stoves that use pellets. Some of the world's largest companies have become involved in this industry, such as the Shell Foundation, Bosch Siemens, Phillips and British Petroleum and others. There are two interesting examples for wood stoves including the Envirofit stoves and the Stovetec produced by Aprovecho. Other innovations include the Worldstove, First Energy's Oorja Stove, Gaia's Dometic (Gaia project), Bosh-Siemens Protos stove. According the manufacturers numbers, there have been approximately one-half million of these stoves sold to date.

Currently, there are about 828 million people using improved stoves in developing countries out of a total solid fuel population of 3 billion people (which includes coal and charcoal). This would amount to roughly 166 million households using these relatively inexpensive improved stoves with 116 million in China, more than 13 million in the rest of East Asia, 20 million in South Asia, 7 million in Sub-Saharan Africa and more than 8 million in Latin America and the Caribbean (World Bank, 2011a).

Lighting

Lighting energy needs in poor households are met mainly by kerosene and electricity, with kerosene being the commonly used energy source in rural areas. Although electrical lamps are more efficient and offer greater user-convenience compared to kerosene lamps, the choice between the two depends primarily on the extent of saturation achieved in household electricity supply in villages that are connected to the grid. In urban areas, electricity is the predominant and most preferred energy source. In urban India, 90 per cent or more households used electricity for lighting. In rural areas on the other hand, about 60 per cent of households in rural India used electricity for lighting while 39 per cent used kerosene (Government of India, 2010) (see figures 4 and 5). On average, a rural household receives six hours of electricity supply from the grid during the off-peak period (usually afternoon and night). In order to meet this shortfall, a rural household uses at least one kerosene lamp as a backup for at least four to five hours during peak hours of the evening. Only 11 per cent of those using electricity consume over 100 kWh per month.

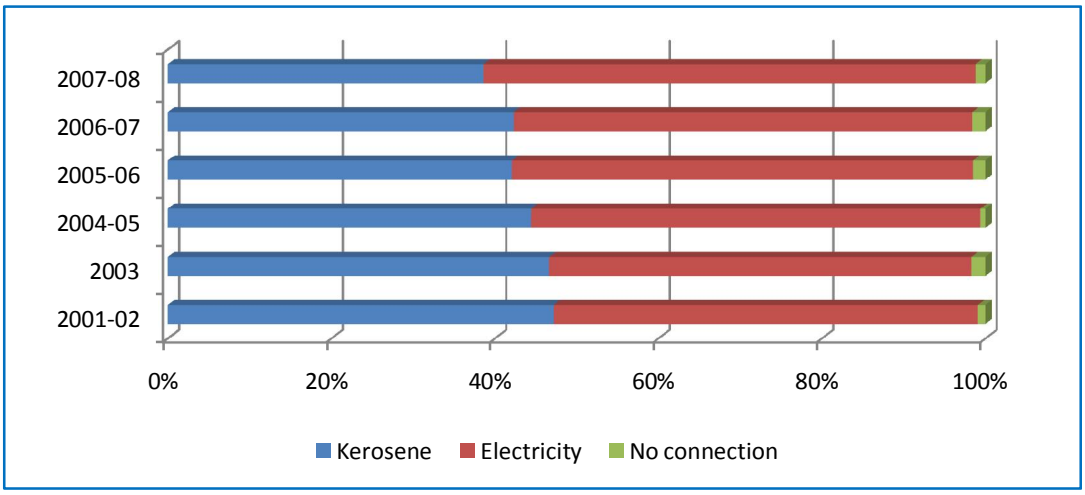


Figure 4. Energy for lighting in India– rural households

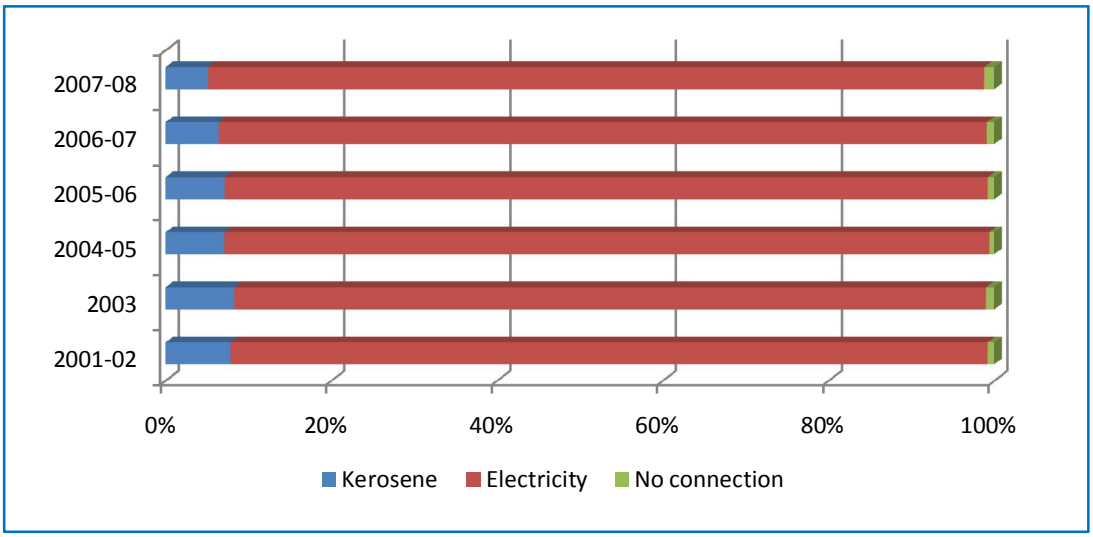


Figure 5. Energy for lighting in India– urban households

Some of the east Asia and Pacific (EAP) countries, Lao People's Democratic Republic and Viet Nam in particular have been remarkably successful in increasing electricity access and in these and in China, the reliance on electricity for lighting is near total. On the other hand, Cambodia, Myanmar and Papua New Guinea are at lower levels of electricity access (World Bank and Ausaid, 2011).

Table 6 Access to electricity in East Asia and the Pacific

Country	Electricity access 2009 (%)	Population without electricity access 2009 (million)
Indonesia	65	81.4
Myanmar	13	43.9
Philippines	84	15.0
China	99	8.0
Cambodia	24	11.4
Papua New Guinea	7	6.3
Viet Nam	96	3.6
Lao People's Democratic Republic	70	1.9
Timor-Leste	22	0.9
Thailand	99	0.7
Mongolia	90	0.3

Other household applications

The use of household appliances, such as rice cookers, fans, radios, and television sets, depends first on the availability of electricity and second on the income levels of the rural population vis-à-vis the costs of acquisition of such appliances. In fact, the poor's lack of purchasing power to own appliances is a major inhibiting factor in rural equity.

Community uses

Community uses for energy include public lighting, water-pumping, lighting, and appliances in health clinics and schools, and the requirements of common facilities for social interaction. Electricity is the most critical source of energy to meet these needs and if it is absent, other forms of energy like kerosene are used.

2.1.2 Energy services for income generation

Agriculture

Rapid agricultural and economic growth has traditionally been the driving force behind the dramatic reduction in poverty in most of Asia. Energy statistics however do not show agricultural activities as major energy consumers in rural areas, mainly because the energy involved in them consists largely of human energy, i.e. human and animal labour, which is not accounted for in national income accounts. Modern energy services essential to increase agricultural productivity and income invariably substitute the labour content of production, a fact that is frequently overlooked in traditional approaches to rural energy analyses.

Rural industries

In general, rural industries can be broadly classified into agro-based and non agro-based industries. The former would consist of such facilities as those for rice-milling, fruit and vegetable processing, tobacco-curing, and a range of skill-based household businesses, whereas the latter would include charcoal and brick manufacturing facilities, potteries, bakeries, black-smithies, woodworks, and village workshops. Shops and establishments that

do not fall under either of these categories form the services sector. The energy needs of rural industries comprise lighting, process heat, and motive power. Lighting requirements are invariably met by electricity in electrified villages and by kerosene in unelectrified villages. The principal supply sources for process heat in facilities, such as blacksmithy, brickmaking, and charcoal manufacture, are fuelwood and biomass. Motive power requirements are met by electricity, where it is available, and by human labour using mechanical equipment, where it is not. In agro-based facilities, such as crop-drying and rice-milling, the use of biomass is widespread.

2.2 A review of policies and practice in expanding energy access

2.2.1 Initiatives in reaching energy services to the poor

Most countries in the Asia-Pacific region have launched a range of large scale initiatives, primarily electricity focused, to enhance energy access. In the past decades an estimated one billion people have been provided with electricity, e.g. Bangladesh, Fiji, India and Philippines, under their programmes for 100 per cent or total electrification within the next decade, and Nepal under its Rural Energy Policy 2006. In Viet Nam, access grew from 3 per cent to 95 per cent in 35 years, and between 1995 and 2008, 3.4 million people were provided with electricity access each year. India, under its RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojana) has committed to reach 17.5 million below-poverty-line households by 2012. National policies that have played a determining role in doing so include electricity access targets at the national, rural and/or urban level; price policies for access (subsidies for electricity access and cooking energy for poor (LPG/ kerosene), public distribution system); and electrification/ rural energy/ energy access funds. As a result of these efforts, a steep fall in the number of people without access to electricity is particularly noticeable in East Asia during the 1980s and 1990s. Presently, China, Thailand, and Viet Nam are close to universal electricity access with more than 95 per cent of households having been electrified. Cambodia, Indonesia, the Pacific island countries (PICs), and the Philippines continue to have large numbers of unelectrified households. Interestingly, the Lao People's Democratic Republic, one of the EAP countries with the lowest gross domestic product (GDP) per capita, has achieved the highest electrification growth rate in the Region in the last decade (World Bank Ausaid, 2011).

2.2.2 Electrification policies

Developing countries, as part of their development agenda, have been expanding electricity services and clean cooking fuels to their populations. Prevalent policies include electricity access targets at the national, rural and/or urban level; targets for access to modern cooking fuels or improved cookstoves or for reducing the share of the population relying on traditional biomass (see table 7); price policies for access (subsidies for electricity access and cooking energy for poor (LPG/ kerosene), public distribution system); and occasionally, existence of electrification/ rural energy/ energy access funds.

Electrification, especially grid-based electrification, continues to be the backbone of energy access efforts, both in terms of investment and in terms of the number of people reached. The choice of a technology for rural electrification depends on issues surrounding customer and load density, relative distance to the national or regional grid, landscape, availability of natural resources, such as wind, sun, water and biomass/forests, economic and financial aspects, and availability and maturity of any chosen technology. Energy technologies used in electrification programmes generally involve national or regional grid extension, diesel generators, LPG, disposable batteries, kerosene lamps, renewable energies (including

photovoltaic systems, wind energy, hydropower, and new wave energy and hydrogen) or hybrid systems. Figure 6, which lays out the relative shares of grid based and off-grid electricity in the East Asian and Pacific (EAP) countries, is an illustration of the emphasis of centralized grid in electrification efforts so far.

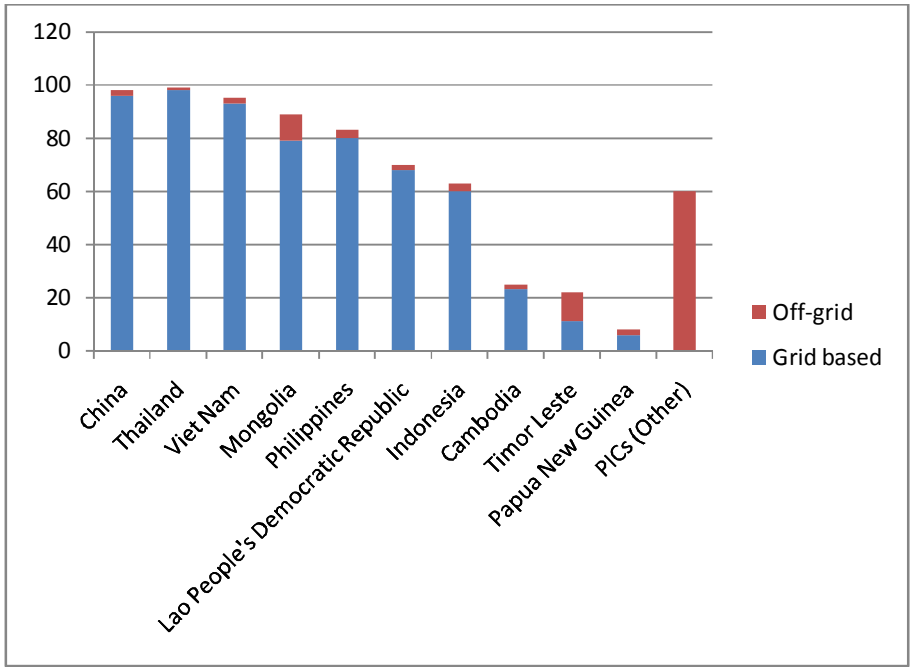


Figure 6. Estimated shares of grid-based and off -grid electricity in East Asian and Pacific countries (population with electricity access, %), 2009

Subsidies (both implicit and explicit) have been a key instrument in keeping energy access affordable to consumers. Subsidies have taken the form of free connections and reduced tariffs for electricity and have been put in place to benefit both household consumers and industrial, commercial and agricultural consumers. Subsidized programmes, however, are known to create a huge drain on financial resources which combined with high transaction costs, transmission and distribution losses has contributed to the poor state of utility operations in a number of countries, such as the extensive use of un-metered water pumps in parts of India. This, in turn, has limited the ability of utilities to maintain their systems and to expand into new areas to meet demand. Unfortunately, subsidized fuels have often been poorly targeted or even diverted from their intended recipients, benefiting those who were never intended as targets of the subsidy programme and, again, creating huge losses without necessarily providing attendant welfare gains.

The results of large scale electrification programmes have been mixed so far (IEA, 2010c; Zerriffi, 2011). With some exceptions, such as the rural electrification efforts of China, the results of largely centralized and heavily subsidized programmes have generally been disappointing. While, because of their very expansion plan, they reach a large number of people, centralized efforts at rural electrification have often created strains on utility budgets, been difficult to manage, and provided power that was irregular and of poor quality while failing to reach their universal service targets. Others have been difficult to scale up, such as many smaller NGO programmes which targeted small geographic regions but could not expand or donor projects that failed to thrive once initial funding was no longer available. Far too many projects have simply failed because they were not financially viable over the long-

term, installed inappropriate technologies and did not implement business models that could account for long-term maintenance and operational problems. In addition, the focus of these programmes (particularly electrification programmes) has often been to provide basic levels of service only to households. This ignores the large, though complicated, role that energy plays directly and indirectly in development processes at a local level when electricity is provided for non-household uses, such as through more efficient agricultural processing or improved health care solutions.

2.2.3 Policies in cooking energy technologies and fuels

Technological options for clean cooking include LPG, biogas and advanced cookstoves. Most national governments have polices to subsidize some or most of these fuels for the poor, however, these have not been very effective and a third of the urban population and the vast majority of the rural poor in Asia continue to use solid fuels to cook their daily meals over open fires or inefficient cookstoves made from clay, metal or bricks. In many countries, the rate of solid fuel usage, especially in rural areas, is 80 per cent to 90 per cent, and the number of people who use these fuels for cooking is expected to rise as population growth outpaces economic development. IEA estimates that by 2030, some 100 million more people will use traditional biomass fuels than do so today (GACC, 2011).

Despite its relevance, cooking energy has attracted relatively less attention from policymakers. National energy policies and poverty reduction strategy papers (PRSP) very often focus only or mainly on electrification and do not reflect adequately the energy–poverty nexus (Kees, 2011). The UNDP-WHO study (UNDP and WHO 2009) revealed that in 2009, while majority of countries had set ambitious targets for reaching electricity to its people, few had set targets for improved cooking fuels. Available data showed that out of all developing countries, while 68 had set targets for electrification in 2009, only 16 have set targets for modern fuels and 11 for improved cookstoves (table 7).

Table 7 National targets for expanding energy access in select Asia-Pacific countries

	Target for electricity access (as a percentage of the population with access	Year	Target for access to modern fuels (as a percentage of the population with access	Year
Afghanistan	35.8	2011	13	2015
Bangladesh	100	2020		
Bhutan	100	2020		
Cambodia	100	2020	48	2015
China	99.7	2015		
Fiji				
India	100	2012		
Iran				
Indonesia	90	2020		
Republic of Korea				
Lao People's Democratic Republic	90	2020		
Malaysia	98.4	2010		
Maldives				
Mongolia	100	2020		
Myanmar				
Nepal	100	2027		
Pakistan				
Papua New Guinea				
Philippines	90	2017		

Source: UNDP 2009.

This emphasis (lack of) is reflected in the number of people with access to modern fuels in developing countries. Data for East Asia and the Pacific show that while electricity access has reached majority of the population (table 8), the same cannot be said for modern cooking fuels.

Table 8. Population without modern cooking fuels, East Asia and Pacific countries

Country	Population without access to modern fuels	
	%	Millions
China	58	768
Indonesia	54	124
Viet Nam	66	57
Myanmar	97	47
Philippines	51	45
Thailand	37	25
Cambodia	93	15
Papua New Guinea	87	6
Lao People's Democratic Republic	97	5
Mongolia	77	2
Timor-Leste	100	1

As Kees points out, there are several reasons for the lack of attention to cooking fuels. First, being a cross-cutting issue is often a disadvantage: in many countries there is no single ministry, such as energy, environment or health) that has the responsibility for setting up a stove programme. Second, the domain of cooking is a very traditional one in many societies. Traditionally programmes have focused almost solely on the technological aspects of stove development, such as achieving efficiency or reducing emissions, with little attention on behavioural change, which is not easy to achieve. Last but not least, cooking energy has traditionally not been considered a very attractive topic among many politicians in developing countries nor in donor organizations. This is changing, with large global cookstoves initiatives being launched. This leads to a paradox in the biomass sector - while biomass is used widely as a source of energy and is of high economic importance in many national economies, political frameworks all too often do not reflect these factors sufficiently. Given the fact that biomass is and will remain the most important fuel for almost one third of the world's population and considering its negative impacts on people and environment, the challenge is how to make its use sustainable and non-polluting.

2.2.4 Renewable energy and its contribution to expanding energy access

The Bloomberg New Energy Finance report 2011 (UNEP and Bloomberg New Energy Finance, 2011) reports that the number of countries with some type of renewable energy policy target and/or support policy more than doubled from an estimated 55 in early 2005 to 119 by early 2011 (REN 21, 2011). A report in mid-2011 by the Intergovernmental Panel on Climate Change (IPCC) also confirmed the role governments play in accelerating the growth of renewable energy deployment (IPCC 2011). REN21, 2011 reported that at least 95 countries now have some type of policy to support renewable power generation, with feed-in tariffs being the most common. More than half of those countries are developing or emerging economies. Targets now exist in at least 98 countries, of which over half of them were set in developing countries.

As a result of these trends, the global investment in renewable power has been surging. For example, in 2010, investment in this area reached $211 billion, of which 48.9 billion of it was invested by China alone), up 32 per cent from $160 billion in 2009, and nearly five and a half times the investment figure for 2004. Renewable energy, excluding large hydro, made up 8 per cent of world's total electricity generation capacity and 5 per cent of actual generation in 2010 (see figure 7).

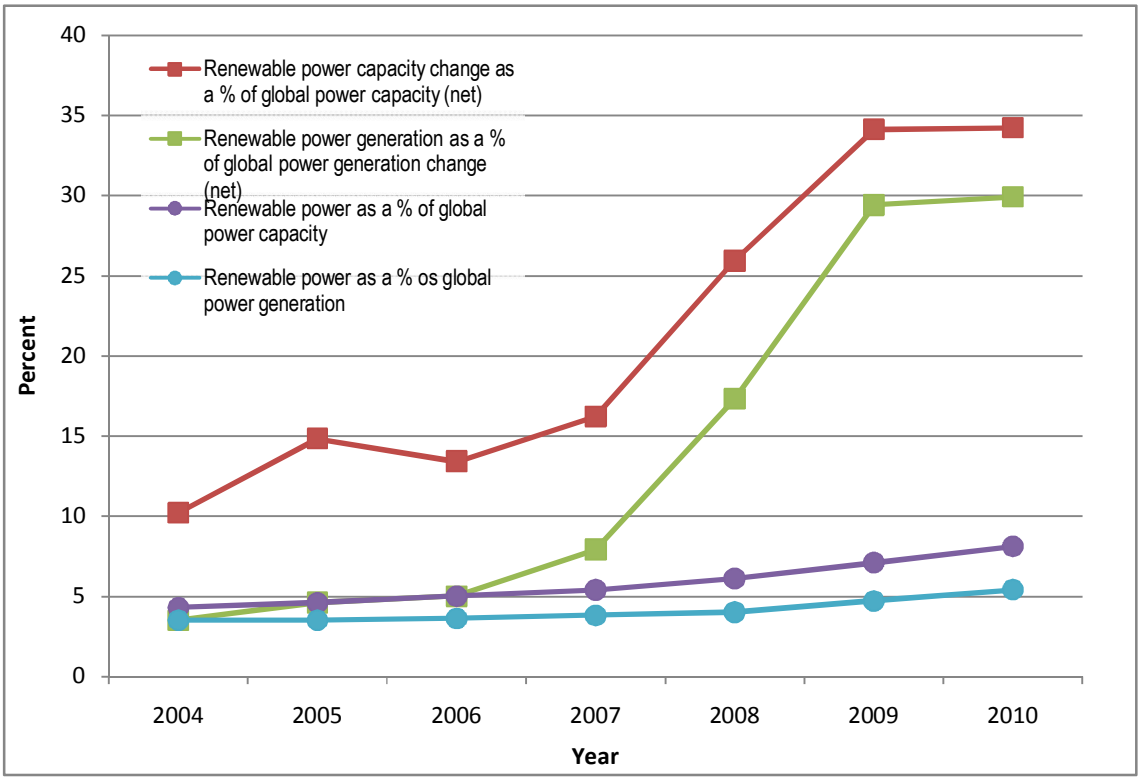


Figure 7 Renewable power generation and capacity as a proportion of global power, 2004-2010

While no data are available on how much of this has increased investment has contributed towards expanding energy access for the poor, some points are illustrative of the fact that the bulk of this investment is directed towards large industry. As of now, the highest growth and investment has been witnessed in wind energy sector, mainly for industrial purposes and with no direct bearing on energy access (except for the fact that it increases the total energy supply in the country). Even though there is a recognition that renewable energy, in many instances, is the most cost-competitive choice and in some, the only choice to reach power to locations that are off the grid map, the financing for biomass and waste-to-energy, biofuels, and small-hydro, typically closer to reaching the poor, have actually declined.

Some of the more successful renewables-based initiatives in the region include the Chinese Promotion of Biogas Utilization in Rural China (DPBURC) Project that entailed the construction of 30 million biogas systems between 2001 and 2010; the DGIS[7]/ SNV supported biogas programmes (by 2010, 360,000 households and 2.1 million people had been equipped with biogas plants in various Asian countries); the World Bank supported

[7] Netherlands Ministry of Foreign Affairs Directorate General for International Cooperation

Renewable Energy for Rural Economic Development Project (REREDP) in Sri Lanka (reaching more 110,000 population trough solar home systems, mini hydro, and village hydro),[8] Infrastructure Development Company Limited (IDCOL) led dissemination of solar home systems (SHS) in Bangladesh (as of August 2010, a total of 645,033 SHSs were installed); and the Indian Lighting a Billion Lights programme[9]. In spite of these programmes, rural electrification in the form of centralized grid expansion continues to form the core of rural energy service delivery in terms of investment as well as the number of people reached. In general, these have been difficult/slow to scale up such as the instances involving many smaller NGO programmes which targeted small geographic regions but could not expand or donor projects that failed to thrive once initial funding was no longer available.

2.2.5 Prevalent energy service delivery models in Asia and the Pacific

The significant effort to improve access to both electricity and cleaner cooking fuels in the last few decades has largely been funded, coordinated and implemented by a combination of international donors, central and subnational governments and NGOs. A number of delivery mechanisms, or combinations thereof, are being applied in the Asia-Pacific region (adapted from UNDP 2008a and 2008b). Some of these are presented as case studies in chapter 5.

Government-led energy programmes. In this model, national governments, as part of their mandate to provide basic services to all citizens, provide subsidized energy services to the poor. A majority of the government-led rural electrification programmes fall in this category.

Commercialization via subsidy support. This model typically involves a public-private-civil society partnership, and has been applied for a range of technologies, including improved cookstoves, biogas plants and solar home systems. The model includes these features:

- A combination of government and donor funds are used to provide subsidies to meet upfront product costs. Subsidies are routed through technology suppliers, who are pre-qualified to participate in the programme and follow quality-standard guidelines;
- The private sector sells and services energy products under quality guidelines As long as a company profits, market expansion continue;
- In some cases, the programme provides consumer financing for the purchase of systems through microfinance institutions (MFIs) or technology suppliers; and
- The programme undertakes campaigns to raise consumer awareness, supports market development and provides capacity development support to stakeholders.

Commercialization models. In this model, the private sector markets the product in a competitive market environment. The commercial model is challenged by the fact that often only a limited number of people can afford the systems at full cost. Hence, the model may not result in programmes or enterprises that reach the people most in need of energy services.

[8] By 2011, 91 per cent of the population had access to electricity.

[9] Promoted by TERI, in this model, a Centralized Solar Lantern Charging Station is set up in villages for charging the lanterns, which provides lanterns daily on rent to households and enterprises. Under this initiative, 640 villages spread across 16 states with 50 lanterns each, reaching a total population of 175,000 have so far been covered.

Commercialization supported by civil society. In some cases, while the private sector performs the core functions of producing and selling energy products and services, NGOs and community based organizations (CBOs) may be engaged simultaneously in specific functions, such as increasing awareness, providing control quality and, perhaps, channeling subsidies/loans/micro-credit/customizing products to reduce costs (smaller capacities) for the poor.

Public-private partnership in community-based systems. Like rural-based enterprises, this model meets operations and maintenance costs by collecting monthly tariffs on generated energy, and entrusts management of the technology to community representatives. These include small hydro-power, special purpose vehicles wind or hybrid power systems or diesel generators.

2.2.6 Financing of energy access for the poor

The significant effort that has been made over the last few decades to improve access to both electricity and cleaner cooking fuels has largely been funded, coordinated and implemented by a combination of international donors, central and subnational governments and NGOs.

/Government and donor continue to be the main sources for financing energy access projects (UNDP, 2011). Equipment subsidies, financed through public finances from governments and development partners remain the primary financing mechanisms for energy projects. Understandably, reliance on subsidies is highest in government-led programmes. Unfortunately, as discussed before, many government subsidies in the energy sector are not well targeted (see figure 8). A typical example is the provision of consumption subsidies, including "lifeline" tariffs that provide the first 20 to 50 kWh of electricity at below cost to all customers regardless of income. Not only does this waste scarce funds that could be targeted at poor people, but it misses opportunity to collect cross subsidies from those customers who could afford to pay more (IEA, 2011).

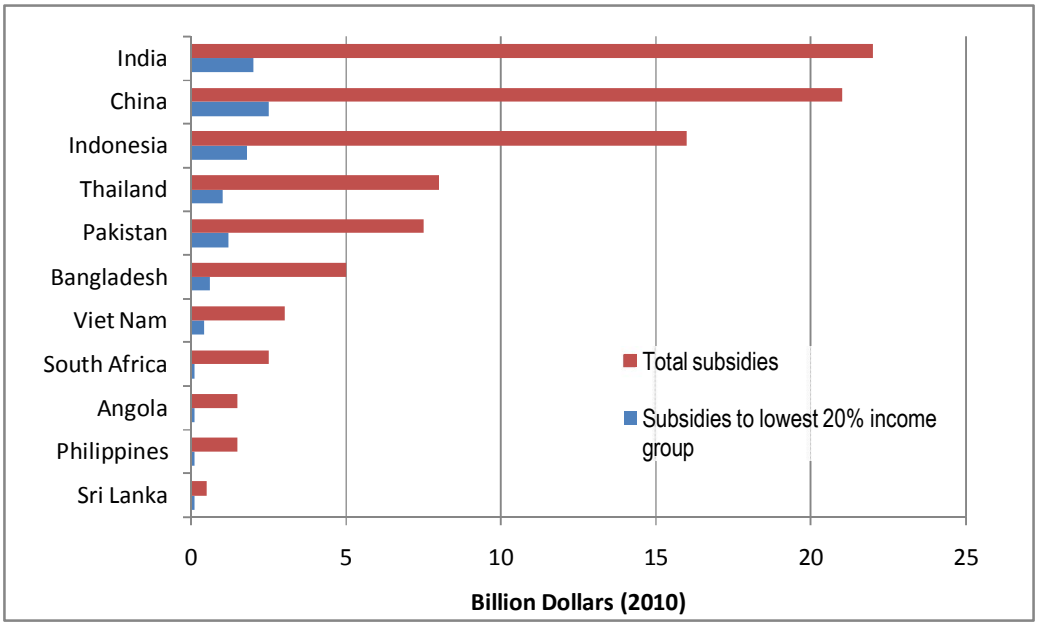


Figure 8 Fossil-fuel subsidies in selected countries, 2010

In India, for example, subsidies on LPG and kerosene were intended to supply affordable fuels to the poor, but due to leakages and mistargeting of subsidies this has not occurred (box 2).

Box 2. How relevant are the cooking energy subsidies for the poor?

The Energy and Resources Institute estimates indicate that 40 per cent of the LPG subsidy is enjoyed by 6.75 per cent of the population that is among the country's highest income groups (TERI 2010). On the other hand, the poor – for whose sake subsidies are ostensibly continued – are generally unable to tap the supply of kerosene and LPG as a large number of them do not have ration cards and/ or official LPG connections.

Among other sources, micro-financing has played some role in energy service expansion for the poor, but successful implementation is difficult to achieve. On the other hand, carbon finance instruments, such as the CDM and voluntary carbon markets, have been less effective in financing energy access projects and present considerable challenges including high transaction costs and lengthy complex processes[10]. There are at least four major constraints in utilizing CDM funds for household projects (UNDP 2011, IEA 2011):

- Getting any project approved for CDM is at present often a long, uncertain and expensive process. Upfront costs are incurred to determine the emissions baseline and to get the project assessed, registered, monitored and certified.
- Carbon credits are only obtained after a project's registration under CDM, and upon verification of emission reductions over the operational phase of the project. Since household projects have limited access to lending, and therefore generally require upfront funding, this represents a significant barrier for implementation.
- CDM transaction costs are quite independent from project volume. Therefore, for household projects (typically small), the percentage of the project budget spent on transaction costs is much higher than it is for larger projects, amounting to as much as 50 per cent of potential CDM benefits.
- The CDM project cycle is a bureaucratic and time-consuming process. For household projects, where availability of accurate data can be limited, this can present a challenge (as with BSP Nepal, where the monitoring data produced was considered "too generic"). Host country approval of the project, moreover, can be difficult to obtain in countries without efficient administrative structures.
- Household projects comprise many small units/interventions; they are also often located across remote locations where accessibility is limited due to inadequate infrastructure. These factors make it difficult to apply the highly formalized and rigorous CDM project-cycle procedures such as those regarding detailed monitoring.

For the above reasons, CDM has been largely ineffective as a mechanism for small-scale energy access programmes. The increasing development of programmatic CDM may help reduce transaction costs by consolidating the small carbon savings of individual access projects. National governments in developing countries can act to reap the benefits from such candidates.

[10] Validation costs for a project can range between EUR 15,000 ($19,300) and EUR 50,000 ($64,600), far too high for small projects (Muller, 2010).

3. Energy access in Asia and the Pacific: Present situation, gaps and challenges

Box 3. Energy access situation: The global scenario

- Globally, more than 1.3 billion people are without access to electricity and 2.7 billion people are without clean cooking facilities. More than 95 per cent of these people are either in sub-Saharan Africa or developing Asia and 84 per cent are in rural areas.
- In 2009, some $9.1 billion was invested globally in extending access to modern energy services, supplying 20 million people with electricity access and 7 million people with improved cookstoves. This was sourced from multilateral organizations (34 per cent, domestic government finance (30 per cent), private investors (22per cent) and bilateral aid (14per cent).
- Between 2010 and 2030, in the New Policies Scenario, $296 billion will be invested in energy access between, an average of $14 billion per year.
- To provide universal modern energy access by 2030, cumulative investment of$1 trillion is required, an average of $48 billion per year, more than five-times the level in 2009.
- At present, energy access funding tends to be directed primarily toward large-scale electricity infrastructure, which does not always reach the poorest households.
- Achieving universal access by 2030 would increase global electricity generation by 2.5per cent. Demand for fossil fuels would grow by 0.8per cent and CO2 emissions go up by 0.7 per cent.

Source IEA, 2011

Note: The *World Energy Outlook-2011* presents projections for three scenarios. The *Current Policies Scenario* includes all policies in place and supported through enacted measures as of mid-2011. The *New Policies Scenario* is based on broad policy commitments and plans that have been announced by countries around the world to address energy security, climate change and local pollution, and other pressing energy-related challenges, even where the specific measures to implement these commitments have yet to be announced. The *450 Scenario* sets out an energy pathway that is consistent with a 50 per cent chance of meeting the goal of limiting the increase in average global temperature to 2°C compared with pre-industrial levels (IEA, 2011).

3.1 Current status of energy access

In 2005, the household sector, which is the focus of energy access activities, accounted for 29 per cent of the total final energy consumed globally. Between 1990 and 2005, global final energy consumption increased by 23 per cent. Energy consumption grew most quickly in the service and transport sectors, both sectors showing an increase of 37 per cent (IEA, 2008).

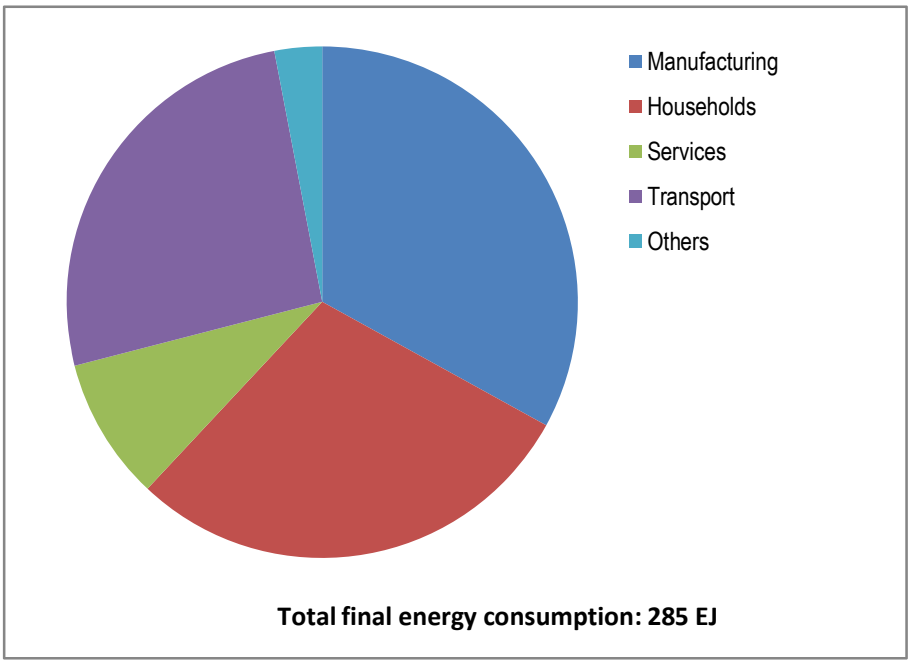


Figure 9. Share of global final energy consumption by sector, 2005

Within the household sector, 2.7 billion people (40 per cent of the world's population) continue to use traditional biomass for cooking; fewer than 30 per cent of these use improved cook stoves; and 1.4 billion remain without access to electricity 85 per cent of who live in rural areas. Moreover, more than one billion people are served by unreliable power supply characterized by unplanned power outages, massive losses and power quality issues (IEA, UNDP and UNIDO, 2010a).

In the Asia-Pacific region, almost two billion people are dependent on the traditional use of biomass and almost 700 million have no access to electricity (see table 9). More than 800 million of these two billion people dependent on biomass are in India and more than 100 million each in Bangladesh, Indonesia and Pakistan (IEA 2009 and IEA; UNDP and UNIDO. 2010a). In South Asia, the absolute numbers of unelectrified households has actually increased, with population growth outpacing expansion to electricity. Between 2005 and 2008, even as the percentage of population with electricity in South Asia increased by 8 per cent, the region accounted for a sizeable 42 per cent of the 1.5 billion people without electricity in 2008. Bangladesh, India and Pakistan then had 570 million people in total without electricity, with 92 per cent of them living in rural areas (IEA 2009). In South Asia as a whole, some 50 per cent of the rural population or more than 300 million people have no access to electricity (Zomers et al 2011).

Table 9 People without access to electricity and relying on traditional use of biomass, 2009

	No. of people lacking access to electricity (million)	Share of population	No. of people relying on traditional use of biomass for cooking (million)	Share of population
Africa	587	58%	657	65%
Sub-Saharan Africa	585		653	
Developing Asia	675	19%	1921	54%
India	289	25%	836	72%
Bangladesh	96	59%	143	88%
Indonesia	82	36%	124	54%
Pakistan	64	38%	122	72%
Myanmar	44	87%	48	95%
China*	8		423	
Rest of developing Asia	102	6%	648	36%
Latin America	31	7%	85	19%
Developing Countries (including Middle East countries)	1314	25%	2662	51%
World**	1317	19%	2662	39%

*From IEA, UNDP and UNIDO, 2010a
** Includes OECD and transition economies

Source: IEA, 2011

In spite of its massive energy access programmes, continued emphasis on rural electrification and a breeding ground for technological and social innovations, India continues to be home for the largest number of people without energy access (see box 4).

Box 4. The case of energy access in India

The Indian energy sector has witnessed rapid expansion in recent years in terms of both total and per capita energy consumption. The country today has one of the most extensive rural electrification programmes, the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) launched by the Government in 2005, with the goal of electrifying all villages and providing electricity access to all rural households by 2010. The role of rural electrification in poverty reduction was strongly articulated in *Bharat Nirman* ("Building India"), a time bound national development plan (2005–2009) focused on rural areas. The programme aimed to provide connectivity to the grid and largely ignored the issue of the reliability and quality of the electricity supply. The predominant targets of these electrifications programmes are to provide single lighting point connection to below poverty line (BPL) households. Non-BPL rural households are largely ignored as a result.

At the same time, similar focused and targeted programmes were not designed for expanding rural cooking energy access. The programmes on subsidizing modern cooking fuels, such as LPG, mostly benefited the middle- and high income households. The technology focused biogas programme failed to influence a shift from biomass-based cooking in rural areas and even the limited success is confined to rich rural families. Between 1985 and 2002, the Government of India implemented the "National Programme for Improved Chulhas" (cookstoves), and has recently launched the National Biomass Cookstoves Initiative (NBCI) to develop and deploy next generation cleaner biomass cookstoves. The government is piloting the demonstration of 100 000 cookstoves during 2011 and 2012 – providing financial assistance for up to 50 per cent of the cost of the stoves – and this will be used to formulate a deployment strategy for the country's next five year plan (2012 to 2017).

Between 1990 and 2008, the country's total energy use nearly doubled, yet its per capita energy consumption remains relatively low – a third of the world average and one-eighth of the average per capita consumption in the Organization for Economic Co-operation and Development (OECD) countries. Today, despite large strides in the energy sector, energy inequalities are evident and widespread:

- The findings of the National Sample Survey indicate that although 74 per cent of the Indian villages were electrified in 2005, only 54.9 per cent of the households had access to electricity and the remaining depended on kerosene lamps for lighting.
- In 2007-08, more than 85 per cent of households in rural India continued to depend on "dirty" cooking fuels (firewood and chips, dung cake and coal/ charcoal) for cooking, with only 9 per cent using LPG. In urban India on the other hand, 62 per cent of households used LPG as the major fuel for cooking and 24 per cent households use "dirty" cooking fuels.
- In urban India, 90 per cent or more households used electricity for lighting in majority of the states. In rural areas on the other hand, about 60 per cent of households in rural India used electricity for lighting while 39 per cent used kerosene.
- Grid electrification has had only limited success in enhancing energy access. The RGGVY, in its current form, caters only to creating infrastructure for rural electrification. The issue of shortages due to inadequate supply and the issues of quality of supply to rural and urban areas are yet to be addressed.

Source: Patil 2010 and 2011

3.2 Mapping energy poverty in Asia and the Pacific

This section presents energy access levels in various Asia-Pacific countries, and the data presented uses the MEPI framework to measure energy poverty, using the following weighted indicators[11]. Access to mechanical power is not included in this matrix because of lack of reliable data.

Table 10. The Multidimensional Energy Poverty Index framework to measure energy poverty

Dimension	variable	Indicator (weight)
Cooking	Type of cooking fuel	Population without access to modern fuels (0.3)
	Exposure to indoor air pollution	Population relying on solid fuels and not using improved stoves (0.1)
Lighting and electricity based services	Access to electricity	Population without access to electricity (0.4)
	Telecommunication and access to information services	Population without telephone (0.1)
		Population without access to internet (0.10)

Table 11 shows the results for MEPI for the Asia-Pacific countries for which data is available. As can be seen, for several countries, data on use of improved cookstoves usage is not available, for these countries, the MEPI has been adjusted for three variables (as against four for other countries), with the weights indicated in the table. Combining physical access to ownership of appliances and the resultant usage of energy services, Myanmar and Thailand rank highest and lowest in terms of energy poverty, respectively.

[11] Available data sources include the following: IEA 2010; IEA 2009; UNDP and WHO 2009; MEASURE DHS. n.d. Demographic and Health Surveys. Available at: http://www.measuredhs.com/.(this contains data on proxy indicators, such as ownership of electrical appliances)

Table 11. Multidimensional Energy Poverty Index for select Asia-Pacific countries

Country	Population without access to modern fuels (%)	Population relying on solid fuels and not using improved stoves (%)	Population without access to electricity (%)	Population without telephone (%)	Population without access to internet (%)	MEPI
5-Variable						
weightage	0.3	0.1	0.4	0.1	0.1	
Bangladesh	91.2	97.9	59	71	96.3	**0.775**
Cambodia	92.5	93.3	76	71	98.7	**0.845**
China	58	26.8	0.6	26	65.7	**0.295**
India	71.2	91.7	35.5	66	92.5	**0.606**
Indonesia	54.4	94.9	35.5	25	90.9	**0.516**
Lao People's Democratic Republic	97.4	87.6	45	65	93	**0.718**
Mongolia	76.8	0.9	33	26	89.8	**0.479**
Myanmar	96.6	95.2	87	98	99.8	**0.931**
Nepal	83.8	94	56.4	83	93.2	**0.747**
Pakistan	67.7	85.3	42.4	44	83.2	**0.585**
Philippines	50.6	83.9	14	20	75	**0.387**
Sri Lanka	80.5	58.8	9	0	88	**0.424**
Thailand	36.9	4.3	0.7	0	78.8	**0.197**
Vanuatu	85.5	93.9	81	80	92	**0.846**
Viet Nam	66	78	24	0	72.4	**0.444**
4-Variable						
weightage	0.4	0	0.4	0.1	0.1	
Bhutan	43.1		31.5	59	86.4	**0.401**
Fiji	48		40	14	99	**0.417**
Maldives	18.1		0	0	71.7	**0.126**
Papua New Guinea	87		90	90	98.7	**0.810**
Solomon Island	92.6		85.6	93	95	**0.808**

3.2.1 Implications of not having electricity access

In spite of its relatively small share of the aggregate rural energy supply, electricity is viewed as symbolic of rural development itself. The crux of the rural electrification dilemma is that electricity is an expensive, high-quality energy source that practically all rural people want but only some can afford, subject to the overriding condition of its availability in the first place (Kaygusuz, 2011).

As mentioned before, close to 700 million people in Asia and the Pacific do not have access to electricity. For lighting, those without electricity must resort to lamps candles and kerosene wick lamps that are polluting, dangerous and provide low-quality light – and yet are more expensive than modern electric lighting. Life without electricity poses many issues (Practical Action, 2010):

Quality of light: People without access to electricity use fuels for lighting that provide fewer units of luminescence, or brightness (measured in lumens) for each watt of power consumed than electricity. A kerosene wick lamp or a candle provides just 11 lm, compared with 1,300 lm from a 100 W incandescent light bulb (figure 10). As a result, those without access to electricity must endure light levels that are insufficient for safe work, study, or recreation.

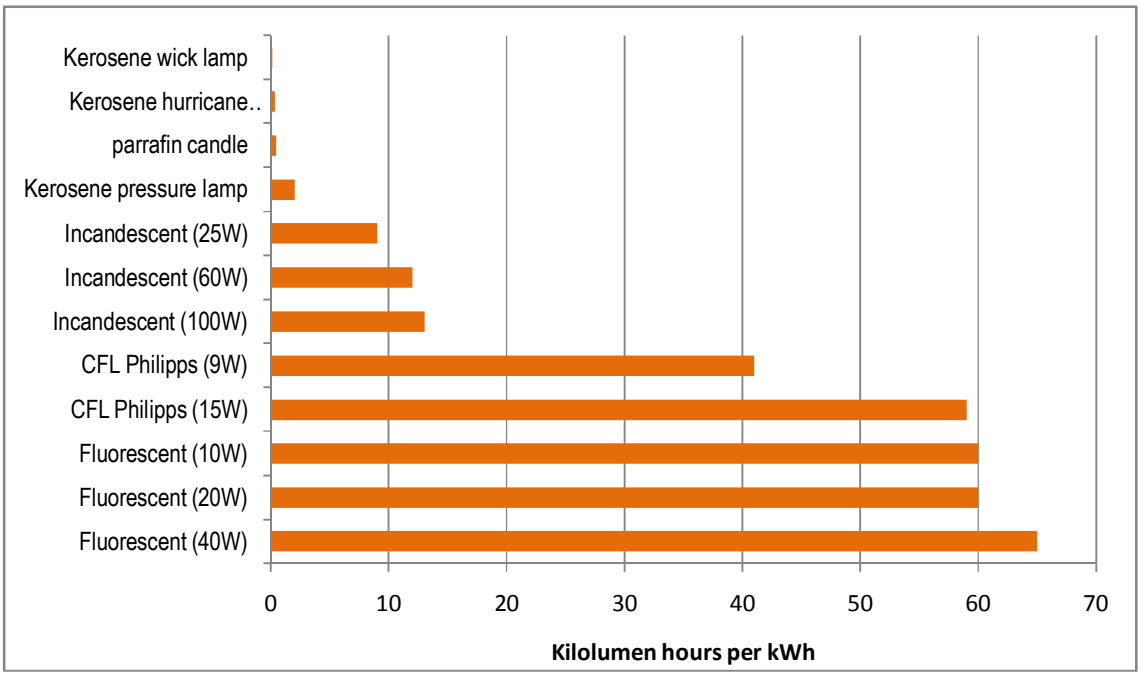


Figure 10. Efficiency of lighting fuels

Pollution from lamps: A laboratory study in Guatemala (Schare and Smith, 1995, quoted in Practical Action 2010) indicates an average particle emission of 540 mg/hour for wick lamps and 300 mg/hour for enclosed lamps. Compared to biomass stove emissions (2–20 g/hour), the emission rate from wick lamps is relatively low, but the most polluting lamps emit levels that compete with those from the cleaner types of biomass stoves. A study by Dustin Poppendieck and colleagues (2010) indicates that pollutants from the cheapest kerosene wick stoves have the smallest particle size, and are thus the most dangerous since they are taken more deeply into the lungs.

Dangers of lamps: Unguarded candles and wick lamps are intrinsically unsafe and lead to injury and deaths, particularly among women and children. In northern India, of the approximately 11,000 patients admitted for burn care during an eight-year period, 2 per cent were injured from using flame lamps (Practical Action, 2010).

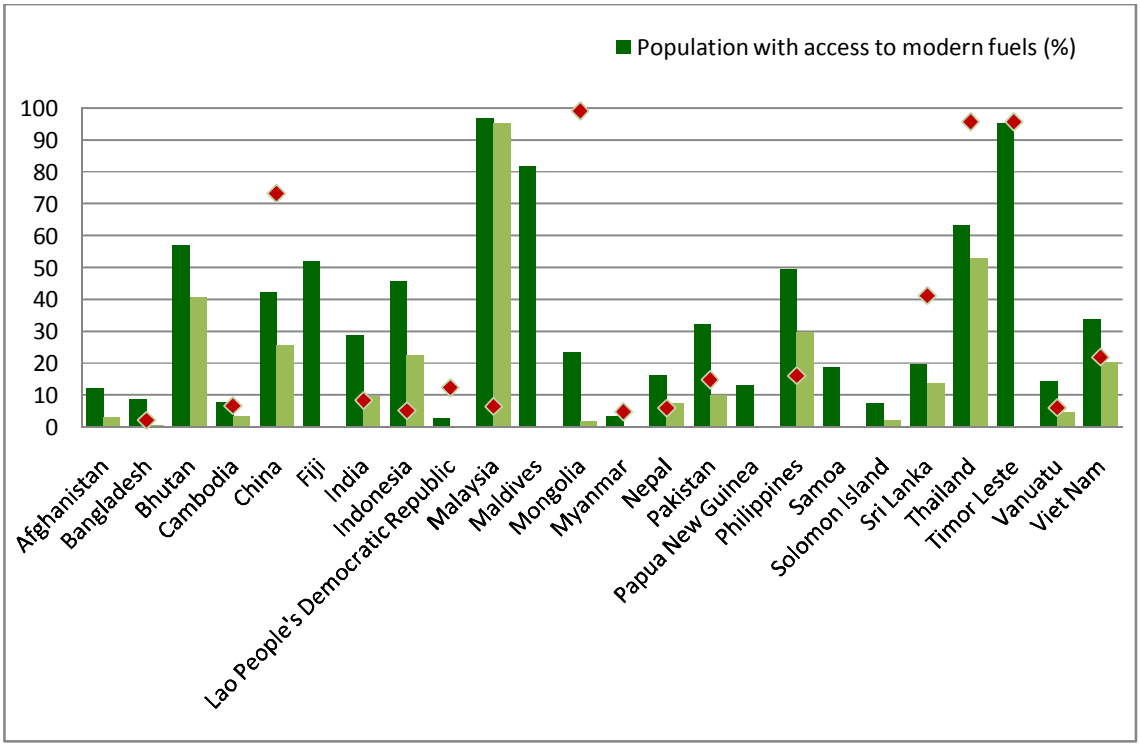
Cost of lighting: A study on sources of lighting has shown the large variation in cost for different forms of lighting (not including candles) showed that the costs range from US$0.003/1000 lm/m2/hour for a grid-connected compact fluorescent lamp to $110/1000 lm/m2/hour for flashlights, which are widely used as a supplement to kerosene lighting in the developing world (Mills, 2003 quoted in Practical Action, 2010).

Perhaps more important is the fact that lack of access to modern energy services by an individual or household is a form of poverty in its own right. The absence of energy access also reinforces constraints in income generation potential, because many product and service-based enterprises and public services either rely on energy or are substantially improved in their productivity, profitability or efficiency by the introduction of improved forms of energy access.

3.2.2 Implications of not having access to modern cooking fuels and technologies

As mentioned before, the most commonly used indicators for energy access include access to electricity and access to modern cooking fuels. The following figure maps these two indicators, along with the level of usage of improved cookstoves, which captures the important aspect of indoor pollution from incomplete combustion of biomass, representing a major health issue.

Figure 11 Access to modern fuels for cooking and heating in Asia and the Pacific



The implication of biomass use in inefficient stoves is well established. In general, there seems to be an inverse correlation between traditional biomass use and desirable demographic indicators, especially for women and children who are most vulnerable. The burden of energy scarcities and the heavy reliance on biomass fuels falls disproportionately on women and the implications are many and well documented (Ezatti et al 2004, Smith 2002,WHO 2011, GACC 2011). The real rural energy crisis is rural women's time, with women working longer work days than men in providing human energy for survival activities such as fuel and water carrying, cooking, food processing, transport, agriculture and small enterprises, non-monetized work, which is largely invisible in national energy accounts and labour force statistics. As a consequence, women:

- Spend a huge amount of time and effort collecting traditional fuels, a physically draining task that can take from 2 to 20 or more hours per week (UNDP 2007b).
- Along with their children, face exposure to smoke from inefficient stoves in poorly ventilated homes, which kills more than 2 million people each year. The World Health Organization (WHO) estimates that exposure to smoke from the simple act of cooking constitutes the fifth worst risk factor for disease in developing countries, and causes almost two million premature deaths per year – exceeding deaths attributable to malaria or tuberculosis (see figure 3) (GACC 2011).

- Face, on a daily basis, hazards associated with fuelwood collection: fractures, repetitive strain injuries, back disorders and miscarriages due to load carrying; exposure to burns, smoke and skin diseases in fuel-use; and physical violence, including rapes, while gathering fuelwood.

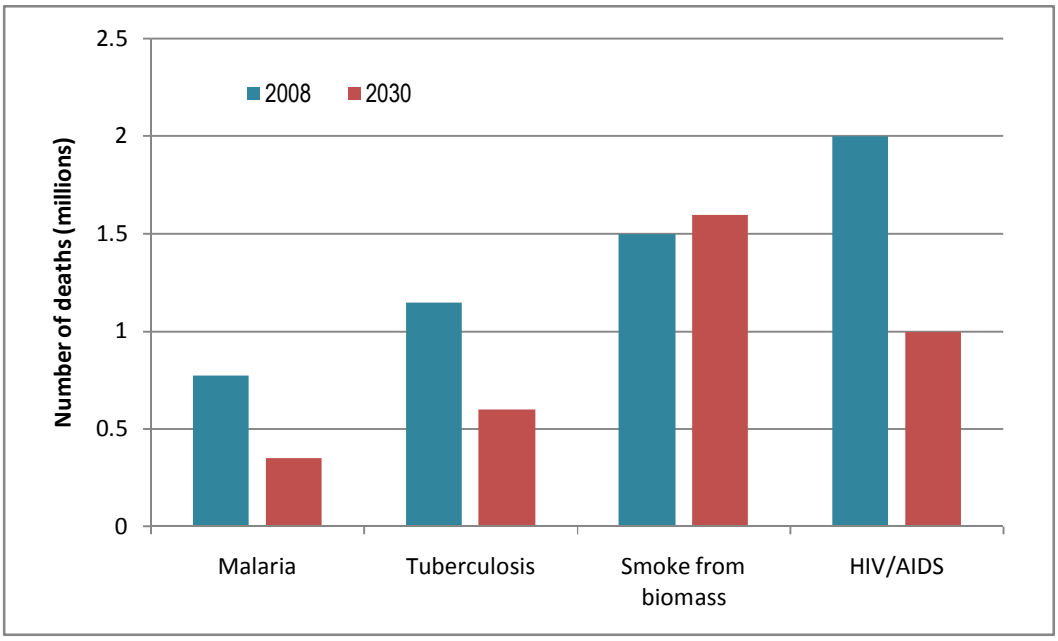
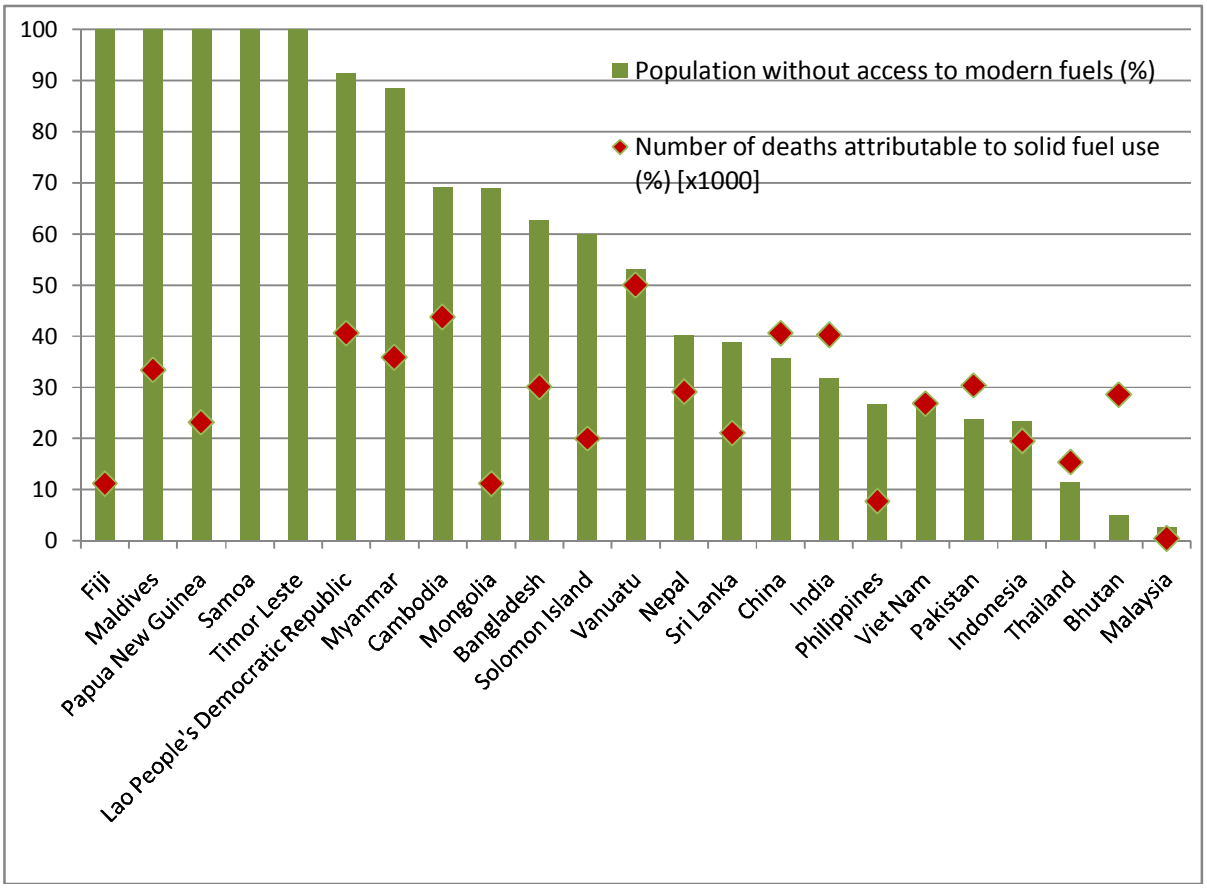


Figure 12. Premature annual deaths from cookstove smoke and selected diseases

The issue of health hazards from imperfect burning of biomass is fast emerging as a global concern and is captured in figure 11, which maps population without access to modern fuels, with the annual number of deaths ascribed to biomass use. Biomass accounts for more than 30 per cent of total energy consumption in many developing countries, and in some Asia-Pacific countries its share stands as high as 95 per cent (IEA, UNDP and UNIDO, 2010a). By 2030, household air pollution from biomass use in inefficient stoves is still likely to cause more than 1.5 million premature deaths every year, more than 4,000 per day.

Figure 13. Population without access to modern fuels with the deaths ascribed to biomass use



3.3 Policy and implementation gaps: Persistent challenges to improving energy access

In the region, with some exceptions, the results of large centralized and heavily subsidized energy access programmes have been suboptimal. The region has been witness to decades of experience with large numbers of, mostly government led, technology= focused programmes, with relatively less attention to aspects like repair and maintenance of technology systems, poorly targeted subsidies for technologies and fuels, and most importantly, with little thinking on how these can input to the overall development process. In rural areas, high transaction cost and resultant high cost of service delivery, coupled with low purchasing power and dispersed populations, have been serious bottlenecks in large scale expansion. Persistent challenges and their underlying causes in providing modern energy services to the poor include the following:

Reaching the presently unserved populations. While the centralized programmes have already reached large numbers of people, a majority of people still lacking access are located in remote rural areas with low population densities. This means delivery costs of energy are higher and the logistics of implementation are more complex. Electricity and fossil fuels rely on capital-intensive distribution networks (transmission and distribution grids or pipelines, and transport by road or rail) to deliver centrally produced supplies to rural areas. Energy service providers often find it difficult, time-consuming and expensive to develop distribution channels to reach rural markets. In Nepal, the Biogas Support programme contends that it has already covered the "easier' markets for biogas, people living in the *terai* region (foothills) who are relatively well off and have adequate cattle and resources to invest in energy services. Presently, it is the poorer farmers living in far off, remote locations, who do not have biogas plants and are the target market. In the Pacific island countries, the unserved live in scattered habitations on a large number of islands, which makes national electric grids impractical; people in the Solomon Islands, for example, are spread across more than 300 islands, while in Kiribati 80,000 people live on 33 widely scattered low atolls (UNDP, 2007a).

Affordability and the rural poor. The second, and much discussed issue is that of affordability. There is evidence that the poor pay more for energy services than their better off counterparts. A recent study undertaken in India show that (Oilchange et al 2011) [12]

- The perception that the poor in rural communities pay less for electricity than their urban counterparts is generally misplaced. The rural poor are in fact often paying more for less energy than those in urban areas.
- People are willing to pay for energy if they are assured high quality and reliable energy supply.

People want energy supply not only to cater to lighting needs, but also for water for irrigation and specifically for flour mills, tailoring, small drying equipment for agro products, and refrigeration, particularly for dairy communities and fishing communities. For the poor, food and other vital expenditures absorb the greater part of already low incomes. The post-2005 period has seen a 40 per cent increase in food and fuel prices, putting yet further pressure on very tight budgets and leaving little to spend on energy (Kaygusuz, 2011). At the same time,

[12] Based on a survey conducted by the Vasudha Foundation in partnership with Christian Aid, UK in rural India on "ability and willingness to pay for energy services". This survey was conducted in eight states of India, covering a total of 240 villages, and roughly 2000 households.

the rural poor live in subsistence economies that do not generate cash surpluses, limiting their purchasing power and the opportunity to shift to modern energy services. Some 85 per cent of the people who don't have access to electricity today live in rural areas, and a majority of them have low agriculture-based livelihoods with limited disposable incomes. Most rural poor find it difficult to obtain the credit necessary to pay high up-front costs for energy services; the cost of capital itself is high, and because income cycles are agriculture-dependent and thus irregular, adherence to regular repayment schedules is challenging.

The low level of effective demand for modern energy makes it uneconomic for power providers to set up the infrastructure needed to supply the fuels, while the lack of supply prevents workshop owners and farmers from improving their productivity and the incomes of the community. This is the "vicious circle" of energy poverty. Tables 12 and 13 show the disparity in rural –urban energy access, which is particularly disturbing given the projections that this trend is likely to continue into the future as well (Kaygusuz 2011).

Table 12. Number of people without access to electricity by region (million)

	2009			2020
	Rural	Urban	Total	Total
Africa	466	121	587	644
Sub-Saharan Africa	465	120	585	640
Developing Asia	716	82	799	650
China	8	0	8	2
India	380	23	404	342
Other Asia	328	59	387	307
Latin America	27	4	31	16
Developing countries[a]	1229	210	1438	1350
World[b]	1232	210	1441	1352

[a] Includes middle east countries
[b] Includes OECD and transition economies

Table 13. Number of people relying on traditional biomass as their primary cooking fuel (million)

	2009			2020
	Rural	Urban	Total	Total
Africa	481	176	657	776
Sub-Saharan Africa	477	176	653	772
Developing Asia	1694	243	1937	1840
China	377	47	423	326
India	765	90	855	823
Other Asia	553	106	659	687
Latin America	60	24	85	81
Developing countries[a]	2235	444	2679	2772
World[b]	2235	444	2679	2772

[a] Includes middle east countries
[b] Includes OECD and transition economies

Notwithstanding the issues surrounding affordability in rural areas, recent experience with renewable energy technologies (RETs) demonstrates innovative energy service delivery and business models that markedly improve the affordability of energy services. These include fee-for-service, retailer loans, and micro-financing, among others. At the same time, product modifications have also contributed to price reductions (see box 5 for example). Hence, while affordability is a constraint, it may not be an insurmountable one, as demonstrated by innovative service delivery, technology innovations and financing models.

Box 5. Multiple product–price options

Greenlight Planet India is an example of sharp product customization, and offering customers multiple options. Three types of low-powered (torch), medium-powered (regular) and high-powered (turbo) lamp modes are provided so that energy is not wasted. The Sun King then is a niche product that is just bright enough to provide adequate light but at an affordable cost.

There is also an option in which lamp has been customized to provide 16 hours of light from a single charge, emitting a thin beam of light, which makes it more suitable for some applications than others, and low cost.

Minimalist nature of energy access programmes. Government and donor energy strategies for the poor continue to focus mostly on their basic energy needs (IEA, UNDP and UNIDO, 2010a; UNDP 2011). In doing so, they do not pay adequate attention to raising incomes and livelihoods, which could potentially increase affordability of energy services. Rural electrification programmes, for example, primarily provide basic home lighting, rather than electricity for lighting plus other power applications, such as for heating, cottage industries and agro-processing, that would help increase incomes. This ignores the large (though complicated) role that energy plays directly and indirectly in development processes at a local level when electricity is provided for non-household uses, for example, through more efficient agricultural processing, improved health care solutions. Other necessary inputs in reducing poverty—among them access to information, market linkages, business development services and capital—do not normally receive the attention they merit.

Policy focus in energy access. Many of the Asia-Pacific countries have underdeveloped regulatory environments and have significant potential economic or political weaknesses, which pose constraints to development of local energy sources. These barriers include financial barriers, shortage of local expertise, limited local production of equipment and components, institutional and regulatory barriers.

Another policy issue is that in the past, energy access has been perceived as simply a technical problem that can be solve with a technology-focused solutions. It is now being recognized that solutions to expanding energy access for the poor can be sustainable only when they take a people-centred approach that looks at how energy affects peoples' lives directly. In practical terms, in addition to reaching the energy service to the people, this would mean ensuring that the technologies offered are sharply aligned with their needs and preferences, and strategies that help the poor to use energy services in a manner that helps them improve their health and well being, helps them reduce workloads and improve convenience at home and at work, helps them improve their livelihoods and increase incomes.

Inadequate policy focus on cooking sector. In Asia and the Pacific, there has been an extensive focus on the provision of electricity as a means to expand energy access. However, energy access is much more than electrification. As such, electricity is not the most appropriate form of energy for cooking (which accounts for the largest part of energy

consumption in developing countries), nor is it the quickest or the most cost effective way of providing energy services to the poor, except for densely populated urban habitations. The social and health implications of cooking with traditional biomass on inefficient cookstoves in poorly ventilated kitchens are well established. Providing clean modern energy services to poor communities will require the expansion of choice of energy options, including conventional and non-conventional sources.

The UNDP-WHO report on the Energy Access Situation in Developing Countries (UNDP and WHO 2009) reviewed actual household surveys for about 140 countries to quantify various aspects of household energy, assembling statistics based on WHO sponsored World Health Surveys, the USAID-sponsored Demographic and Health Surveys, and the UNICEF-sponsored Multiple Indicators Cluster Surveys as well as other international studies such as the World Bank Living Standards Studies. Interestingly, data on stove characteristics were available for only 67 of the 140 developing countries in the study, which in itself is reflective of the emphasis that cooking energy receives in national policies. An estimate of the number of people using improved cookstoves is shown in figure 14 (World Bank 2011a).

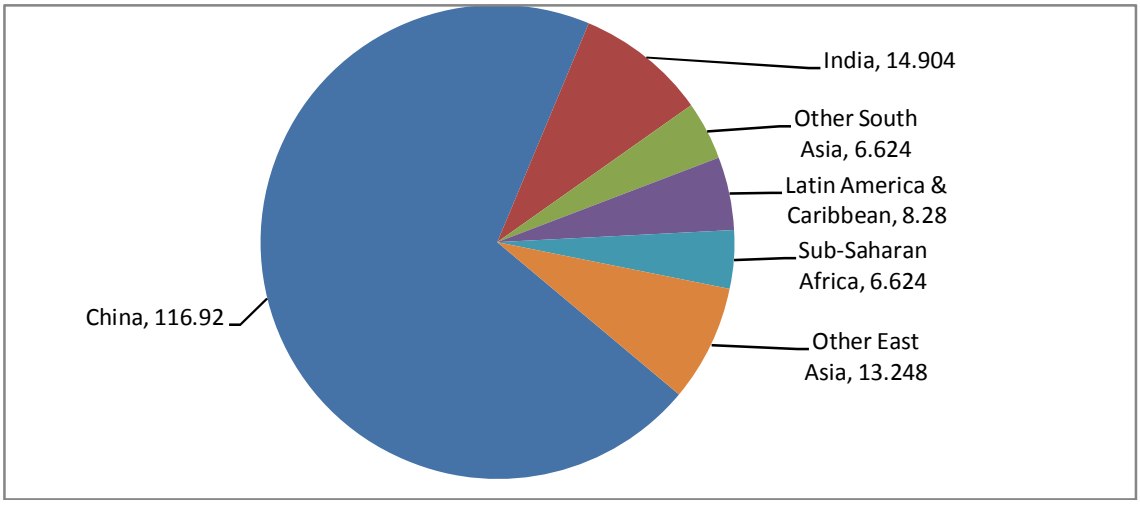


Figure 14. Number of people using improved cookstoves (million)

Dependence on oil. Oil has been an important fuel for expanding energy access in the region and most countries have subsidized the supply of petroleum products, including kerosene, for lighting and cooking and diesel for irrigation. Countries in Asia and the Pacific already consume about three times more oil than they produce, and consumption is increasing twice as fast in the region as in the world as a whole (see figure 15). The region has less than 4 per cent of the world's proven oil reserves, relies mainly on imports to meet its high and increasing demand for oil and is primarily dependent on the Middle East, which has been a most volatile region in recent years. Hence prudency in oil use will likely have to form as significant element of future strategy for these countries (Wu et al 2011, Wu et al 2008).

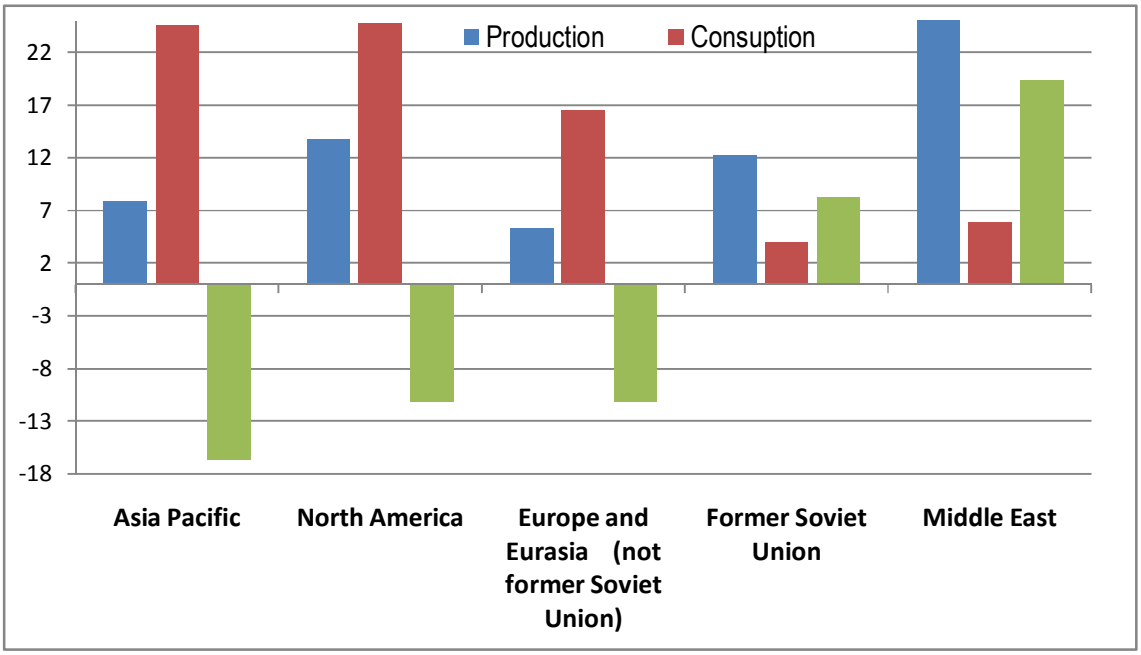


Figure 15. Oil production, consumption, net surplus or deficit in major regions of the world, 2006

In principle, oil consumption in the region could be reduced by eliminating inappropriate government intervention in oil markets, removing price distortions and allowing market prices to reflect the true cost of oil. Possible measures include tax benefits and incentives that encourage the use of energy-saving goods and services, and to support increased use of renewable energy. Yet in real terms, the possibilities are limited. Given the region's growing population, expanding transportation needs and rising expectations for a better standard of living, the demand for oil can only go up.

Issue surrounding electrification. Within electricity, there are a range of issues that planners need to confront: first, conventional approach to electrification, through centralized power plant and power line distribution, often bypasses rural communities because they are located too far away from the grid. Majority of the population in Asia and the Pacific lives in rural areas, where population densities are low, levels of demand are limited and the cost of providing an energy supply is high compared with densely populated areas. At the same time, the ongoing electricity sector reforms, while improving the overall efficiency of operations, have largely resulted in decreased attention to providing electricity services to the poor, whose affordability to pay is limited. Thus, electricity utilities have little incentive to provide services to these areas. Clearly, there is a need to ensure that the reform processes do not jeopardize the chances of the poor to get connected to the grid, and consideration for expanding energy access to the poor progress at tandem with other components of the reforms.

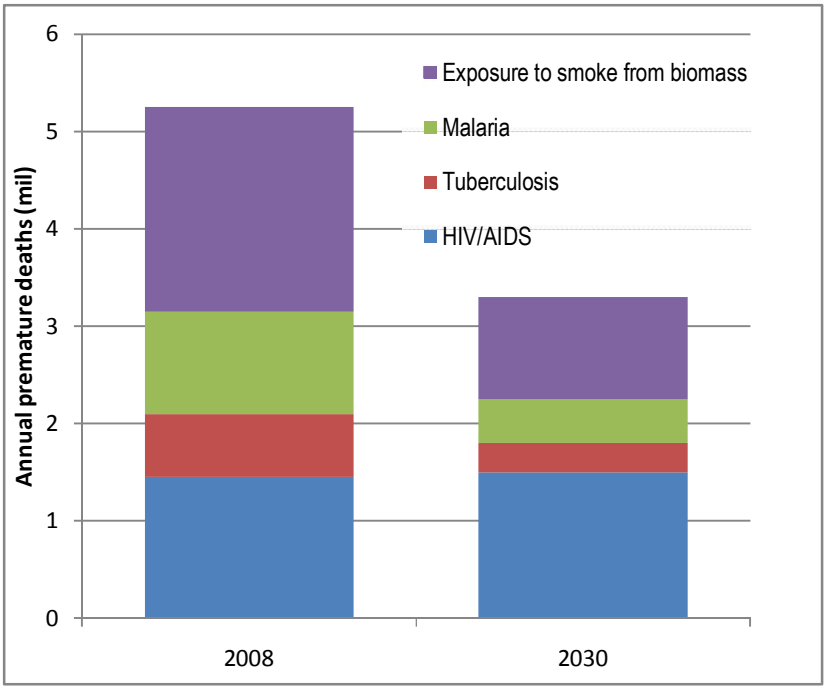
4. The future business-as-usual scenario of energy access

With an annual growth rate of 3.5 per cent till 2030, the Asia-Pacific region will have witnessed one of the highest growth rates in GDP that eventually would raise the energy demand at 2.4 per cent per year between 2005 and 2030 (ADB 2009). The region is also witnessing development in the area of energy trade, with many countries exporting or importing electricity from neighbouring nations. Data on energy trade being undertaken in

the Asia Pacific countries are presented in annex 2. The demand for energy is expected to grow, with increases in population, accompanied with improvements in living standards, leading to higher expectations/ demand for energy services. IEA 2010c estimates that between now and 2030, energy consumption will likely increase by over half (53 per cent); the energy mix will remain fairly stable and dominated by fossil fuels (80 per cent share); and energy-related CO2 emissions will increase by over half (55 per cent).

However, with the current policy regime, in terms of energy access, the future scenario does not look to be markedly different from the present one and large populations of the world's poor will continue to lack access. The number of people relying on the traditional use of biomass is projected to rise from 2.7 billion today to 2.8 billion in 2030. In 2030, household air pollution from the use of biomass in inefficient stoves will still lead to over 1.5 million premature deaths per year, over 4000 per day, in 2030. In developing Asia, the number of people using biomass is likely to increase from 678 million today to 731 million in 2030. The projected trend in major causes of premature deaths in developing countries, 2008–30 (million) is as follows (World Bank and Ausaid 2011).

Figure 16. Projected trends in major causes of premature deaths in developing countries, 2008–2030



Based on the MEPI mapping in the previous section, the following table makes some projections for 2030 on the extent of energy poverty likely to be persistent in the Asia-Pacific countries. The length of the horizontal bars indicates the extent an assessment of energy poverty likely to be present in 2030, based on existing policy regime and population projects. As expected, India and China are likely to be most afflicted by energy poverty, China because of the population.

Figure 17. Multidimensional Energy Poverty Index: Extent of energy poverty in 2030

Country	Extent of Energy poverty 2010	Entent of Energy Poverty (projected) 2030
5-Variable		
weightage	**MEPI*Population 2010**	**MEPI*Population 2030**
India	735.7	899.4
China	399.3	431.1
Bangladesh	127.4	157.4
Indonesia	120.0	140.1
Pakistan	108.1	155.5
Myanmar	47.0	55.3
Viet Nam	39.6	46.8
Philippines	36.2	48.1
Nepal	22.3	30.3
Thailand	13.4	14.5
Cambodia	12.8	17.0
Sri Lanka	10.4	11.3
Lao People'e Democratic Republic	4.6	6.4
Mongolia	1.3	1.5
Vanuatu	0.2	0.3
4-Variable		
weightage	**MEPI*Population**	**MEPI*Population 2030**
Papua New Guinea	5.6	8.2
Solomon Island	0.4	0.4
Fiji	0.4	0.4
Bhutan	0.3	0.4
Maldives	0.0	0.1

4.1.1 Access to electricity

The World Energy Outlook 2011 provides s projections about the number of people without access in 2030 under various scenarios.[13] In the New Policies Scenario, while the share of the global population lacking access to electricity declines from 19 per cent in 2009 to 12 per cent in 2030, 1.0 billion people are still without electricity by the end of the period (table 14). The proportion of those without access to electricity in rural areas was around five-times higher than in urban areas in 2009, and this disparity widens to be around six-times higher in 2030.

[13] The World Energy Outlook-2011 presents projections for three scenarios. The *Current Policies Scenario* includes all policies in place and supported through enacted measures as of mid-2011. The *New Policies Scenario* is based on broad policy commitments and plans that have been announced by countries around the world to address energy security, climate change and local pollution, and other pressing energy-related challenges, even where the specific measures to implement these commitments have yet to be announced. The *450 Scenario* sets out an energy pathway that is consistent with a 50% chance of meeting the goal of limiting the increase in average global temperature to 2°C compared with pre-industrial levels.

Under the New Policies Scenario, The World Energy Outlook 2011 projects that the number of people without access to electricity in developing Asia is likely to decrease by almost 45 per cent, from 675 million people in 2009 to 375 million in 2030. Around 270 million people in rural areas will receive electricity but, despite this, the rural population still constitutes the great majority of those lacking access in 2030. China has provided 500 million people in rural areas with electricity access since 1990 and is expected to achieve universal electrification by 2015. For India, the WEO predicts reaching a 98 per cent electrification rate in urban areas and 84 per cent in rural areas in 2030. In the rest of developing Asia, the average electrification rate reaches almost 93 per cent.

Table 14. People without access to electricity in the New Policies scenario (million)

	2009			2030		
	Rural	Urban	Share of population (%)	Rural	Urban	Share of population (%)
Africa	466	121	58	539	107	42
Sub-Saharan Africa	465	121	69	538	107	49
Developing Asia	595	81	19	327	49	9
China	8	0	1	0	0	0
India	268	21	25	145	9	10
Rest of developing Asia	319	60	36	181	40	16
Latin America	26	4	7	8	2	2
Middle East	19	2	11	5	0	2
Developing countries	**1106**	**208**	**25**	**879**	**157**	**16**
World[b]	**1109**	**208**	**19**	**879**	**157**	**12**
[b] Includes OECD and Eastern Europe/ Eurasia						

4.1.2 Access to clean cooking facilities

In the New Policies Scenario, after an initial increase, the number of people without clean cooking facilities drops back to 2.7 billion, the level of 2009, in 2030 (table 15). The proportion of people globally without clean cooking facilities declines from 39 per cent in 2009 to 33 per cent in 2030. In developing Asia, the number of people without access to clean cooking facilities declines from 1.9 billion in 2009 to around 1.7 billion in 2030. In the New Policies Scenario, the number of people without clean cooking facilities in India peaks before 2015 and then declines, but India still has nearly 780 million people lacking them in 2030. The number of people without clean cooking facilities in China maintains a declining trend and stands at around 260 million in 2030. Together, China and India account for all of the fall in the number of people lacking clean cooking facilities in the region. Across the rest of developing Asia, the number of people without access increases by 4.5 per cent to reach 690 million.

Table 15. People without clean cooking facilities in the New Policies scenario (million)

	2009			2030		
	Rural	Urban	Share of population (%)	Rural	Urban	Share of population (%)
Africa	480	177	65	641	270	58
Sub-Saharan Africa	476	177	78	638	270	67
Developing Asia	1680	240	54	1532	198	41
China	377	46	32	236	25	19
India	749	87	72	719	59	53
Rest of developing Asia	554	107	63	576	114	52
Latin America	61	24	19	57	17	14
Middle East	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Developing countries	2221	441	51	2230	485	43
World[b]	2221	441	39	2230	485	33
[b] Includes OECD and Eastern Europe/ Eurasia						

The adverse implications of these trends, particularly on health of the poor, are likely to be huge. According to estimates presented by the Global Alliance for Clean Cookstoves (GACC), the health implications of biomass use are going to rise, reflected in the estimated number of deaths caused each year (see figure 18)[14].

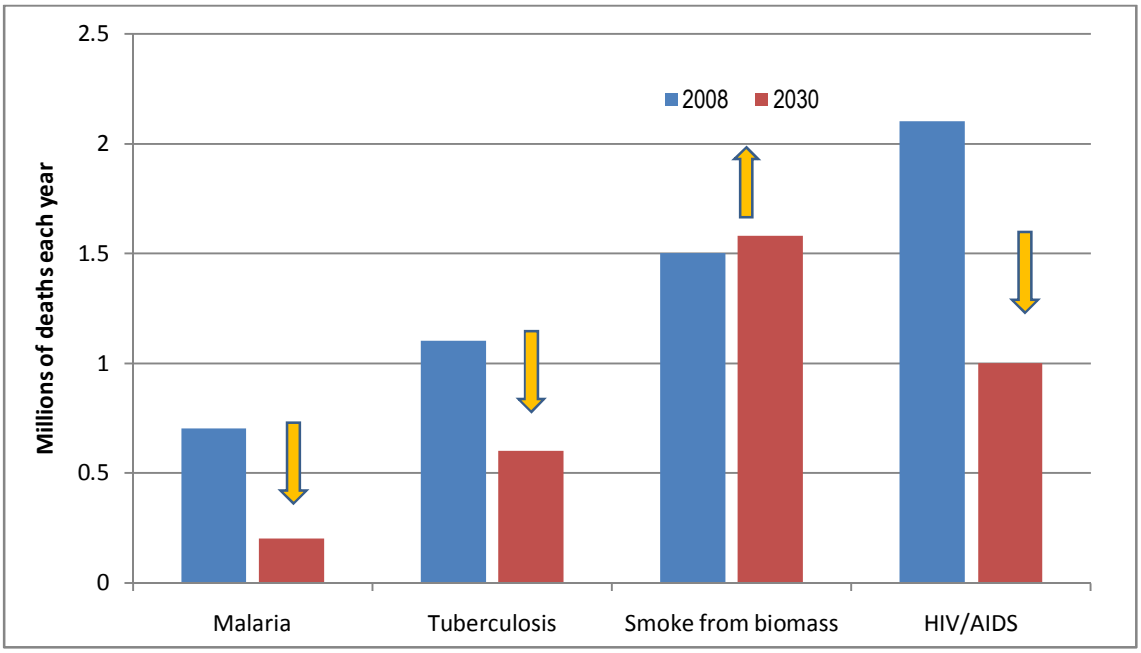


Figure 18. Health impact of biomass smoke in 2030

[14] Global Alliance for Clean Cookstoves. Excerpts from the Draft Strategic Business Plan 2012 – 2020.

4.2 Developmental impacts of expanding energy access

When communities gain access to energy services, it can have a marked effect on their lives:

- By freeing up people's time from repetitive and drudgerous tasks- gathering fuelwood, hauling water, milling grain.
- By reducing expenditure on energy, by improving productivity of processes like cooking, heating and production processes like agro-processing, which can reduce fuelwood consumption and save money on energy expenditures.
- By expanding the ability to engage in income-generation activities. Many enterprises become viable once there is access to a reliable modern energy source: mechanical power, electricity, process heat, and transport fuel.
- By promoting energy delivery enterprises. Energy enterprises themselves can become sources of income generation.
- By improving human capital though reducing drudgery in subsistence tasks and making time for leisure and self-improvement; improved community services, such as street-lighting, and lighting at health centres and schools and access to television.

A recent review of 17 energy projects in the Asia-Pacific region revealed that the energy access projects substantiate a number of benefits in terms of their impacts on the various MDGs, as follows (UNDP 2011):

Table 16. Millennium Development Goals benefits of expanding energy access to the poor

MDG	MDG related impacts of energy access projects
MDG 1: Reducing extreme poverty and hunger	• Improved fuel efficiency reduces household expenditure on energy. Improved stoves, for example, can bring about 20-24 per cent reduction in fuel use. • Energy used for productive purposes increases incomes. • Efficient lighting enables income generation beyond daylight hours. • Renewable energy projects create employment for communities, and promote new energy-based enterprises • Electricity brings about lifestyle changes, and encourages households to invest in appliances.
MDG 2: Achieving universal primary education	• Improved lighting enables children to study in the evenings. • Freeing children from fuelwood collection tasks enables them to study and attend school.
MDG 3: Promoting gender equality and empowering women	• Access to modern energy frees women's time formerly devoted to fuelwood and water collection. • Electrification increases women's access to information through television and other media. • Energy services bring new training opportunities for women and men. Availability of household and community electric lighting improves the sense of security, particularly among women.
MDG 4: Reducing child mortality	• Use of improved cookstoves and biogas plants reduces ailments among children through reduced indoor air pollution. • Improved lighting reduces exposure to polluting kerosene lamps.

MDG	MDG related impacts of energy access projects
	• Affordable energy makes it possible to boil water, making it safe for consumption.
MDG 5: Improving maternal health	• Reducing drudgery/labour of fuelwood collection and reducing exposure to smoke from burning of biomass fuels in kitchens, improve women's health. • Affordable energy makes it possible to boil water, making it safe for consumption.
MDG 6: Combating HIV/AIDS, malaria, tuberculosis and other diseases	• Electrification makes possible refrigeration of vaccines and lighting for clinical services. • Reduced exposure to smoke from inefficient burning of biomass and solid fuels in kitchens improves health outcomes. • Provision of electricity and LPG to rural health clinics can improve the quality of health care to a greater degree if other complimentary inputs—trained staff, equipment, sanitary facilities, running water—are also available
MDG 7: Ensuring environmental sustainability	• Reduced fuelwood consumption has a potentially positive impact on forest resources. • Reduced use of fossil and biomass-based fuels can reduce GHG emissions. • Improved burning of biomass reduces indoor air pollution. • Greater access to clean drinking water, with modern energy available for boiling water
MDG 8: Promoting global partnership for development	• Community-managed energy projects bring communities together to work towards common development goals. • Electrification makes it possible for communities to benefit from new technologies, especially those related to information and communications (television, radio and Internet). • Energy programmes and projects can collaborate with other, non-energy development programmes.

In general, the most immediate and visible benefits of energy access is seen in terms of improvements in the lives of the poor in terms of fuel savings, health, education, and access to information. Impacts on livelihoods and incomes are less visible. The review also showed that projects and programmes that implement energy interventions from a poverty-reduction perspective—providing energy services in combination with business development support, access to finance, and market linkages—show promise in bringing people out of poverty. However, these strategies are yet to be scaled up.

Costs and benefits of electrification [15]

A wide range of off-grid technologies are available to serve individual households or small communities. The technologies can be classified in two broad categories: (1) isolated mini-grids, which can serve communities; and (2) systems which typically serve one household. In between are community systems that can serve small schools, health centers, or community facilities.

[15] These estimates are drawn from a World Bank study undertaken in Cambodia, China, Indonesia, and the Lao People's Democratic Republic (World Bank and Ausaid 2011)

Grid and off-grid energy options have a wide range of costs. The table below presents the "levelized power generating costs" for various technologies used for household energy systems and isolated mini-grids.[16] The table compares them with the costs for the large-scale conventional sources that typically power the main grid. The range of levelized costs for household systems ($0.15–0.65) is distinctly higher than that for mini-grid systems $0.7–0.51). In contrast, the large generation sources that typically power the main grid provide the cheapest electricity (US$0.4–0.23). Generally speaking, grid systems are least costly when they serve large loads in areas of high population density. Isolated off-grid systems cost the least for serving smaller, localized loads in places far from the grid. Similarly, household systems such as solar photovoltaic (PV) systems are the least costly for low-load areas that are even farther from the grid and in less accessible areas.

Table 17. Levellized power generation costs for various technologies, 2005

Range of applications	Generation source	Rated output (kW)	Levelized cost (USc/kWh)
Households/ community systems	Pico/micro-hydro	0.30	15
	Wind	0.30	35
	PV-wind hybrid	0.30	42
	Solar PV	0.05	62
	Diesel/ gasoline generator	0.30	65
Isolated mini-grids	Biogas	60	7
	Mini-hydro	5000	7
	Biomass gasifier	20,000	7
	Diesel base load	5000	9
	Pico/ micro hydro	100	11
	Wind	100	20
	Solar PV	25	51
Main grid	Coal steam subcritical	300000	4
	Large hydro	100,000	5
	Oil steam	300,000	7
	Oil	300,000	12

16 Levelized costs are the present value of the total cost of building and operating a generating plant over its financial life converted to equal annual payments and amortized over expected annual generation from an assumed duty cycle.

At the household level, electricity is mainly used for powering light bulbs, fans, television sets, computers and phones (when available). Studies have noted that benefits from electricity usually are derived from the longer days that powered light bulbs offer to the household. In addition, access to information, communication and health care is facilitated by the powering of computers and phones. When electricity is used for powering home appliances, household chores tend to become less tedious; when it is used for lighting, the relative brightness of the light bulb as opposed to candle light allows children to read or study in the later hours of the day, bringing obvious education and leisure benefits. Women and children benefit directly from these improvements, but table or ceiling fans and television sets offer comfort during evening leisure time, increasing the general welfare of all members of the household.

Box 6. Electrification and its impacts on women

A recent workshop in Bangladesh (World Bank 2010a) points out that regardless of the technology, the benefits to women from rural electrification are numerous: increase in women's productive activities, such as raising livestock and poultry, increased awareness on health issues through television programmes (health care during pregnancy and safe motherhood), increase in women's entrepreneurship, and generally improved social empowerment as their names are written on all documents jointly or independently of their husbands. In Bangladesh (and elsewhere) with rural electrification, textile and garment industries are being established and provide jobs to poor rural women (predominantly) and men.

A recent Energy Sector Management Assistance Program (ESMAP) study in East Asia and the Pacific (World Bank and Ausaid, 2011) showed that the welfare benefits of rural electrification for a household adopting electricity typically range from $10 to–$ 20 a month or up to $1 per kilowatt hour (kWh). For household lighting alone, the benefits are estimated to be close to $0.80 per kWh in the Lao People's Democratic Republic and $ 0.50 per kWh in the Philippines. These benefits are much higher than the cost of supplying electricity to rural areas, which ranges between $0.15 and0.65/kWh.

A study undertaken by the Asian Development Bank (ADB) in Fiji some years ago points out in the context of Fiji, but which holds true elsewhere as well that, "….The most immediate and direct…impact on the poor is in reducing cash expenditure on traditional and high-cost forms of commercial energy, such as kerosene and dry-cell batteries. Unelectrified households spend more on all sources of energy than households with electricity from any source. This is despite the fact that households with electricity are likely to use a number of electrical appliances that cannot be used without electricity. Connecting poor households will immediately reduce cash expenditure so that scarce cash income can be diverted to other more beneficial expenditure items. As poor households' electricity consumption is likely to increase as appliances become more affordable, expenditure on electricity will increase also……" (ADB, 2005).

Besides the social benefits, decision makers tend to give more importance to the economic impact of access to electricity as an income-generating process. Electricity use is expected to lead to more productive processes; the growth of businesses or farms using electricity will then increase demand for electricity, leading to a virtuous growth cycle profitable to both electricity providers and rural communities. Such economic growth is obviously an important achievement of any rural electrification programme. Experience however indicates that the necessary conditions for such economic growth lie in the parallel or complementary development programmes for the newly electrified communities (UNDP 2011; Barnes 2007; Ramani 2004). While electricity is indeed an important input to rural businesses, farms or

other small rural structures, adequate local conditions such as organized rural markets and sufficient credit are necessary for such businesses to grow. Lack of such complementary development programmes in these regions may hinder their economic growth.

Developmental impacts of cooking energy interventions

A 2006 study led by WHO (Hutton 2006) estimates the costs and benefits of selected household energy and health interventions, based on two main intervention approaches (reducing exposure through changing from solid fuels to cleaner fuels and reducing exposure through a cleaner-burning and more efficient improved stove) and three specific interventions (LPG, biofuels (ethanol) and a chimneyless "rocket" stove[17]). In general, the results show favourable benefit–cost ratios.

The benefit–cost ratio is calculated as the annual average economic benefits of the intervention divided by the annual average economic net costs of the intervention. Net intervention costs are calculated as absolute intervention costs minus cost savings as a result of fuel-efficiency gains. Economic benefits include reduced health expenditure due to less illness, the value of assumed productivity gains due to less illness and death, time savings due to less time spent on fuel collection and cooking, and environmental impacts at the local and global level. Major findings are as follows:

- In reducing by half the current population without access to LPG, the total economic benefits amount to roughly $90 billion per year compared to net intervention costs of only $13 billion. A pro-poor approach to reduce the population without access to LPG generates $102 billion in economic benefits, with a price tag of $15 billion.
- The improved-stove scenario (50 per cent reduction of those using traditional stoves) generates $104 billion in economic benefits, and at the same time has a negative net intervention cost of $34 billion. In other words, the net present annual value is $ 138 billion.
- For all scenarios modelled, the net intervention costs were found to be higher for rural populations, as the urban population already purchases a higher proportion of their fuel, thus giving a greater cost saving when switching to an alternative fuel. Economic benefits also varied considerably between urban and rural areas. This holds particularly true for time savings due to the higher proportion of the rural population that collects rather than purchases their fuels.

In conclusion, the study showed that it is potentially cost-beneficial and, in some cases, cost-saving to invest in household energy and health interventions. Under the assumptions of the model, improved stoves lead to the greatest overall economic benefits.

The benefits of shifting from traditional biomass based stoves to improved ones have also been reiterated in the Igniting Change report published by the Global Alliance on Clean Cookstoves (GACC 2011), which, in addition to fuel saving, highlights the multiple cost-effective health, environmental, economic, and women's empowerment co-benefits. For example, fewer trips to local clinics for smoke-induced pneumonia and lung ailments can mean less strain on overtaxed health services and systems, while reducing the need to collect scarce firewood preserves precious watersheds, animal habitats, and dwindling forest cover.

[17] A rocket stove is an innovative clean and efficient cooking stove using small diameter wood fuel which is burned in simple high-temperature combustion chamber containing an insulated vertical chimney which ensures complete combustion prior to the flames reaching the cooking surface.

Time saved in fuel collection through the use of efficient cookstoves and fuels can mean the ability to keep a girl in school, while financial savings from more efficient cookstoves means that income previously used to buy fuel can now be used to buy chickens for eggs or to start a small business. Higher birth weights lessen risks for disease throughout adult life, independent of any future exposure to cookstove smoke. In short, adoption of clean and efficient cookstoves and fuels in developing countries can help the international community meet the MDGs for maternal and child health, other chronic diseases in adults, education, and environmental sustainability, as well as foster gains in nutrition, female literacy levels, and economic independence.

5. Promising approaches

This section presents a number of cases of energy access programmes in Asia and the Pacific that demonstrate promising approaches in areas of government policy, product, delivery approaches, financing and private-public partnerships (PPPs). Covering various technologies, end-uses and countries, each of these experiences highlights one or more such element of strategy. This is followed by a synthesis of good practices lessons learned for upscaling energy access for the poor.

5.1 Encouraging private sector participation in biogas dissemination: Biogas Support Programme Nepal

In Nepal, about 90 per cent of the population rely on traditional biomass fuels for cooking, only 40 per cent of the rural population has access to electricity, and hydroelectricity and coal each meet only one percent of national energy needs. Nepal has installed more than 170,000 biogas plants, benefiting more than a million people, in a 13- year programme during the 1980s and 1990s. More than 90 per cent of these plants are still in operation today.

BSP is being implemented by Biogas Sector Partnership Nepal (BSP-Nepal),[18] a national NGO established in 2003 and emerging from the BSP Programme, which was earlier funded and managed in Nepal by the Netherlands Development Organization (SNV). Currently, BSP-Nepal has a tripartite agreement with donors and the Government.

Between 35 and 50 per cent of the capital costs of biogas plants are subsidized through grants from international donors, and loan capital made available for the remaining capital costs. BSP encourages private-sector construction of biogas plants for the poor by combining grants, incentives, loans and micro-financing to biogas companies and users; expanding the market by educating and motivating banks and MFIs to provide financing; taking responsibility for promotion and marketing in new, underdeveloped areas; and then, once markets are developed, turning the latter functions over to the private sector.

The project encourages private-sector participation through a variety of supportive measures, and ensures private-sector accountability for constructing high-quality biogas plants and providing back-up service. Subsidies are routed through the biogas companies. System checks and balances are linked to subsidy disbursement, starting with company qualification according to clearly defined criteria and going on to product standardization, quality testing of accessories and appliances, and quality control and monitoring of plants in the field,

[18] The Biogas Support Programme (BSP) involves the cooperation of a number of legal parties including AEPC, Biogas Sector Partnership–Nepal (BSP-N), SNV Netherlands Development Organisation, KfW, Government of Nepal, various private companies and MFIs. BSP-N is the implementing agency.

including performance evaluations complete with grading and associated penalties and rewards for companies. Specific quality control measures include the following:

- BSP has developed technical standards for more than 80 biogas-plant parameters, and these standards have been incorporated in the agreement with the biogas companies.
- BSP directly inspects a minimum of 5 per cent of newly constructed plants, as well as those under the tow-year guarantee period. Then, where appropriate, BSP sends early-warning reports to biogas companies specifying necessary improvements and repairs.
- Biogas companies are classified according to grades "AAA" through "E", depending on plant performance in the field. Grades are sanctioned with penalties or bonuses, as appropriate.
- Weak companies (graded "D" or "E") are provided with counselling support aimed at improving their performance. If a biogas company receives "E' grades for two years, it has to leave the programme.
- The annual "partner satisfaction" and biogas users' surveys provide regular user feedback.

With its strong emphasis on quality control under the Programme, BSP-Nepal has been awarded ISO 9001:2008 certification.

Starting with one biogas company (a joint venture involving three public organizations), the Programme now includes 90 licensed private-sector biogas companies with about 200 offices, 16 workshops and more than 200 MFIs providing loans to biogas users. Newly established companies work as dealers under already qualified or licensed counterparts. Except in a few areas where the services of an NGO or consulting firm might be more appropriate, most activities, following capacity development, are turned over to the private sector or government agencies.

5.2 Standardization and certification for quality control: Improved cookstoves in Cambodia[19]

In rural Cambodia, more than 90 per cent of total household energy used comes from wood and charcoal, with rural families consuming approximately 5 kilograms of firewood per day for cooking. Energy-related activities such as gathering wood, boiling water, and cooking take the poor as much as 3–4 hours a day. In the late 1990s, the NGO Groupe Energies Renouvelables, Environnement et Solidarités (GERES–Cambodia) introduced the efficient New Lao Stove in Cambodia. So far, more than a million stoves have been sold. Over the last two years, with the rising cost of wood and charcoal in the local market, sales of the New Lao Stove have more than doubled to over 290,000 stoves per year. This means that over half of all urban households in Cambodia have at least one New Lao Stove, and many have two or even three, saving the country more than$ 9,000,000 in fuelwood costs since 2003.

By combining a traditional, local stove design with latest knowledge, quality assurance techniques and testing facilities, GERES has been able to create a simple stove that appeals to the community, and at the same time saves more than 20 per cent fuelwood. These stoves use either charcoal or firewood; can be made using (mainly) fine and coarse clay, the same raw

[19] World Bank and Ausaid 2011 and World Bank 2010a

materials as for traditional stoves in rural areas; requires the same skills traditional stove producers already use; and is transportable in the stove carriers used by traditional stove distributors.

The innovative aspect of the GERES effort is the successful institutional model for selling the stoves, rather than the design of the stove itself.

- The GERES approach targets the producer segment and helps artisans produce a higher quality and more fuel-efficient stove than the one they were producing which is then sold through existing distribution channels at a higher price.

- GERES has taken a value chain approach to stove dissemination. One challenge that emerged during the initial years of implementation was the large number of decentralized production units. Having approximately 31 scattered production centres made it difficult to control the quality of the stove. GERES addressed this challenge by consolidating the scattered production centers to a few centralized facilities. Next, the NGO set up a local supply chain, selected a trial area, and trained producers to produce stoves first for this area, and then for the country. The entire supply chain has the extensive participation of women, who are managing retail shops and promoting stoves.

- The selling price of the stove has been fixed in such a way that the users are able to recoup the outlay from fuel savings within one to three months. By working the cost structure back from the customer to the producer, the margin for middlemen and producers has been established. This has resulted in a commercialized business case that is beneficial to all actors in the stove chain from producer to customer.

- According to the project implementer (GERES), standards, certification, quality control and monitoring systems have played a central role in achieving success for the stove project:
  - Product and process standards have been introduced in the producer segment to secure the quality consistency and energy efficiency of the stove.
  - Each producer has his/hers own unique logo making it possible to trace back individual stoves to a certain producer.
  - Certification labels are issued on the basis of observed sales and only once the stock has been monitored and the stoves are living up to the set standards.
  - A system of stamping the stoves with the month and year of production has been put in place to enable accurate records of average lifespan of the stoves.
  - Producers of the stove are also required to fill out sales log books to document production and sales. This makes it possible for GERES to keep track of how many stoves are being produced and sold every month.

The certification system acts both as a quality control measure and as a monitoring tool to document production and sales rates, usage rates, stove lifetime and the stove shelf time (the time it takes from the stove is produced until it is being used in the households). Being able to collect this type of data is necessary to make the documentations needed to obtain carbon financing.

5.3 Unwavering commitment, long-term vision and a flexible approach: Rural electrification in Vietnam[20]

Viet Nam has achieved very high rates of electrification. Access grew from 3 per cent to 95 per cent in 35 years, with the most intensive growth period being 1995-2008, during which time an average of 3.4 million people were provided with electricity access each year. The country succeeded in providing access to more than 80 million people over 33 years; the number of people with access to electricity grew from 1.2 million in 1976 to about 82 million in 2009.

Table 18. Commune and household electrification rates, 1996-2009

	1996	1998	2000	2002	2004	2006	2007	2008	2009
Communes	62.2	75.1	82	89.8	94.3	97.4	97.89	97.89	97.89
Households	50.7	62.5	73	81	87.4	92.3	93.66	93.66	96.3

Since 1996, the World Bank has been a strong partner for Vietnam in rural electrification, supporting it through a long-term, results-oriented programme comprising consecutive rural electrification projects. Bilateral donors and other international agencies have provided support to the rural electrification in Viet Nam.. The progress in electrification can be divided into four phases:

- During the postwar *recovery period* (1976–85), the household electrification rate grew from 2.5 per cent to 9.3 per cent. At this time, electricity service to rural households was secondary to electricity supply for productive uses, especially irrigation of agricultural areas.
- The *preparation period* (1986–1993) was the period of the Doi Moi reforms,[21] during which household electrification rate grew from 10 to 14 per cent. The policy decisions made during this period led to an increase in rural incomes as a result of Doi Moi, the development of several large power plants across the country, building of medium-voltage (MV) networks, and the start of the construction of the 500 kV transmission line running the length of the country.
- The *taking off period* (1994–1997) increased the share of households with access to electricity from 14 to 61 per cent. A notable feature of the progress was the strong demand-driven, bottom-up process that characterized rural electrification. Other important developments included the establishment of Electricity of Viet Nam (EVN) in 1995 and the setting of nationwide electrification targets by the government in 1996.
- The next period (1998–2004) saw a move toward better regulation. During that time, the government took a strong role in in determining the course of rural electrification through defining strategies for the planning, implementation and management of rural

[20] Bazilian and Nussbaumer 2011 and World Bank 2011b

[21] **Đổi Mới** (English: *Renovation*) is the name given to the economic reforms initiated in Vietnam in 1986 with the goal of creating a "socialist-oriented market economy". As a result of *Đổi mới* privately-owned enterprises were permitted; and the push to collectivize the industrial and agricultural sectors, previously the focus of intense efforts by the Communist authorities, was abandoned.

electrification; setting the legal framework in the sector; and engaging with its international partners for the implementation of its strategic priorities. In addition to important actions, such as the prime minister's Decision 22 and government Decree 45, which set out institutional and financial arrangements for the electricity system, this period also witnessed the passing of the country's first electricity law and issuing of a policy paper on rural electrification. Another critical government initiative at the time was the setting of a ceiling tariff for rural customers as a step toward establishing financial controls over the rural electricity supply business

Between 2005 and 2008, the government focused on quality and regulation, in addition to continued expansion of electricity access. This period was characterized by the enforcement of regulations, a shift in focus from network extension to rehabilitation and direct government support for extending electricity access, particularly to minorities and those in remote areas.

The period from 2009 onwards can be characterized as one of consolidation for the last mile, focusing on ensuring sustainability of the rural electricity supply business, while pushing for greater accountability, working to determine the most appropriate strategies for extending access to those without electricity and ensuring the affordability of electricity for the poor. An important milestone of this period was the prime minister's Decision 21, issued in February 2009, stipulating a unified national tariff for all residential consumers, alongside an incremental block tariff arrangement, with a new lifeline block. The Viet Nam Distribution Code, which outlined the rights and obligations of service providers and their customers, including provisions concerning quality of service obligations and consumer protection, was approved.

As of 2010, it was estimated that 99 per cent of the communes and 96 per cent of the households in Viet Nam were connected to the grid. Going forward, the tasks lying ahead include the rehabilitation of the electricity networks in about 3,000 communes, determining the most suitable way of achieving the target of electrifying all the country's households, ensuring sustainability of the operation of rural electricity networks and continuing to make sure that electricity is affordable to the poor.

The success of Viet Nam in rural electrification can be explained by a range of factors, including the following:

- Unwavering government commitment that is responsive to strong demand from society.
- Long-term vision, gradual approach, prioritization and flexibility. The rural electrification effort involved an evolving strategy that was anchored by very clear objectives, implemented gradually and fine-tuned over time to reflect changing priorities. The government maintained a strategic vision for achieving its electrification targets, and the core tenet of this vision was achieving it through the extension of the national grid. Different approaches were adopted for different periods, each with their own challenges.
- Sharing of costs by all stakeholders and mobilization of various resources.
- Clear allocation of responsibilities among all levels of government, sector participants and consumers.
- The emergence of EVN as a strong champion for rural electrification after 1999.

- Making technical choices suitable for sector status and priorities.

- Ensuring the economic and financial viability of rural electricity supply while establishing and maintaining financial controls.

The policy and regulatory measures introduced by the government were critical components of Viet Nam's success in rural electrification as they equipped EVN with the mandate and resources it needed to perform its leadership role in a commercially sustainable way. The emergence of EVN as a strong champion for rural electrification in the late 1990s was an important factor for ensuring the technical quality of the rural energy networks and sustainability of rural electricity supply going forward.

5.4 A customized approach to solar home light dissemination: Solar Electric Company India

SELCO, or the Solar Electric Light Company, started as SELF (Solar Electric Light Fund) in 1994 with investors from Germany, Switzerland, the United States of America. In 1995, SELCO India became a commercial company, combining business with the social objective of improving the living conditions of people by providing electricity from solar power.

SELCO has sold solar lighting to more than 110,000 rural homes and to 4,000 institutions, such as orphanages, clinics, seminaries and schools in the Indian state of Karnataka. An impact assessment study by World Resources Institute in 2007 reported that 86 per cent of the low-income customers of SELCO cited significant savings in energy costs as their primary benefit of using SELCO products, while the rest pointed to their children's education as the primary benefit. The aspect that sets this approach apart from other modes of dissemination is that there is no subsidy involved for the consumers and the approach has been totally commercial from the very beginning.

The aim of SELCO is to bring affordable, reliable and clean solar electric light and power services to rural people. The company's attributes are the following:

- Provides better quality products to the customers at the most competitive price;

- Emphasizes high quality service by customizing the product to suit the customer's needs and by timely delivery of the service; and

- Provides assistance in the arrangement for finance at the best possible terms.

The main elements of its s strategy are:

- Customized solutions based on end user needs. The market segments of SELCO include, among others, of households, shops, hotels, banks, small businesses and cottage industries, corporate customers in the cities (for indoor and outdoor lighting), traffic kiosks, religious institutions, hospitals and health clinics, college hostels, government office and wildlife departments and police stations. By continuous research, SELCO has been able to adapt its products to rural conditions (including factors like dust and humidity). It also provides customized services based on factors such as household size and the purchasing power. As most households have many rooms, SELCO provides as many sockets as the owner desires (usually one in each room), which supply a fixed number of light points. Services offered include the following.

- Initial visit and assessment
- Product customization and installation
- Financial facilitation with local bank
- Maintenance (12 visits during the warrantee period)
- Maintenance contract (INR 500 per annum, includes 4 visits, filling up of distilled water and cleaning of the PV panel)
- Maintenance contracts offered to customers who have bought government subsidized systems as well
- Training of customer/users

- Dedicated service network (24 service centres), each with its own set of technicians and collection agents in the chosen villages, all hired locally. The technicians themselves are the salesmen and they work for SELCO on an income-cum-commission basis thus infusing interest to sell more systems.

- End-user financing through a variety of channels. Like any other renewable energy programme**,** SELCO initially faced the hindrance that the cost of the system was very high and low cost financing options were not available as traditional banking institutions were unable to provide low-interest and flexible credit lines. SELCO therefore identified micro-credit oriented financial institutions and agricultural cooperatives lending at the village level and charging reasonable interest rates, and established institutional linkages with them. Apart from cash sales, SELCO uses other means to sell solar home systems:

  - Sale through nationalized rural banks to lend for installation of Solar Home Systems to its customers. The Solar Lighting scheme of these banks offer three-to-five-year loans to consumers for 90 per cent of the solar system cost at an interest rate of 12 to 12.5 per cent (priority sector lending rate).
  - SELCO has tied up with rural/local institutions, such as cooperatives, farmer societies/associations and societies, which function like localized banks and provide loans to its members for installing SELCO solar PV systems. Many of these institutions offer payment schedules linked with the agricultural season.

5.5 Solar lanterns with central charging station: Lighting a Billion Lives programme, The Energy and Resources Institute India

TERI has been implementing a rental "fee for service" model under its Lighting a Billion Lives (LaBL) initiative since 2008. The initiative aims to provide lighting service to rural people by displacing kerosene and paraffin lanterns with solar lighting devices. In this model, a centralized solar lantern charging station is set up in villages for charging the lanterns, which provides lanterns daily on rent to households and enterprises. Under this initiative, 62,120 solar lanterns, benefiting more than 340,600 lives across 1356 villages in India, have so far been disseminated.

Key features of the implementation strategy are as follows (Palit, 2011; TERI, 2012):

- A typical Solar Charging Station consists of 50 solar lanterns with five numbers of solar panels and junction boxes.

- The solar lantern provides light for 5-6 hours daily using lighting emitting dioxide (LED) lamps on full charge of the battery providing illumination of 200-250 lumens or for eight hours if operated on the dimming option. In addition, a battery can also be

provided, which acts as a buffer for charging during rainy and foggy days or for any emergency charging during night.

- The charging stations are operated and managed by entrepreneurs (self-help groups/ youth) who qualify for the selection criteria set as part of the LaBL campaign. These entrepreneurs are provided handholding support by local implementation partners called LaBL Partner Organization. The entrepreneur collects the rent, a part of which is used for operation and maintenance of the charging station and for replacement of battery as may be required after 12-15 months of operation.
- Each user contributes a one-time deposit of 200 rupee ($3.70). The deposit is used to generate a corpus which goes towards resource maintenance to ensure the model's sustainability beyond the project's support period. The daily rent of INR 2 ($0.03) collected from users also adds to this amount.
- TERI provides training support to both the LaBL partner organizations and the entrepreneurs.
- The LABL team has constantly strived to reduce costs, without compromising on performance specifications. In order to take the solar lantern technology to the masses and to turn local women and youth into entrepreneurs, simplification of the technology was of prime importance. Under the LaBL initiative, solar PV systems without electronic circuitry were designed for the first time. The system, working on 12V and 6V batteries, is electrically safe even for the children to handle. All components of the system (except the moulded casing) are readily available in small towns and hence replacement is easy. Reduction in cost has also been made possible through strategic partnerships with leading component manufacturers. The 6V/4.5 Ah lead-acid batteries generally used in the LED lanterns have a market price between INR 140 ($2.59) and INR 150 ($2.78). By partnering with renowned manufacturing companies, the price has been reduced by 1520 per cent (Sharma and Thakur, 2010).
- The programme has synergized and converged with other developmental initiatives, thereby increasing its overall effectiveness (Chhibber, 2010). LABL entered into strategic partnership with YES Bank Limited to expand the reach of the campaign. As part of the collaboration, YES Bank shall work with TERI in two specific areas, namely design and implementing a scalable semi-commercial business model for financing solar charging stations and developing fundraising programmes/products at YES Bank for grant support to initiative. In another effort, it has partnered with Voltas, which has created a welfare fund. Anyone can participate in this movement and contribute by bringing home an energy-efficient Voltas Star Rated AC. In yet another partnership, LABL entered into a strategic partnership with Usha International Ltd. As part of this collaboration, stitching and sewing training would be extended to rural women at the LBL solar charging stations, in addition to the provision of solar lanterns.

5.6 Synthesis and lessons learned: Overall strategies

The experiences described above point to a number of good practices in energy policy and programme configuration. In order to expand energy access for the poor at a significant scale in the future, it is important that these form the basis for future policy design.

Long-term government commitment backed with financial allocation

Energy policies, including electrification policies, are formulated at the national level. Most countries are prioritizing energy, especially energy security. In countries, such as China and

India, there is a key emphasis on renewable energy and energy efficiency, both of which are viewed more as supplements not substitutes to fossil fuels. In developing countries, a long-term vision and government commitment backed by financial allocations continues to be the most significant driver for expanding energy access. In Viet Nam the long-term government strategy on rural electrification, anchored by clear objectives, was implemented gradually and fine-tuned to reflect changing priorities and needs over time. The government maintained a strategic vision for achieving its electrification targets, and the core tenet of this vision was achieving it through the extension of the national grid.

The Fiji rural electrification programme doubled access to electricity between 1986 and 2007, from 48.5 to 88.9 per cent (UNDP, 2011). Over the years, the Government's priority of rural electrification has been reiterated through various policy documents and setting of quantitative access targets (see Table 19). This well-articulated mandate has enabled the Government to make the necessary budgetary allocations.[22] Between 1994 and 2007, this allocation was FJD54.3 million ($30.7), for a yearly average of FJD3.6 million ($2.0 million)(UNDP, 2011).[23]

Table 19. Government electricity access targets in Fiji

Access targets	Document	Year
"…electrify all rural villages within a period of approximately eleven years" such as by 2004	Rural Electrification Policy (1993)	1994
"95 percent of the urban population have access to electricity by 2005	Strategic Development Plan 2003-2005	2002
"90 percent national electrification coverage by 2011 with urban increased from 95 to 100 per cent and rural areas from 70 to 85 per cent"	Strategic Development Plan 2007-2011	2006
"Pursue a 100 per cent electrification coverage by the year 2016"	National Energy Strategic Action Plan	2006
"88 per cent national electrification coverage by 2010 with urban increased from 95 to 98 per cent and rural areas from 70 to 80 per cent'	Sustainable Economic and Empowerment Development Strategy 2008-2010	2007

Another example of government commitment is reflected in the Chinese rural electrification programme which achieved a national electrification rate of 99.4 per cent in 2009 with rural areas reaching 99 per cent and urban areas 100 per cent (IEA 2010b). Through either grid extension or decentralized off-grid applications, universal supply of electricity has been one of the government's objectives. As a socialist country, China aims to give all its citizens the same basic living conditions, including access to electricity. As with other rural electrification programmes, the government's commitment (through efficient planning and sufficient long-term funding) has proven fundamental to the electrification success.

[22] Between 1994 and 2007, this allocation was FJD54.3 million Fiji dollar ($31 million), for a yearly average of FJD3.6 million ($2 million). For 2009 alone, a total of FJD7.795 million ($4.40 million) was made available to the programme, with another FJD12 million ($6.8 million) added in October 2009.
[23] 1 FJD = USD 0.53.

Sector wide capacity building for expanding access

Capacity-building is important for introducing or developing a technology as well as absorption of the technology introduced. Alongside the final consumers, there is a need to build the capacity of all stakeholders within the sector that play critical roles in energy provision, such as policymakers, technology suppliers, service providers, energy service companies, end-users, project developers and consultants. In the Bangladesh solar home systems project, since the solar energy technology brought to the communities was fairly new, the partner organizations invested time and resources in training people for installation and maintenance of SHS. . This has also resulted in availability of local manufacturers of, among other things, batteries, charge controllers and inverters. [24]

Sector-wide cooperation and coordination mechanisms

An important feature contributing to success has been the coordination and cooperation amongst different agencies or stakeholders. In all the cases studied, existence of different stakeholders with clear roles and mechanisms for interaction and coordination across the value chain was a key observation. A success factor identified in the Vietnamese rural electrification effort has been the building of effective partnerships between EVN, local authorities, and communities, and specifically through the sharing of costs and responsibilities among stakeholders. Similarly, BSP presents a model of PPP, involving the government, the private sector, NGOs, CBOs, banks, financial institutions and international development partners. It is a donor-supported, government-led programme implemented by an NGO, using the private sector as the prime movers and involving hundreds of MFIs, NGOs, CBO and local government organizations. The role of different players varies from project to project and evolves from one stage to another within a project. In some places, introduction of new actors or networks such as cooperatives and associations further intensifies cooperation and initiates coherence with the larger community in the area.

Needs-based and customized approach to energy service delivery

A service delivery and financing approach that is sharply based on the needs of the purported target groups has been central to all successful energy access initiatives. Energy needs vary according to geographical location, community demands and even individual household requirements. Successful delivery of products and services has to take account of these factors. In general, products that do not require users to make major behavioural changes are accepted quickly and used more effectively. SELCO, for example, factors into its product design variables such as household size and the purchasing power. In majority of cases, SELCO also tailors its product to meet specific lighting requirements of target groups, such as street hawkers, weavers etc. Sunlabob in Lao People's Democratic Republic[25] disseminates solar lanterns that are charged at a centralized charging station, these provide reliable lighting, but also can be used for low-power charging, such as for mobile phones. The package also incorporates an affordable fee based on usage level rather than a fixed

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[24] In Bangladesh, 645,033 SHSs were installed by August 2010 under the REREDP (Rural Electrification and Renewable Energy Development Project), World Bank-backed and IDCOL- administered, which provides a (diminishing) subsidy for each system installed and concessional refinancing for each system installed. The project has positively impacted access to reliable off-grid energy for poor households, generated employment in the form of POs and distributors of SHS equipment as well as local jobs for maintenance and installations of SHS and promoted income generation among SHS households as shops remain open for longer hours (http://siteresources.worldbank.org/EXTENERGY/Resources/336805-1151692180187/grameenShaktiRahimafroozBangladeshMediaSummary.pdf).

[25] Sunlabob Renewable Energy Ltd., a private company operating in the Lao People's Democratic Republic, has been disseminating solar lanterns in rural areas using a fee-for-service rental model.

monthly charge. Product customization calls for systematic market research, and engaging end-users in design process. It is also important to ensure that energy products are robust and tamper-proof particularly in remote locations where servicing facilities may not be readily available. Product design should address ease, and economy of use and maintenance in remote locations. At the same time, however, even customized products have to be backed by strict quality assurance measures including setting of standards and certification as well as rewards and penalties for equipment suppliers, as seen in the case of the Cambodian cookstove and the Nepal biogas programmes.

Customizing the solution is critical in terms of the technology or the product offered, but equally important in terms of the financing mechanism offered, which has to be in line with the needs of the final consumers. Most often, the financing package is a combination of an element of subsidy in some form or the other, mostly equipment subsidy, with loans offered by banks, and at times combined with micro credit options. BSP Nepal uses a combination of all of these: loans and micro credit for biogas plants are supported through a Biogas Credit Fund, a revolving fund of 3.5 million which is used to provide wholesale loans at an interest rate of 4 per cent per annum to MFIs, which the MFIs use to on-lend to farmers at a maximum of 14 per cent interest rate. Four types of MFIs are involved in extending credit to biogas users: Grameen Banks and their branches, cooperatives, financial intermediary NGOs and rural self-help groups or CBOs. These operate on a "credit-plus approach", providing credit through group collateral and a host of services, such as information and counseling. SELCO in India offers payment schedules that match the income streams of the target groups, which are developed in close association with the rural banks.

Micro financing for expanding energy access

The BSP experience shows that micro finance can play a critical role in making biogas plants affordable for the poor. AEPC, SNV and BSP-Nepal work together to develop capacity of the MFIs and help them expand their portfolio to include biogas plants, ensuring that the business is profitable to them. Capacity development includes training, orientation, and helping them build linkages with biogas companies. Currently around 30 per cent of the users take loans, mainly from MFIs to construct biogas plants, and this trend of availing loans from MFIs is on the rise. A similar experience was seen in Sri Lanka, where after an initial lackluster response to solar home systems, the markets for SHSs picked up with Sarvodaya Economic Enterprise Development Services (SEEDS), an MFI was brought in to provide micro credit for SHSs. SEEDS has financed around 44 per cent of all SHSs sold under RERED's predecessor, the ESD project, and about 63 per cent of credit sales under the RERED project (UNDP, 2011)[26].

In rural areas, providing small loans to dispersed consumers, however, entails high risks and transaction costs. In order to make financing for energy services for the poor a feasible option for financial institutions, there is a need to set in place mechanism to mitigate these risks and buy down the cost of financing. Several projects have set in place revolving funds that provide long-term concessional financing for operators to provide loans for energy services to the poor. Experience also shows that the functions of technology dissemination are best separated from credit provision, with technology suppliers focusing on installing, and maintaining technologies and the local financial institutions focusing on credit provision.

[26] Since 2002, the Government of Sri Lanka, with assistance from the IDA and the GEF, has been implementing RERED, the successor to the Energy Services Delivery Project (ESD), 1997–2002. The ESD and RERED projects have enabled energy access for over 134,000 households through solar home systems and village based micro hydro systems and added power generation capacity of over 120 MW to the national grid.

SELCO has adopted this approach in India as well as Viet Nam.[27]In order for this model to work, it is necessary to build the capacities of the MFIs in basic technical aspects of the energy product/ service; establish functional linkages between MFIs and technology suppliers; and to involve NGOs in mediating commercial bank credit and assisting in identification of beneficiaries, conducting of credit checks, and mediating for loans.

[27] In Viet Nam, SELCO coordinates with Vietnam Women Union (VWU) and Vietnam Bank of Agriculture and Rural Development (VBARD) to deploy generously "the project of electrification the countryside with solar energy" in 15 southern provinces.

SECTION II
UNIVERSAL ACCESS TO ENERGY BY 2030: PRESENT OPPORTUNITIES

6. Existing policy and implementation opportunities

The General Assembly designated 2012 as the "International Year of Sustainable Energy for All" – providing a much-needed opportunity to focus increased international attention on energy poverty, as well as on the affordable solutions and business models that exist and can be deployed at the global scale at global scale.[28] This was launched by the Secretary- General at the opening ceremony of the World Future Energy Summit 2012 in Abu Dhabi on 16 January 2012. As the General Assembly President Nassir Abdulaziz Al-Nasser stressed at the event, by declaring 2012 as the International Year of Energy for All, the Assembly established a key platform from which to raise awareness in the international community of the importance of addressing energy issues, finding ways to develop the renewable energy sector, and promoting efficient energy and water use and waste management. "As part of the International Year, which officially begins today, it is incumbent upon Member States and international organizations to take initiatives that are designed to create an environment that will foster access to energy and energy-related services and the use of new and renewable energy technologies." This momentum presents several opportunities for United Nations Member States, other stakeholders, national and the general public to engage in the process. Most recently, the importance of energy access was emphasized at the recently concluded United Nations Conference on Sustainable Development (Rio + 20), which was held from 20 to 22 June 2012 in Rio de Janeiro, Brazil.

Rio + 20.

In the Rio + 20 Outcome document, the heads of State and Government and high level representative recognize the critical role that energy plays in the development process, as access to sustainable modern energy services contributes to poverty eradication, saves lives, improves health and helps provide for basic human needs. It committed to facilitate support for access to these services by 1.4 billion people worldwide who are currently without them. Further planned actions include mobilizing adequate financial resources, so as to provide these services in a reliable, affordable, economically viable and socially and environmentally acceptable manner; support for implementation of national and subnational policies and strategies, based on individual national circumstances and development aspirations, using an appropriate energy mix to meet developmental needs, including through increased use of renewable energy sources and other low-emission technologies, the more efficient use of energy, greater reliance on advanced energy technologies, including cleaner fossil fuel technologies, and the sustainable use of traditional energy resources. Creation of enabling environments that facilitate public and private sector investment in cleaner energy technologies; improving energy efficiency, increasing the share of renewable energy and cleaner and energy-efficient technologies have also been highlighted.[29]

[28] See resolution 65/151 of 21 January 2011.
[29] See General Assembly resolution 66/288.

Sustainable Energy for All initiative[30]. In order to meet the goal of **"universal access to clean, affordable energy by 2030"**, one of high-level goals coming out of the report of AGECC, UN-Energy – a coordinating group of 20 United Nations agencies in partnership with the United Nations Foundation – has launched the Sustainable Energy for All initiative. This initiative will engage governments, the private sector, and civil society partners globally to achieve three major goals by 2030: ensure universal access to modern energy services; reduce global energy intensity by 40 per cent; and increase renewable energy use globally to 30 per cent. The campaign will focus on removing barriers to the effective delivery of energy services, and identify and disseminate best practices in this sector and foster strategic partnerships to promote energy access (see box 7). To help guide this initiative, the Secretary-General has appointed a high-level group of global leaders from business, finance, government and civil society to mobilize and facilitate commitments to action on the ground, in corporate board rooms, and in policy discussions around the world.

Box 7. Focus areas of the Sustainable Energy for All initiative

Electrification – Encourage renewable and low-carbon technologies to be deployed at scale to provide convenient and affordable energy through grid extension, creation of mini-grids, and off-grid household systems.

Clean Cooking Solutions – Through the Global Alliance for Clean Cookstoves, address market barriers in order to foster a thriving cookstove industry, with a goal of 100 million households adopting clean and safe household cooking solutions by 2020.

Bio-energy – Advance environmentally sustainable biomass solutions to provide energy from the land and support economic development.

Efficiency – Improve efficiency in energy generation, transmission, and end-use technologies to reduce costs and expand the availability of modern energy services to the poor

Seven sectoral Action Areas have been identified to address both power generation and the principle sectors of energy consumption. They include: Modern Cooking Appliances & Fuels; Distributed Electricity Solutions; Grid Infrastructure & Supply Efficiency; Large Scale Renewable Power; Industrial & Agricultural Processes; Transportation; and Buildings & Appliances. In addition, there are four enabling Action Areas that characterize cross-cutting mechanisms designed to support effective sectoral action and address existing obstacles. These are: Energy Planning & Policies; Business Model & Technology Innovation; Finance & Risk Management; Capacity Building & Knowledge Sharing.

As part of the Sustainable Energy for All, national Governments will design and implement integrated country actions that strategically transform their energy systems. To spur investment, action is needed to create national policy and financial environments that enable changes which the market alone will not deliver. This applies to both developing and developed countries, although the challenges to be overcome in each case may be substantially different.

So far, more than 50 Governments from developing countries have joined the SE4ALL initiative and have expressed an interest in advancing Sustainable Energy for All. The majority of these countries have initiated and many have completed rapid assessment to help determine the main challenges and opportunities in achieving the three goals of SE4ALL. These Rapid Assessment are laying the groundwork to scale up action in priority areas, undertake strategic reforms where needed, and attract new investments and financial support.

[30] http://www.sustainableenergyforall.org/

Energy Access Practitioner Network. As part of the Sustainable Energy for All Initiative, the United Nations Foundation has launched a new global Energy Access Practitioner Network. This group will to bring together practitioners from the private sector and civil society working on the delivery of energy services and solutions related to electrification in a range of developing country contexts to develop a more integrated approach to energy access planning and execution in support of the Sustainable Energy for All Target to achieve universal energy access by 2030. The Network will focus on both household and community level electrification for productive purposes, incorporating specific market-based applications for health, agriculture, education, small business, communities and household solutions. As part of this, the network members are working together to catalyse the scale-up of renewable and low-carbon technologies and spur the market toward universal energy access. The focus in particular is on the removal of market barriers to the effective delivery of energy services by promoting the adoption of new technologies and innovative financial and business models, as well as the identification and dissemination of best practices and advocacy in support of progress on the energy access target.

Global Alliance for Clean Cookstoves. GACC is a PPP led by the United Nations Foundation to create a thriving global market for clean and efficient household cooking solutions. The Alliance, launched in September 2010, has a goal "100" by "20", calling for 100 million households to adopt clean and efficient cookstoves and fuels by 2020. It is working with its public, private and non-profit partners to help overcome the market barriers that currently impede the production, deployment and use of clean cookstoves in developing countries. More than 350 practitioners and 11 expert Working Groups provide inputs to the Alliance. It has a three-pronged strategy comprising of enhancing demand, strengthening supply and fostering an enabling environment.

7. Imperatives for achieving universal energy access by 2030

7.1 Policy and strategic directions for expanding energy access

In addition to the needs for an increased level of financing, recent literature on energy access point to a number of policy imperatives and a number of functional partnerships that meeting universal energy access calls for (IEA 2011 and 2010c, UNDP 2011, Wesley 2011, Kaygusuz 2011):

- National governments must provide an enabling environment for expanding energy access at scale, which includes the following.
  - Adopting clear and consistent statement that modern energy access is a political priority; incorporating explicit energy access commitments into national development strategies in terms of national energy access targets and investments; and articulating their strategy, implementing measures and monitoring and reporting arrangements.
  - Creating a supportive investment climate to the private sector to invest in energy access by implementing strong governance and regulatory reforms and setting of standards for energy products and services.
  - Adopting a process of collaborative policymaking process, that includes the private sector as well as civil society organizations.
- Multilateral and bilateral institutions need to use their funds to do the following.
  - Leverage greater private sector involvement and encourage the development of replicable business models and energy service delivery models.
  - Support piloting and fine-tuning innovative energy access initiatives that incorporate good practices in energy service delivery and financing mechanisms, including those discussed in chapter 5.
  - Place additional focus on the difficult areas of access which do not initially offer an adequate commercial return.
  - Operate through local banks and microfinance arrangements, directly or through guarantees, and support the creation of local networks and the necessary capacity in energy sector activity.
  - Mobilize additional investment in universal access, above the $14 billion per year assumed in the New Policies Scenario, of $34 billion per year. The sum is large, but is equivalent to around 3 per cent of global energy infrastructure investment over the period.
- Countries and energy access programmes and projects must develop and put in place mechanisms for collection of robust, regular and comprehensive data to quantify the outstanding challenge on energy access and monitor progress towards universal energy access.

7.2 Electrification for expanding energy access: Strategic directions

IEA examined the rural electrification policies adopted by the four major emerging economies, Brazil, China, India and South Africa and concluded that the ingredients listed below are keys to the successful implementation of such policies. These results were also corroborated by the case studies discussed above and earlier reports (Barnes 2007, ESMAP/ World Bank 2008, Haselip et al 2011, IEA 2010c, Pereira 2010, World Bank 2011b, World Bank and Ausaid 2011).

- Ensure government commitment to electrification and long-term funding in order to guarantee implementation of electrification objectives, and the elimination of any misuse of electrification funds in favour of other objectives. Also ensure that funds are "ring-fenced", efforts are durable and electrification objectives are not interfered with according to politicians' personal agendas.
- Establish/ strengthen institutional structures that are independent from political agendas.
- A strong market infrastructure is necessary to attract private investors. For the private sector to participate especially in electrifying remote villages, governments must ensure the existence of a secure market infrastructure, as all electrification projects need to be viable in order to be sustainable.
- Policies and/or regulations including energy efficiency policies should be implemented alongside the electrification process to sustain long-term economic development. Policies in two specific areas are needed to complement rural electrification efforts: First, measures including complementary economic development programmes, alongside the provision of electricity in rural areas, should be introduced to foster business. Secondly, in parallel to the electrification process, the implementation of energy efficiency policies or measures such as the use of energy-saving appliances, simple demand-side management measures, or energy conservation in buildings, significantly reduce electricity demand. The Indian Bureau of Energy Efficiency (BEE), for example, has taken many energy conservation measures to control electricity consumption in parallel to the country's electrification efforts.
- Affordability of the poor for electricity is an issue to contend with. Recent studies show that (Oilchange et al 2011) rural households are willing to pay for access to energy services, but the hurdle of meeting the connection cost, which is often high, has to be dealt with, and spreading the connection costs over several years is a possibility. The second issue is that of tariff, which needs to consider at least three points:
    - First, contrary to what conventional wisdom would lead us to believe, to benefit the rural poor, electricity does not necessarily need to be sold at a very low price; facts often prove the contrary. In reality, richer communities will benefit more than the poorer ones since they can afford to buy electric appliances, which the very poor cannot. In addition, subsidies should be designed in such a way that only the poorest segments of society benefit from them, and not the better-off communities.
    - Second, if the "natural" price is charged, the electricity supplier will be able to effectively and sustainably supply electricity while making a profit that will ensure the sustainability of the electrification process (Barnes & Foley, 2004).

- Third, rural households are often able to pay for their electricity consumption. Involving these communities in the tariff-setting process will secure better and more adequate tariff systems.

- Effective metering, billing and payment recovery ensure the long-term viability of the electricity supplier and therefore of the electrification process as a whole. When meters do not function correctly, is not properly read or billing is incorrect, then the customer's actual consumption will not be paid for. Measures such as the creation of franchisees (India), the part-time recruitment of farmers for meter reading (China), or the use of prepaid meters (South Africa and Brazil) as well as stricter management rules (such as random controls) all help to improve the recovery of customer payment, a necessary condition for successful rural electrification efforts.
- Full involvement of the rural communities in the electrification efforts throughout the decision-making process increases their sense of ownership and brings support to utilities' efforts to encourage customers to use electricity wisely once they are connected.

7.3 Cooking fuels and improved cookstoves: Strategic directions

A recent review of international experiences on improved cookstoves yields several useful lessons from past experience (World Bank 2010b, GACC 2011, Foell et al 2011):

- The national government playing a major role gives credibility to programme activities, resulting in higher priority and recognition. A strong government backing and an organizational structure that allows government and programme staff to work in a coordinated way is essential for success. Engaging local government has benefits in effective awareness-raising, monitoring, increased coordination at the local level, and overall achievement of programme objectives.
- Training and capacity-building are essential components of such activities as awareness creation within communities and provision of monitoring services.
- Almost all programmes focused on developing private entrepreneurs, manufacturers, and energy service companies. Entrepreneurs and NGOs help in awareness-raising, establishing a commercial market, and providing after-sales services, which are key to the success of any programme.
- There is a need to have a wide range of efficient stove designs tailored to specific user requirements. These should have proven efficiency, the ability to reduce indoor air pollution, and good durability and safety.
- Investing in community mobilization instead of hardware, and shifting the focus from cookstove construction for individual households to the benefits of creation of well-ventilated homes can be an important factor in motivating people to buy improved stoves.
- The viability of the programme in the long term often depends on strong commercial approaches to promoting stoves. An important element of this being targeted marketing; stoves should be marketed to households facing fuelwood scarcity or high costs of purchasing wood as they are the most likely group to benefit from improved stoves.

- Performance monitoring for stoves should be an important component of any improved cookstove promotion programme, as perception of reduced kitchen smoke has been shown to be a motivating factor in consumer decision-making.
- Certification, quality control, and after-sales services are important factors for programme success. A transparent, regular certification process for stoves and promoters of stoves can be an important aspect for convincing users and generating demand.

7.4 Costs of meeting the targets: Financing requirements for universal energy access[31]

To achieve universal energy access to electrification, additional investment required is estimated to be about $640 billion between 2010 and 2030. To arrive at this estimate, the WEO assumes that grid extension as the most suitable option for all urban areas and for about 30 per cent of rural areas, but not a cost effective in more remote rural areas. Therefore, 70 per cent of rural areas are assumed to be connected either with mini-grids (65 per cent of this share) or with small, stand-alone off-grid solutions (the remaining 35 per cent).

Table 20. Additional financing for electricity access in the Energy for All case, 2010-2030

	Additional annual investment (S$ million)	People gaining access annually (million)	Level of household energy expenditure	Main source of financing	Other sources of financing
On-grid	11	20	Higher	Private sector	Developing country utilities
			Lower	Government budget	Developing country utilities
Mini-grid	12.2	19	Higher	Government budget, private sector	Multilateral and bilateral guarantees
			Lower	Government budget	Multilateral and bilateral concessional loans
Off-grid	7.4	10	Higher	Multilateral and bilateral guarantees and concessional loans	Private sector, government budget
			Lower	Multilateral and bilateral concessional loans and grants	Government budget

[31] IEA 2011

To achieve universal energy access to clean cooking, $74 billion of additional investment is required by 2030, representing nearly four times the level of the New Policies Scenario. While the largest share of additional investment in the region is for biogas systems, a significant proportion (about 24 per cent) is needed to provide advanced biomass cookstoves to 395 million people in rural areas. Developing Asia accounts for almost two-thirds of the total additional investment required for clean cooking facilities, the largest element ($26 billion) being for biogas systems, principally in China and India.

Globally, it is estimated that to ensure universal electricity access by 2030, out of a total generation requirement of 952 TWh, a staggering 60 per cent (or 572 TWh) will be provisioned via mini-grid and isolated off-grid technology (**DB Climate Change Advisors** 2010).

Table 21. Generation requirements for universal electricity access, 2030 (TWh)

	On-Grid	**Mini-Grid**	**Isolated Off-Grid**	**Total**
Africa	196	187	80	463
Sub-Saharan Africa	195	187	80	462
Developing Asia	173	206	88	468
China	1	1	0	2
India	85	112	48	245
Other Asia	87	94	40	221
Latin America	6	3	1	10
Developing Countries*	379	3,993	171	949
World**	380	400	172	952

* Includes Middle East Countries; ** Includes OECD and transition economies

Table 22 Additional financing for clean cooking facilities in the Energy for All case, 2010-2030

	Additional annual investment (US$ million)	People gaining access annually (million)	Level of household energy expenditure	Main source of financing	Other sources of financing
LPG	0.9	55	Higher	Government budget, private sector Private sector	Multi lateral and bilateral development banks, microfinance
			Lower	Government budget, multilateral and bilateral development banks	Private sector
Biogas systems	1.8	15	Higher	Private sector	Microfinance, government budget, multilateral and bilateral development banks
			Lower	Government budget, multilateral and bilateral development banks	Private sector, microfinance
Advanced biomass cookstoves	0.8	59	Higher	Private sector	Government budget, multilateral and bilateral development banks
			Lower	Government budget, multilateral and bilateral development banks	Private sector

Achieving modern energy access for all by 2030 would therefore require more than three times the expected level of investment in the New Policies Scenario, growing from $14 billion per year to $48 billion per year. This means that an additional $34 billion is needed every year, over and above investment what has already been reflected in the New Policies Scenario. The total required is more than five-times the estimated level of actual investment

in 2009. Nonetheless, the total investment required is a small share of global investment in energy infrastructure, about three per cent of the total.

7.5 Costing universal energy access in East Asia

More than one billion people in the East Asia and Pacific Region (EAP) still lack the most basic access to electricity and modern cooking solutions. A recent study that examined the way to achieve universal energy access in EAP looked at the challenge of providing for universal access to electricity and modern cooking fuels and advanced cooking stoves in EAP (World Bank and Ausaid, 2011).

In EAP, provided that government commitment is forthcoming, the main barriers to universal electricity access are limited institutional and implementation capacities, and low levels of affordability on part of the beneficiaries. Regarding modern cooking solutions, a major additional barrier is the lack of low-cost, reliable LPG supply and clean and advanced cookstoves that poor people can afford. In urban areas, the main challenge is to develop the infrastructure for modern cooking fuels, and will call for significant investments in importing and processing facilities for natural gas and LPG, in addition to investments in the electricity infrastructure. In rural areas, the major challenge will be to develop and market large numbers of advanced stoves that burn coal and traditional biomass.

In EAP, under the Business-as-Usual scenario, the number of households electrified would be approximately 39 million, and the required investments would be approximately $30 billion. The Business-as-Usual scenario still would leave approximately 21 million households without electricity access by 2030. Providing universal electricity access in EAP by 2030 would require the electrification of approximately 60 million households and an investment of approximately $56 billion. For clean cooking, under the Business-as-Usual scenario, the investment requirement would be approximately $16 billion by 2030. Under the Universal Access scenario for clean cooking, the total financing requirement would be approximately $22 billion by 2030. The additional investment for urban areas by the same year would be approximately $4 billion, and for rural areas approximately $2 billion.

The combined investments required for a scenario of “Universal Access” to electricity, modern cooking fuels, and advanced cooking stoves are estimated at $78 billion over the next 2 decades. This amount represents an increase of $32 billion over the amount required to maintain the “Business-as-Usual” scenario over the same period. The annual incremental investment needed for universal access is 0.1 per cent of the regional GDP, excluding China. Nevertheless, if most of the poorer EAP countries are to reach the goal of universal access to modern energy by 2030, they will require significant support from donors and multilateral institutions.

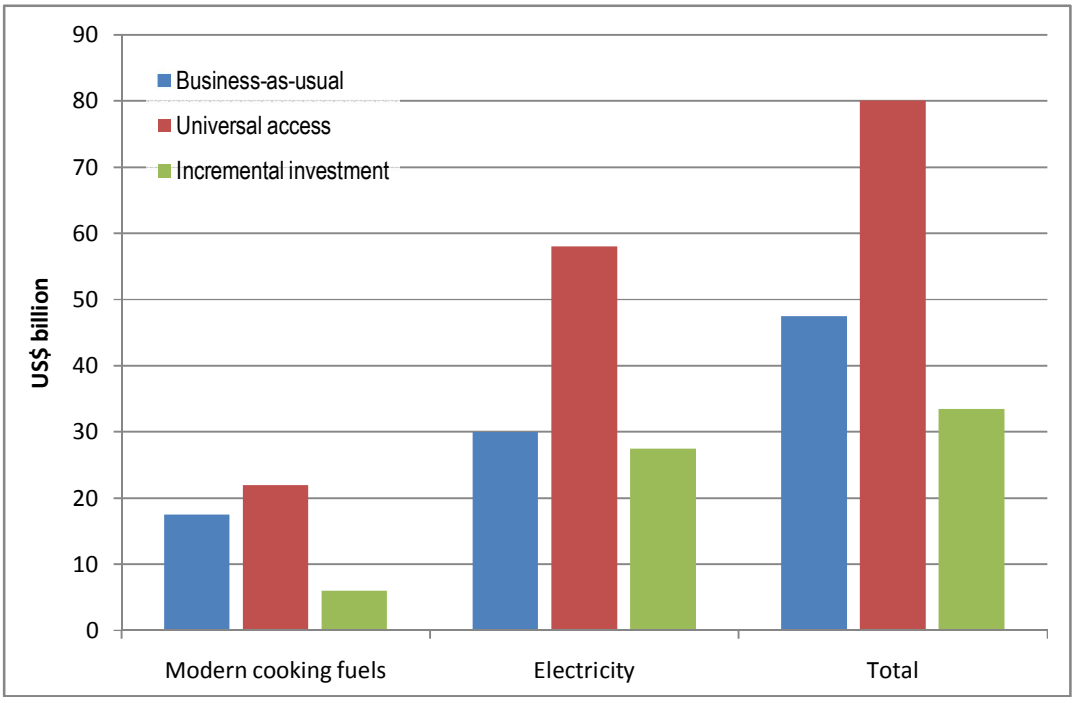

Figure 19. Investment requirements for universal access to electricity and modern cooking solutions in East Asia and the Pacific, 2011–2030

The role of International cooperation in expanding energy access

Based on the lessons learned from programmes (national and regional) to provide access to electricity and modern fuels, and in light of the present opportunities, a number of imperatives can be derived that will need to be met for universal energy access targets are to be met. This will call for a huge mobilization of efforts, investment commitments and partnerships at national, regional and international levels.

Engage national governments to make long- term policy commitments

As mentioned before, government commitment supported by financial allocations has proven to be the single most important enabler of expanding energy access. Several national governments have set targets for electrification, but only a few of them have set targets for clean cooking energy. Governments need to prioritize energy access, set aggressive national targets for universal access, and put in place plans and the enabling environment to deliver them. Successful large-scale electrification programmes, including those in Brazil, Fiji, India, the Philippines and Viet Nam, are underpinned by government targets and priorities that inform a rigorous planning process. These commitments and targets must form long-term policies and prevail through government changes. The necessary policies, programmatic capabilities, tariff structures and incentives to support these targets and participation from the private sector also need to be put in place. These policies will need to be translated rapidly into regulations and legislation.

Mobilize financing

Even though a large number of innovative financing mechanisms have been experimented with, past trends show that "external" project/ programme financing will be required in the foreseeable future, especially given the issues related to affordability and the fact that bulk of

the under- and un-served now form "bottom of the pyramid" consumers. The international community will need to provide financial support to developing countries for meeting the global universal energy access and energy efficiency goals. The IEA reference case estimates that it is possible to provide electricity access sufficient to meet the objectives of the MDGs to the vast majority of the world's energy poor in the next 20 years, for an average capital investment of about $35 billion per year.

In perspective, this investment requirement is not insurmountable. In 2010, despite the global economic recession, total investment in renewable energy reached an all-time high of $211 billion, more than seven times the figure invested in 2004 (REN21, 2011). In addition, global investment in new renewable energy generation capacity in 2010 exceeds that of new fossil-fuel based electricity generation, and for the first time, developing countries overtook developed countries in terms of investments in renewable energy (Haselip et al 2011).

Develop capacities to expand energy access at all levels

Effecting a multi-level and multi-stakeholder partnership calls for a massive capacity building drive at all levels, of local institutions for the provision of delivery, quality monitoring, finance, and operations and maintenance services. Such capacity development is needed in both the public and private sectors, and at all levels – national, subnational and community – and should leverage and build on the expertise and knowledge base that has been developed by multilateral institutions and international agencies.

Benchmark and track progress in achieving universal energy access

Energy access data availability at the national and subnational levels is a serious issue. In order to track progress and undertake comparisons in achieving universal energy access, it is imperative that credible databases are in place to map energy access levels between countries. As noted by the UNDP-WHO study of 2009 (UNDP and WHO 2009), in the present scenario, statistical data collected on energy access are often not directly comparable from one country to another. First, within a country, different estimates may exist for the same indicator. At the same time, the data collected from national governments are based on the country's own definitions, methods, and coverage, which may differ from country to country. For instance, definitions of what constitutes a rural or urban area may differ; data from national surveys will depend on the sample selection; data from national utilities do not include illegal connections, but data from surveys may include them; and some data are based on the proportion of households with energy access, while others reference the proportion of the population with access. All of these factors make cross country comparisons as well as inter-temporal tracking difficult.

Improve efficiency of operations

Improving the performance of public utilities will be critical for the success of expanding the grid and achieving the universal access target, since utilities in developing countries often have technical losses four or five times higher than their counterparts in developed countries. Expertise from the private sector in the developed and developing world needs to be leveraged to drive these utility improvements.

8. Way Forward to the Asia-Pacific-Energy-Forum: An agenda for action

The September 2011 EGM discussed the upcoming Asian and Pacific Energy Forum and agreed as a key desired outcome a "ministerial declaration" with a renewed political commitment and statement to enhance both energy security and the sustainable use of energy through regional cooperation. Participants offered suggestions to the secretariat for possible inclusion in the agenda for the Forum. This section presents suggestions on priority areas of action for international cooperation. It also presents a road map for ESCAP towards the preparation of the event for the next year, specifically focused on the area of energy access.

8.1 An initiative to measure, benchmark and monitor progress on energy access

Defining energy poverty metrics and respective targets is a complex task. As of now, each country measures certain parameters of energy access, independently, with no common methodology being utilized. International analyses have so far been using the data available at national levels for comparisons, in spite of the fact that there may actually be little consistency between data collected and reported by individual countries. At this point, several agencies including those already involved in this area, such as ESMAP, UNDP, WHO, UN Energy, UNIDO, IEA, the United Nations Foundation and the Global Village Energy Partnership (GVEP).

It is proposed that a systematic process of data collection, analysis and publication for energy access in the Asia and the Pacific be launched. This exercise would provide the much needed baseline on energy access in various countries, develop credible "energy road maps" and structures to reduce dependency on fossil fuel and allow for intertemporal comparisons to evaluate the progress towards universal energy access over time.[32] As such, given the Asia-Pacific region's diversity, it is difficult to set benchmarks to define a uniform "energy access" for the entire region, and a multidimensional and multipartner approach for defining, analysing and measuring access to energy will need to be employed. Based on a common method, quantification of targets can be based on subregional or country specific studies.

Among those available, MEPI as a composite indicator and the Practical Action's Energy Access Index are good starting points. At the national level, data collection and measurement need to be tied to or aligned with central statistics offices. Steps involved for such a process include the following.

- Finalizing a theoretical framework
- Developing data-gathering systems and development of a "tool kit" that permits a range of additional statistical analysis that provides supplementary policy guidance.
- Piloting a measurement and reporting programme in 5-7 countries. This would provide valuable insights into data gaps, data gathering techniques, appropriateness and usefulness of various indicators and proxies, training needs, institutional requirements, useful reporting formats, how best to support national policies, and the role of international cooperation.

[32] Developing credible "energy road maps" and structures to reduce dependency on fossil fuel was identified as a priority area at the Expert Group Meeting on Sustainable Energy Development in Asia and the Pacific, convened by ESCAP on 27-29 September, 2011, Bangkok.

- Training of national data collection agencies
- Organizing data collection and annual reporting. This can also serve as a basis for training and capacity development in the energy sector in the Asia-Pacific countries.

8.2 Create a database on energy services for livelihoods, including motive power

While some data on household electrification and cooking are available in most countries, data on energy services for income generation are mostly not collected systematically. Energy statistics do not show agricultural activities as major energy consumers in rural areas, mainly because the energy involved in them consists largely of human and animal labour. Modern energy services essential to increase agricultural productivity and income invariably substitute the labour content of production, a fact that is frequently overlooked in traditional approaches to rural energy analyses (Kaygusuz, 2011). As far as other rural industries are concerned, available definitions of rural industries vary by country according to the criteria employed, such as the size of capital invested, strength of the labour force employed, production volume and the use of modern energy sources. The energy needs of rural industries comprise lighting, process heat, and motive power. Lighting requirements are invariably met by electricity in electrified villages and by kerosene in unelectrified villages, on which some data are available. However, in informal, micro enterprises, such as village-based blacksmithy, brickmaking and charcoal manufacturing and agro-based facilities, such as crop drying and rice milling, the principal supply sources for process heat are fuelwood and biomass, on which systematic data collection processes are seldom in place. A systematic study on energy services for livelihoods is timely and would be useful to fill this gap.

8.3 Promote regional cooperation through systematic documentation and sharing of innovative processes and practices in energy access

Issues and challenges surrounding energy access are well established, and in response, a large number of energy access projects and programmes continue to be implemented. There are several good *models* available within the Asia-Pacific region. Some of these are expanded into large- scale programmes, but the majority remain as "islands of success". Documentation of good practices has been undertaken by several agencies, most recently the UNDP report on "Towards an Energy Plus approach for the poor" (UNDP, 2011). It is suggested that a database of good practices on expanding energy access for the poor and to map regional and national initiatives in Asia and the Pacific be developed. Given the breadth of the experience in the region, an information hub on good practices could be useful in establishing the links between various existing centres, networks and organizations.

8.4 Facilitate interministerial dialogue

Expanding energy access calls for coordinated action by many stakeholders. Most importantly, it requires coordination between different ministries within the national governments. To make any programme successful and reach the intended beneficiaries, it has to be coordinated at all levels. For example, a clean cookstoves programme is likely to have a multiplier effect if the ministries of renewable energy, women and health streamline their interventions in this field. Similarly, any interventions dealing with biomass energy need concerted actions from the ministries of energy, forests as well as environment. It is suggested that at the national level, a process of interministerial dialogue be initiated, in which common areas of work can be identified to maximize the overall impacts on energy access for the poor.

8.5 Capacity development initiative

As mentioned before capacity development will need to be undertaken in several areas. Two specific areas for focus are as follows:

- Capacity development of national policymakers to help translate the stated political support towards energy access and renewable energy into tangible initiatives by, among other things, establishing linkages with other development priorities (such as, health). This builds on ESCAP's previous work on developing guidelines to assist national energy and rural development planners and policymakers in introducing an integrated approach to energy and rural development policies and programmes, subsequent development of training material for the same, their adaption to national contexts and piloting these in selected countries (ESCAP, 2003) and

- Development of a database and monitoring of performance in energy access (described above)

8.6 Promoting regional cooperation and connectivity in the oil strategy[33]

Expansion of LPG at scale is seen as one of the solutions to the Universal energy access challenge (IEA, UNDP and UNIDO 2010a). At the same time, a large number of people in both rural and urban areas rely on kerosene oil, as a transitional fuel, with the national governments subsidizing their use.[34] In the region, oil has been an important primary energy source in the region, and is likely to continue to remain so in the future as well. In the future, it is expected that the transport sector will be the primary reason for an increased demand for oil, however, higher oil prices are likely to increase production costs for many goods and services, and thereby put pressure on price levels generally. At the same time, it is expected that improving the efficiency of operations in the oil sector hence will have a huge impact on saving money, enhancing results and delivering more services for those without access.

Give this reality, a regional strategy for managing oil reserves has been suggested by the East West Centre (Wu et al 2011), the main elements of which are as follows:

Build up strategic oil stocks: One of the most obvious approaches to preventing supply disruptions is to develop or augment strategic stocks of oil. As members of IEA, a specialized agency within OECD, Australia, Japan, New Zealand and the Republic of Korea maintain mandatory stocks of oil equivalent to at least 90 days of net oil imports. While China has developed its first batch of strategic storage facilities and the programme for India is under way, other countries in the region are much more exposed to supply shortages. A bottleneck likely to be faced by majority of the countries in the region is the high cost of constructing and maintaining oil storage facilities, an area which calls for of international assistance or cooperation among neighboring countries.

Strengthen regional cooperation: One practical way to cooperate is to coordinate the maintenance of emergency stockpiles among countries in the region. The benefits of a coordinated effort may justify establishing a mechanism for more-affluent countries in the

[33] Adapted from Wu et al 2011, Wu et al 2008 and IEA 2011

[34] In India, 39% of rural households use kerosene (Government of India 2010). On an average, a rural household receives six hours of electricity supply from the grid during the off-peak period (usually afternoon and night). In order to meet this shortfall, a rural household uses at least one kerosene lamp as a backup for at least four to five hours during peak hours of the evening.

region to provide some initial financial assistance to their less-affluent neighbors. Another potential area of cooperation is collective bargaining to obtain lower prices and better terms on oil imports from the Middle East. This concept has been widely discussed, but no collective-bargaining arrangement has yet been formulated because of concerns about a negative response from oil-exporting nations.

9. Working towards the Asian and Pacific Energy Forum

On the issue of energy access, the proposed primary objective of the Asian and Pacific Energy Forum is "to promote greater understanding of the issues surrounding energy access for the poor; to work towards a renewed focus on energy access as a key outcome of the Forum and to promote the inclusion of energy access initiatives in national plans for achieving the Millennium Development Goals".

Specific Objectives:

- To raise awareness of the importance of energy access in efforts to promote regional and national energy policies at policymaking levels.
- To advocate for a renewed focus on energy access strategies for the poor, reflected in the policy outcome documents/declaration of the Asian and Pacific Energy Forum.
- To provide country-specific inputs and recommendations to governments on energy access issues.

A number of areas for action are suggested for ESCAP in this section, some of which will require deliberations at the highest level, however, there are other low hanging actions, which can be quite effective. As indicated in the next section, developing a credible database on energy access is one such action. Most importantly, the run-up to the Forum must be focused on building a consensus on the importance of the issue of energy access for the poor.

9.1 Policy and action agenda note

Using this assessment report as a basis, to develop a policy and action agenda note on energy access, which can be used as a tool for advocacy at the Forum and afterwards at national and subnational levels. The note should describe how energy access can be adequately and realistically integrated into the planning, budgeting and implementation processes of national and local governments, and from experts and stakeholders in specific countries on how those linkages can be addressed by government policies in order to help meet national objective for poverty reduction, development of economic enterprises, and improvements in health, education and social equity. A suggested outline for this note is presented in annex 3.

9.2 Preparatory meeting for the Asian and Pacific Energy Forum

It is suggested that prior to the Asian and Pacific Energy Forum, senior government official and others who can influence national policies be brought together for a high-level consultation on the integration of energy access issues into national development strategies. The policy consultation can share concrete evidence/examples from developing countries to demonstrate successful energy access strategies and their contribution to poverty reduction and on all MDGs. It should also inform policymakers about ways to develop such strategies, policies and programmes in a more systematic, cost-effective and culturally harmonious manner. Potential participants include

- Energy policymakers and senior administrators in the energy sector and those who advise policymakers

- Senior administrators in relevant other sectors, such as poverty reduction, women's development, agricultural/rural development, water supply and health, small and medium enterprise development, and financing/micro-financing

- Representatives of energy financing institutions, donor agencies, and individuals involved in intergovernmental policy processes

- Research/training institutions or policy think tanks that feed into government decision making processes

Specific issues for discussion include the following:

- What is the emerging energy and poverty scenario, including persistent challenges in addressing energy poverty in developing countries? What are the existing opportunities to influence policies?;

- What information do policymakers need to address these issues? What concrete actions are being sought from governments, donors, the energy industry and the international energy community?;

- What actions and commitments can the group make ahead of and beyond the Asian and Pacific Energy Forum?

Based on the outcomes of the preparatory meetings, the production of priorities for action (less than 1000 words) can be presented for deliberations at the Forum in 2013.

9.3 Discussions at the Asian and Pacific Energy Forum

The Asian and Pacific Energy Forum will provide an international platform for discussions about energy's role in sustainable development. By facilitating the dissemination of country-level inputs from select energy access practitioners that can be presented to delegates and incorporated into the negotiations, together with a strategic analysis of their conclusions and policy recommendations, the proposed publications (policy and action agenda note and priorities for action) will add specificity and authenticity to advocacy efforts and policy recommendations on energy access, help to raise these issues more effectively at the Forum, and increase the likelihood of concrete national actions on energy access resulting from the international discussions. They will also boost the influence and participation of national and local experts in the Forum processes. It is clear that in addition to national governments, other regional and subregional stakeholders like ASEAN (Association of Southeast Asian Nations), SAARC (South Asian Association for Regional Cooperation), SPC (Secretariat of the Pacific Community), EURASEC (Eurasian Economic Community), and other subregional organizations will need to be engaged in the process, in addition to international organizations, such as UNDP, UNIDO, FAO, UNEP, World Bank, ADB and IEA.

9.4 Conclusions and recommendations

In the Asia-Pacific region, almost two billion people are dependent on the traditional use of biomass and close to 700 million have no access to electricity. Among the various prevalent options, grid-based electrification has so far been the most widely used option, with renewable energy options accounting for a very small proportion. In the cooking and heating sectors, especially among rural households, biomass accounts for more than 30 per cent of total energy consumption in many developing countries, and in some Asia-Pacific countries its share stands as high as 95 per cent. Traditional use of biomass for cooking and heating has serious impacts on the health and well-being of people, especially of women and children. However, despite its relevance, cooking energy has attracted relatively less attention from policymakers. In 2009, while a majority of countries had set ambitious targets for reaching electricity to its people, few had set targets for improved cooking fuels.

With the existing policies, the future scenario is not likely to very different. In 2030, one billion people globally are still likely to be without electricity. The number of people without access to electricity in developing Asia is likely to decrease by almost 45 per cent, from 675 million people in 2009 to 375 million in 2030. In developing Asia, the number of people without access to clean cooking facilities will decline from 1.9 billion in 2009 to around 1.7 billion in 2030.

The General Assembly designated 2012 as the "International Year of Sustainable Energy for All". Three goals have been set to be achieved by 2030: ensure universal access to modern energy services; reduce global energy intensity by 40 per cent and increase renewable energy use globally to 30 per cent. International cooperation has a huge role in achieving this target for 2030, and needs to play the following roles:

- Engage and support national governments to make long term policy commitments, backed by explicit targets and financial allocations for energy access;
- Mobilize financing to the tune of an annual capital investment of $35 billion per year;
- Develop capacities to expand energy access at all levels: subnational, national and regional;
- Benchmark and track progress in achieving universal energy access, building a credible database on energy access in the region;
- Assist countries to improve efficiency of operations, especially those of public utilities and incorporate good practices in energy service delivery and financing within access projects and programmes.

In working towards achieving these targets, the following actions are recommended in working towards APEF:

- Launch an initiative to measure, benchmark and monitor progress on energy access;
- Create a database on energy services for livelihoods including motive power;
- Undertake documentation of innovative processes and practices in energy access and setting up of an information hub on good practices can prove useful in establishing the links between various existing centers, networks and organizations;
- Capacity development of national policymakers to help translate the stated political support towards energy access into concrete actions;

- Promote a regional oil strategy, including working towards building up and maintaining oil storage facilities, and coordinate the maintenance of emergency stockpiles among countries in the region.
- Facilitate interministerial dialogues at national level to maximize the impact of energy access interventions;
- Develop a policy and action agenda note on energy access, which can be used as a tool for advocacy at APEF and afterwards at national and subnational levels;
- Conduct a preparatory meeting for APEF, with participation from senior government officials and others who can influence national policies, sharing concrete evidence from developing countries to demonstrate successful energy access strategies and their contribution to poverty reduction, and inform policymakers about ways to develop such strategies, policies and programmes in a more systematic, cost-effective and culturally harmonious manner.

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Annex 1. Energy consumption patter n in selected Asia-Pacific countries

	% of population with access to modern fuels	% of rural population with access to modern fuels	% of population relying on solid fuels for cooking that use improved stoves	Percentage of households with access to electricity
Afghanistan	12.0	3		1.4
Bangladesh	8.8	0.6	2.1	41
Bhutan	56.9	40.6		68.5
Cambodia	7.5	3.4	6.7	24.0
China	42.0	25.5	73.2	99.4
Fiji	52.0			60.0
India	28.8	9.5	8.3	64.5
Indonesia	45.6	22.5	5.1	64.5
Lao People's Democratic Republic	2.6	0.2	12.4	55.0
Malaysia	96.7	95.3	6.5	99.4
Maldives	81.9			100.0
Mongolia		1.8	99.1	67.0
Myanmar	3.4	0.1	4.8	13.0
Nepal	16.2	7.3	6	43.6
Pakistan	32.3	9.8	14.7	57.6
Papua New Guinea	13.0			10.0
Philippines	49.4	29.5	16.1	86.0
Republic of Korea	99.9	99.5		100
Samoa	18.6			97.0
Solomon Islands	7.4	2		14.4
Sri Lanka	19.5	13.5	41.2	91[35]
Thailand	63.1	52.7		99.3
Timor-Leste	95.0		95.7	22.0
Vanuatu	14.5	4.6	6.1	19.0
Viet Nam	34.0	20.4	22	76.0

Source: UNDP 2009.

[35] Data for 2011, source: Central Bank of Sri Lanka, Annual Report, 2012

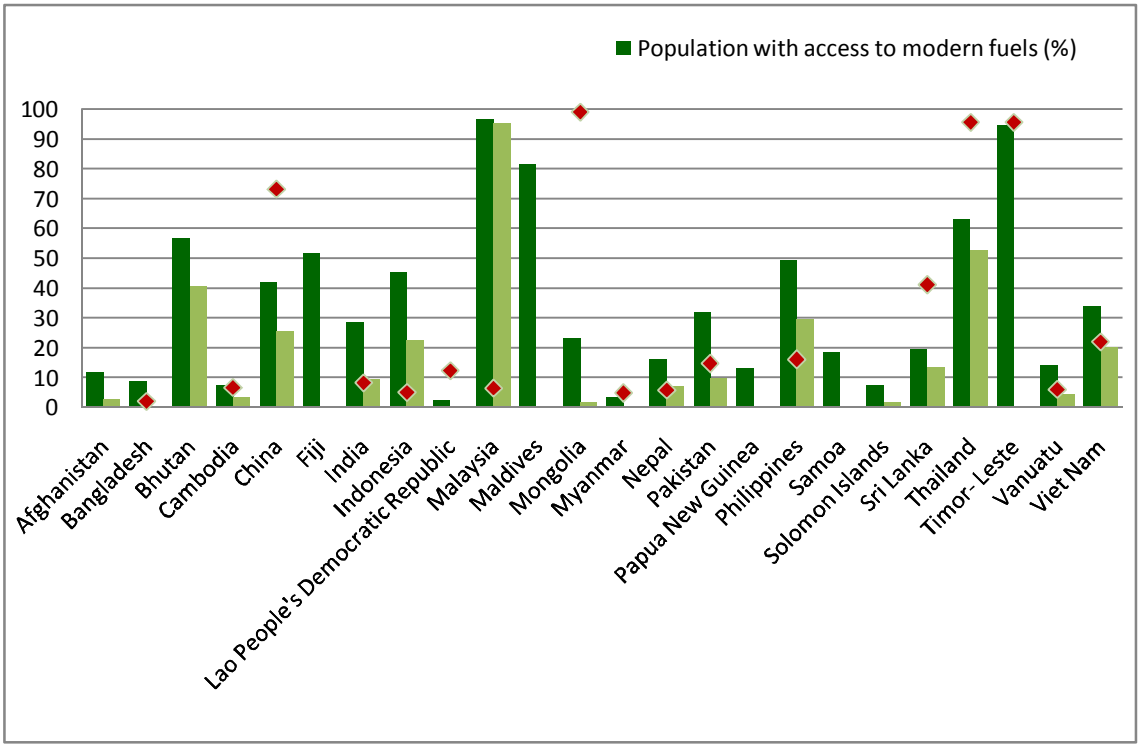
Annex 2. Production, trade and consumption of commercial energy
(in thousand metric tonnes of coal equivalent and kgs per capita)

Country or area	Primary energy production					Imports	Exports
	Total	Solids	Liquids	Gas	Electricity		
World	15528465	4977546	5780386	3986522	784010	6498213	6511936
Asia	6943390	3024859	2469768	1241670	207093	2608117	2516169
Afghanistan	600	500		5	95	2519	
Bangladesh	25236	612	106	24327	191	6095	231
Bhutan	908	49			860	136	685
Cambodia	6				6	2177	
China	2592809	2120934	273493	108446	89936	452735	67973
Cook Islands						34	
Democratic People's Republic of Korea	30306	28775			1531	1321	3002
Fiji	57				57	682	48
India	577088	452095	54775	54797	15421	308256	58238
Indonesia	418830	255408	77960	83633	1829	53514	267916
Iran	517076	1174	330462	184528	913	19844	206885
Iraq	169026		167139	1490	396	12744	134970
Japan	51998		1052	5439	45507	557940	24518
Kiribati						29	
	22077	1655	356	1068	18998	317402	51539
Lao People's Democratic Republic							
Malaysia	131007	2138	48079	79929	861	42678	65787
Mongolia	8845	8845				1136	4347
Myanmar	18578	1217	1385	15462	514	685	12166
Nepal	398	16			382	1665	
Pakistan	57678	2352	5050	46470	3806	30764	1138
Papua New Guinea	3344		2878	361	105	1501	2771
Philippines	12376	3124	1567	5204	2481	23171	3053
Republic of Korea	1030	591			439	304	384
Sri Lanka	480				480	5483	
Thailand	70038	11457	22230	35493	859	85703	18091
Timor-Leste	10597		10597			88	10487
Vanuatu	2				2	56	
Viet Nam	83308	43715	24639	11271	3683	20316	46927

Annex 3. Draft policy and action agenda note on energy access

Energy services make possible basic human needs to be met: cooked food, comfortable living temperatures, lighting, use of appliances, piped water, modern health care, educational and communication aids and swift transportation. Energy is essential for production, income, and employment generation in agriculture, manufacturing, commerce and service industries. However,

- Globally, more than 1.3 billion people are without access to electricity and 2.7 billion people are without clean cooking facilities. More than 95 per cent of these are either in sub-Saharan Africa or developing Asia (IEA 2011).
- In South Asia, some 50 per cent of the rural population or more than 300 million people have no access to electricity (Zomers et al 2011).
- Poor people in developing countries spend up to a third or a quarter of their cash income on meeting their energy needs.
- 2 million lives—mostly women and children—are lost annually, resulting from exposure to indoor biomass cooking smoke (World Bank 2011a)



Not having access to energy services means

- not being able to keep shops open in the evenings,
- the fear of accidents when children read with kerosene wick-lamps,
- in majority of cases, ending the day with sundown.

Access to modern energy: "A household having reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time to reach the regional average".

-World Energy Outlook 2011

Multidimensional Energy Poverty Index: A multi dimensional mapping of energy poverty in Asia Pacific

The Multidimensional Energy Poverty Index (MEPI) is a metric to measure and report on energy poverty, which combines supply-side input-oriented data with aspects related to the quality of energy services delivered and/or their reliability, as well as to the notion of affordability.

Calculating MEPI for Asia and the Pacific: Dimensions and variables used

Dimension	variable	Indicator (weight)
Cooking	Type of cooking fuel	Population without access to modern fuels (0.3)
	Exposure to indoor air pollution	Population relying on solid fuels and not using improved stoves (0.1)
Lighting and electricity- based services	Access to electricity	Population without access to electricity (0.4)
	Telecommunication and access to information services	Population without telephone (0.1)
		Population without access to internet (0.10)

Investments in expanding Energy access: Current and future

- In 2009, some 9.1 billion was invested globally in extending access to modern energy services, supplying 20 million people with electricity access and seven million people with improved cookstoves. This was sourced from multilateral organizations (34 per cent), domestic government finance (30 per cent), private investors (22 per cent) and bilateral aid (14 per cent).
- Between 2010 and 2030, in the New Policies Scenario,[1] $296 billion will be invested in energy access between, an average of $14 billion per year.
- To provide universal modern energy access by 2030, a cumulative investment of $ 1 trillion is required, an average of $48 billion per year, more than five-times the level in 2009.
- At present, energy access funding tends to be directed primarily toward large-scale electricity infrastructure, which does not always reach the poorest households.
- Achieving universal access by 2030 would increase global electricity generation by 2.5 per cent. Demand for fossil fuels would grow by 0.8 per cent and CO2 emissions go up by 0.7 per cent.

Source IEA 2011

MEPI for select Asia-Pacific countries

Country	Population without access to modern fuels (%)	Population relying on solid fuels and not using improved stoves (%)	Population without access to electricity (%)	Population without telephone (%)	Population without access to Internet (%)	**MEPI**
5-Variable						
weightage	0.3	0.1	0.4	0.1	0.1	
Bangladesh	91.2	97.9	59	71	96.3	**0.775**
Cambodia	92.5	93.3	76	71	98.7	**0.845**
China	58	26.8	0.6	26	65.7	**0.295**
India	71.2	91.7	35.5	66	92.5	**0.606**
Indonesia	54.4	94.9	35.5	25	90.9	**0.516**
Lao People's Democratic Republic	97.4	87.6	45	65	93	**0.718**
Mongolia	76.8	0.9	33	26	89.8	**0.479**
Myanmar	96.6	95.2	87	98	99.8	**0.931**
Nepal	83.8	94	56.4	83	93.2	**0.747**
Pakistan	67.7	85.3	42.4	44	83.2	**0.585**
Philippines	50.6	83.9	14	20	75	**0.387**
Sri Lanka	80.5	58.8	9	0	88	**0.424**
Thailand	36.9	4.3	0.7	0	78.8	**0.197**
Vanuatu	85.5	93.9	81	80	92	**0.846**
Viet Nam	66	78	24	0	72.4	**0.444**
4-Variable						
weightage	0.4	0	0.4	0.1	0.1	
Bhutan	43.1		31.5	59	86.4	**0.401**
Fiji	48		40	14	99	**0.417**
Maldives	18.1		0	0	71.7	**0.126**
Papua New Guinea	87		90	90	98.7	**0.810**
Solomon Islands	92.6		85.6	93	95	**0.808**

Imperatives for meeting the universal energy access targets: Policy and strategic directions

- National governments must provide an enabling environment for expanding energy access at scale, which includes the following:
  - Adopting clear and consistent statement that modern energy access is a political priority; incorporating explicit energy access commitments into national development strategies in terms of national energy access targets and investments; and articulating their strategy, implementing measures and the monitoring and reporting arrangements.

- Creating a supportive investment climate to the private sector to invest in energy access by implementing strong governance and regulatory reforms and setting of standards for energy products and services.
- Adopting a collaborative policymaking process that includes the private sector as well as civil society organizations.

- Multilateral and bilateral institutions need to use their funds to do the following:
  - Leverage greater private sector involvement and encourage the development of replicable business models and energy service delivery models.
  - Support piloting and fine-tuning innovative energy access initiatives that incorporate good practices in energy service delivery and financing mechanisms.
  - Place additional focus on the difficult areas of access which do not initially offer an adequate commercial return.
  - Operate through local banks and microfinance arrangements and support the creation of local networks and the necessary capacity in energy sector activity.
  - Mobilize additional investment in universal access, above the $14 billion per year assumed in the New Policies Scenario, of $34 billion per year, a sum equivalent to 3 per cent of global energy infrastructure investment over the period.
- Countries and energy access programmes must put in place mechanisms for collection of robust, regular and comprehensive data to quantify the outstanding challenge on energy access and monitor progress towards universal energy access.

What is the role of International Cooperation in Expanding Energy Access?

- Engage and support national governments to make long-term policy commitments, backed by explicit targets and financial allocations for energy access, and to develop enabling frameworks in terms of regulations, legislation, tariff structures and incentives to support these targets and participation from the private sector and programmatic capabilities.
- Mobilize financing to the tune of an annual capital investment of $35 billion per year.
- Develop capacities to expand energy access at all levels: subnational, national and regional.
- Benchmark and track progress in achieving universal energy access, building a credible database on energy access in the region.
- Assist countries to improve efficiency of operations, especially public utilities and incorporate good practices in energy service delivery and financing within access programmes.

Areas of action for ESCAP and the APEF

Energy Access Objective at the APEF: "To promote greater understanding of the issues surrounding energy access for the poor; to work towards a renewed focus on energy access as a key outcome of APEF and to promote inclusion of energy access initiatives in national plans for achieving the Millennium Development Goals"

- Launch an initiative to measure, benchmark and monitor progress on energy access, including helping countries develop credible "energy access road maps" and allow for intertemporal comparisons to track the progress towards universal energy access.
- Create a database on energy services for livelihoods including motive power
- Facilitate interministerial dialogues at national level to maximize the impact of energy access interventions
- Promote regional sharing of good practices through systematic documentation of innovative processes and practices in energy access and setting up of an information hub on the same.
- Capacity development of national policymakers to help translate the stated political support towards energy access into concrete actions.
- Promote a regional oil strategy, including working towards building up and maintaining oil storage facilities, and coordinate the maintenance of emergency stockpiles.