



ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Special Body on Least Developed and Landlocked Developing Countries

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**INTERCOUNTRY ENERGY COOPERATION TO ENHANCE ENERGY SECURITY FOR  
SUSTAINABLE DEVELOPMENT AND TO WIDEN ACCESS TO ENERGY SERVICES  
IN LEAST DEVELOPED AND LANDLOCKED DEVELOPING COUNTRIES**

(Item 4 of the provisional agenda)

*Note by the secretariat*

**SUMMARY**

The volatility of oil prices has highlighted the importance of energy security to many least developed and landlocked developing countries, particularly those that are heavily dependent on imported oil. Many least developed countries also utilize traditional energy sources, such as biomass, to meet the energy needs of a large proportion of the population. Although only some countries, particularly landlocked developing countries, have fossil fuel energy resources, all have renewable energy resources that, when developed in modern form, can reduce dependency on fossil fuels or energy imports. Opportunities exist for least developed and landlocked developing countries to work together to supplement their national efforts to improve energy security and energy services in an efficient and cost-effective manner. In addressing energy security in the Asian and Pacific region, the Commission at its sixty-second session noted that the region had considerable potential for improving energy cooperation and creating region-wide energy infrastructure. The present document reviews the energy supply and demand in the region, especially least developed and landlocked developing countries, and identifies the potential role of intercountry cooperation to supplement their national efforts to enhance energy security. The document discusses energy security issue from two perspectives: (a) energy infrastructure for sustainable development, including widening access to energy services for poverty reduction; and (b) enhanced intercountry cooperation for energy trade or exchange through coordinated planning and development.

The Special Body may wish to consider the points raised in the present document in their deliberation on energy security issues and suggest a future course of action.

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## I. INTRODUCTION

1. In recent months, the price of oil has eased from a peak of over US\$ 78 to below US\$ 60 per barrel. However, energy security continues to be a major concern in the Asian and Pacific region stemming from the high and volatile oil/energy price. This has put considerable pressure on the oil-importing least developed and landlocked developing countries of the region.

2. Economic growth in the Asian and Pacific region has been impressive in recent years, and this trend has also been observed in most of the least developed and landlocked developing countries. Economic growth in least developed countries as a group grew by 6.1 per cent in 2004, and many landlocked developing countries experienced growth of between 7 and 11 per cent in 2004.<sup>1</sup> Due to the strong economic growth and considerable unmet energy demand from the poor, energy demand growth is likely to remain high in the near future.

3. Policymakers are gravely concerned about how to ensure adequate supply of and access to energy for economic and social development so that the lack of energy does not pose a threat to meeting socio-economic objectives. Though a few least developed countries, such as Bangladesh, Myanmar and Timor-Leste, are blessed with varying amounts and types of fossil fuel resources, along with some landlocked developing countries, such as Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan, many others do not have fossil fuel resources and rely on traditional fuels or imported energy. Countries such as Afghanistan, Cambodia, Maldives and Nepal as well as all Pacific small island developing States are heavily dependent on imported energy.

4. Although the primary responsibility to address the energy security lies with the countries themselves, intercountry cooperation could supplement national efforts in addressing issues related to energy supply and demand as well as the efficient distribution of energy resources. The Commission at its sixty-second session noted that the region had considerable potential for improving energy cooperation and creating region-wide energy infrastructure.

5. Cooperation could take many forms, ranging from technology transfer and knowledge sharing to energy trade and policy coordination. It could help promote a coordinated planning and development approach for the mutual benefit of trade and exchange, which could lead to the integration of energy infrastructure aimed at facilitating the supply of energy to final consumption destinations beyond national boundaries. Moreover, given the abundance of renewable energy in all of the least developed and landlocked developing countries, regional and subregional cooperation could contribute to the accelerated development of these resources through the sharing of experiences, technology and research outcomes.

6. The present document reviews the energy supply, demand and trade situation in the region in general and in least developed and landlocked developing countries in particular, and highlights the

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<sup>1</sup> ESCAP, *Economic and Social Survey of Asia and the Pacific 2006* (United Nations publication, Sales No. E.06.II.F.10).

potential role of intercountry cooperation to supplement the national efforts of those countries to enhance energy security. It analyses the energy security issue from two perspectives: (a) energy infrastructure for sustainable development, including the widening of access to energy services for poverty reduction; and (b) enhanced intercountry cooperation for energy trade or exchange through coordinated planning and development. The opportunities, benefits and possible issues related to energy cooperation with least developed and landlocked developing countries are also briefly discussed. With respect to energy infrastructure for sustainable development, the issues to be considered could include selecting appropriate infrastructure to meet the unmet and growing demand for energy, along with strengthening weak and replacing old infrastructure, which would provide efficiency and cost savings. The resource mismatch among various least developed and landlocked developing countries, along with the variation between technical capacity and knowledge among countries, could lead to energy cooperation for resource and knowledge transfer and trade.

7. While the present document covers least developed and landlocked developing countries collectively, they are often discussed separately due to the wide variation between the geographical, historical and socio-political factors affecting the countries' development.<sup>2</sup> Factors such as the access to energy services and the type and amount of energy resources available vary significantly and are discussed further in document.

8. The purpose of the present document is to stimulate the discussion at the Special Body on the issue of energy security for sustainable development, including the widening of access to energy services in least developed and landlocked developing countries in order to facilitate the achievement of the Millennium Development Goals.

9. The Special Body is invited to deliberate on key points and issues presented in the document and provide comments and advice on possible strategies to address those both at the national and regional levels. In doing so, it may wish to take note of relevant paragraphs from the Brussels Declaration<sup>3</sup> and the Programme of Action for the Least Developed Countries for the Decade 2001-2010,<sup>4</sup> the Almaty Declaration<sup>5</sup> and Programme of Action: Addressing the Special Needs of Landlocked Developing Countries within a New Global Framework for Transit Transport

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<sup>2</sup> As some of the least developed countries are also landlocked developing countries and vice versa, overlaps are obviously unavoidable. Nevertheless, for the purposes of the present document, they were analysed in separate groups in order to capture some unique features and differences.

<sup>3</sup> A/CONF.191/13, chap. I.

<sup>4</sup> Ibid., chap. II.

<sup>5</sup> *Report of the International Ministerial Conference of Landlocked and Transit Developing Countries and Donor Countries and International Financial and Development Institutions on Transit Transport Cooperation, Almaty, Kazakhstan, 28 and 29 August 2003* (A/CONF.202/3), annex II.

Cooperation for Landlocked and Transit Developing Countries,<sup>6</sup> and the outcome of the World Summit on Sustainable Development.<sup>7</sup>

## II. OVERVIEW OF THE ENERGY SITUATION

10. As shown in table 1, at just 77 million tons of oil equivalent (mtoe), least developed countries in 2004 accounted for only 1.5 per cent of the region's total primary energy supply (TPES) of 5,031 mtoe, which in turn was 43 per cent of the world TPES. Landlocked developing countries fared better at 188 mtoe, or 3.7 per cent of the region's TPES. Similarly, least developed countries consumed 63 mtoe or only 2 per cent, while least developed and landlocked developing countries consumed around 115 mtoe or 4 per cent of the region's total consumption of 2,858 mtoe in 2004. As the least developed countries in the ESCAP region have roughly 4 per cent of the world's population or about 7 per cent of that of the region in 2004, this low energy supply reflects the poor access to modern energy services in many of these countries.

**Table 1. Summary of the total primary energy supply, total final consumption, gross domestic product and population for selected subregional groups, 2004**

	Least developed countries	Landlocked developing countries	Developing Asia Pacific	Asia Pacific Total
TPES <sup>a</sup> (mtoe)	77	188	4 398	5 031
TFC <sup>b</sup> (mtoe)	63	115	2 470	2 858
GDP <sup>c</sup> (million 1990 US\$)	92 940	75 367	4 669 153	8 863 911
Population (million people)	268	135	3 763	3 914

*Source:* Derived from United Nations Energy Statistics database, 2006, and United Nations Common Database (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

<sup>a</sup> Includes both commercial and traditional energy sources. The total primary energy supply (TPES) is based on the energy production in the country, adding imports and stock changes and subtracting exports and energy transferred to international bunkers and aircraft.

<sup>b</sup> Total final consumption.

<sup>c</sup> Gross domestic product.

11. In most landlocked developing countries, energy production in 2004 was dominated by oil, natural gas and hydropower. For many least developed countries, on the other hand, biomass in its traditional form was the predominant contributor to energy supplies. Table 2 shows a breakdown of the production in 2004 by fuel type and producer while figure 1 depicts the proportion of traditional biomass fuels (fuelwood, animal wastes, bagasse, charcoal, vegetable wastes, other non-commercial energy) when compared with the total primary energy supply for landlocked developing countries and least developed countries. In table 2, primary electricity production refers only to electricity production from nuclear, hydro, solar and other primary renewable resources and does not include

<sup>6</sup> Ibid., annex I.

<sup>7</sup> Plan of Implementation of the World Summit on Sustainable Development (*Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex).

electricity generated through the combustion of other fuels such as coal or oil, while the electricity consumption (table 4) includes both primary and secondary forms of electricity.

**Table 2. Energy production in 2004 by fuel type in selected least developed and landlocked developing countries (Thousands of toe)**

Country	Primary electricity <sup>a</sup>	Gaseous fuels		Liquid fuels		Solid fuels			Total production
		Natural gas	Total <sup>b</sup>	Crude petroleum	Total <sup>c</sup>	Fuelwood	Coal	Total <sup>d</sup>	
Afghanistan	48	3	3	0	0	333	24	357	408
Armenia	361	0	0	0	0	14	0	15	376
Azerbaijan	237	4 672	4 672	15 348	15 565	2	0	3	20 477
Bangladesh	105	11 171	11 171	0	97	6 469	0	19 901	31 275
Bhutan	168	0	0	0	0	1 045	36	1 081	1 249
Cambodia	3	0	0	0	0	2 190	0	2 190	2 193
Kazakhstan	693	20 601	20 601	50 672	60 185	78	61 263	61 416	142 894
Kyrgyzstan	1 212	27	27	74	74	4	152	159	1 472
Lao People's Democratic Republic	107	0	0	0	0	1 383	203	1 586	1 694
Mongolia	0	0	0	0	0	43	2 332	2 376	2 376
Myanmar	200	7 598	7 598	1 002	1 025	8 763	631	19 873	28 696
Nepal	201	0	46	0	0	2 963	8	11 197	11 444
Samoa	3	0	0	0	0	16	0	18	21
Solomon Islands	0	0	0	0	0	32	0	80	80
Tajikistan	1 451	30	30	18	18	0	29	29	1 528
Timor-Leste	0	0	0	135	7 367	0	0	0	7 367
Turkmenistan	0	53 393	53 393	9 350	10 120	1	0	1	63 513
Uzbekistan	564	53 393	53 393	4 298	7 565	0	727	728	62 250
Vanuatu	0	0	0	0	0	21	0	21	21
<b>Total</b>	<b>5 355</b>	<b>150 888</b>	<b>150 934</b>	<b>80 897</b>	<b>102 015</b>	<b>23 358</b>	<b>65 405</b>	<b>121 030</b>	<b>379 334</b>

Source: Derived from United Nations Energy Statistics database, 2006 (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

<sup>a</sup> Primary electricity includes power generated from geothermal, solar, hydro, wind, tidal, wave and nuclear sources, and excludes power generated through the transformation from other forms of energy (such as fossil fuels).

<sup>b</sup> Total gaseous fuels include biogas and natural gas.

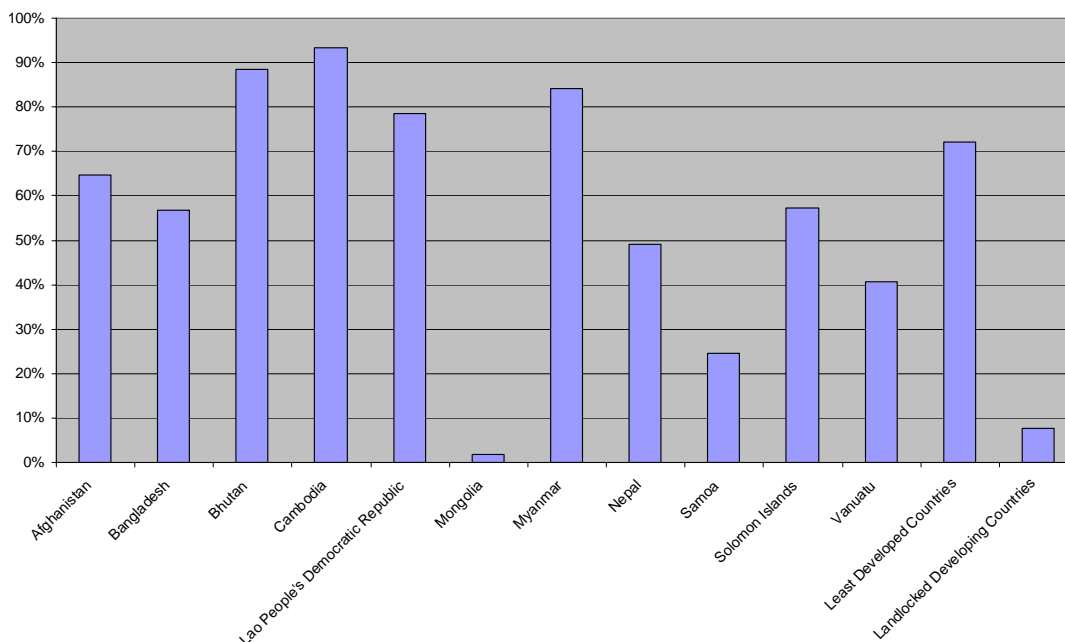
<sup>c</sup> Total liquid fuels include alcohol, crude petroleum and natural gas liquids.

<sup>d</sup> Total solid fuels include animal wastes, bagasse, fuelwood, hard coal, brown coal, lignite, industrial wastes, municipal wastes, oil shale, peat, pulp and paper wastes and vegetable wastes.

12. It is important to note that TPES is based on the energy production in the country, adding imports and stock changes and subtracting exports and energy transferred to international bunkers and aircraft. It differs from the energy production in that it more accurately reflects the energy used domestically. It also reflects the total amount of energy used in the country before transformation into other forms. On the other hand, total final consumption (TFC) is the energy ultimately consumed within the country. TPES and TFC can differ significantly due primarily to the efficiency of the transformation process. That is, for example, how efficient an electric power plant is at converting the primary fuel (such as coal or oil) into electricity. Furthermore, losses can also be experienced in the transmission of this electricity to consumers. These inefficiencies are particularly prevalent in some

landlocked developing countries and can provide substantial cost-saving opportunities in these countries. This will be discussed later in the document.

**Figure 1. Percentage of traditional fuel in the TPES in selected least developed and landlocked developing countries, 2004**



*Source:* Derived from United Nations Energy Statistics database, 2006 (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

13. Resources in least developed and landlocked developing countries vary widely. For example, as shown in table 3, at the end of 2005 Kazakhstan had almost 1.7 per cent of the world's known natural gas reserves. At the 2005 level of production of 21.1 mtoe, this is sufficient to last more than 100 years and is equivalent to almost twice the amount of natural gas actually consumed in Kazakhstan. Some other landlocked countries, such as Mongolia, Tajikistan and Kyrgyzstan, are fortunate to have limited fossil fuel reserves. Some of the least developed countries, such as Bangladesh, Myanmar and Timor-Leste, also have fossil fuel reserves. Exports from some of these countries are a major source of income.

**Table 3. Proved reserves of fossil fuels for selected least developed and landlocked developing countries at the end of 2005**

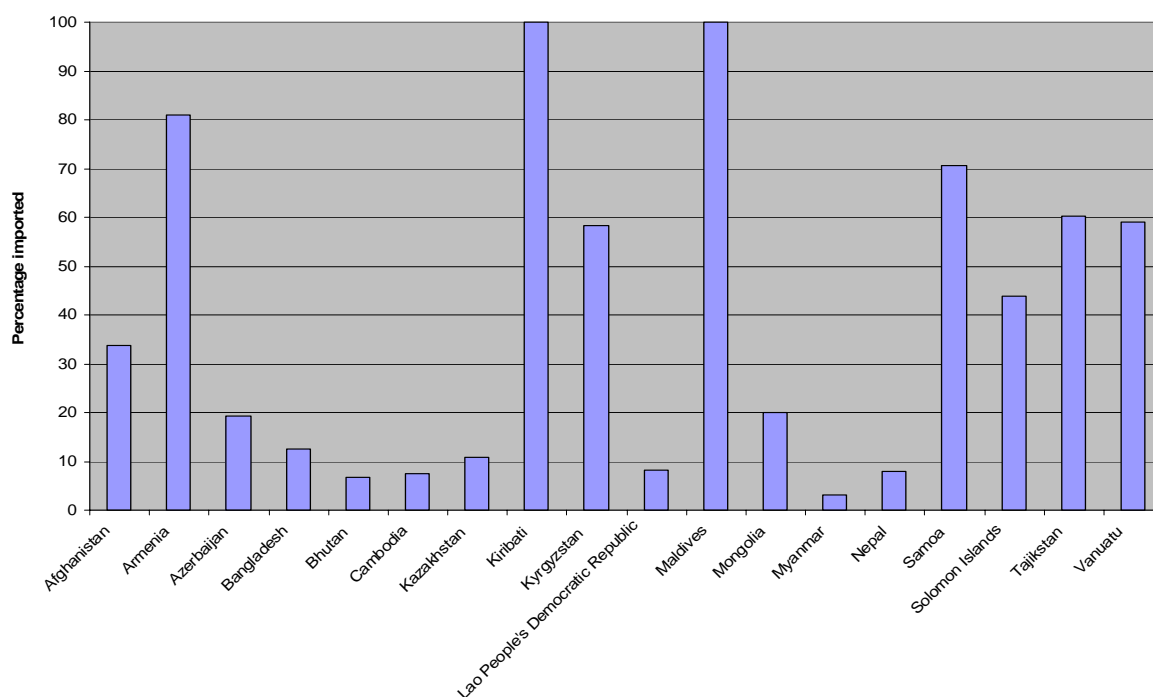
	Oil			Coal			Natural gas		
	Reserves	Share	R/P	Reserves	Share	R/P	Reserves	Share	R/P
	Billion	of total	Ratio	Million	of total	ratio	Trillion cubic	of total	ratio
	Barrels	percentage		tonnes	percentage		metres	percentage	
Azerbaijan	7.0	0.58	42				1.4	0.76	>100 years
Bangladesh							0.4	0.24	31
Kazakhstan	39.6	3.30	80	31 279.00	3.44	362	3.0	1.67	>100 years
Myanmar							0.5	0.28	38
Timor-Leste <sup>a</sup>	0.3						0.2		
Turkmenistan	0.5	<0.05	8				2.9	1.61	49
Uzbekistan	0.6	<0.05	13				1.9	1.03	33
<b>Total Asia Pacific</b>	<b>299.9</b>	<b>24.84</b>	<b>35</b>	<b>489 364.00</b>	<b>53.73</b>	<b>133</b>	<b>14.8</b>	<b>54.78</b>	<b>12</b>
<b>World</b>	<b>1 200.7</b>	<b>100.00</b>	<b>41</b>	<b>909 064.06</b>	<b>100.00</b>	<b>155</b>	<b>179.8</b>	<b>100.00</b>	<b>65</b>

Source: BP, 2006, *BP Statistical Review of World Energy June 2006* (<http://www.bp.com/statisticalreview>).

<sup>a</sup> Source for Timor-Leste: The Timor Sea Office website (<http://timorseaoffice.gov.tp/iaufacts.htm>), accessed in January 2007.

14. In comparison, many other least developed countries, such as Kiribati and Maldives, import most of their commercial energy supplies and thus are vulnerable to high and volatile oil/energy prices. As can be seen from figure 2, some countries almost entirely depend on energy imports to meet their commercial energy needs. Consequently, most of the least developed and some landlocked developing countries depend on renewable resources in traditional form, which are far more plentiful and could contribute to enhanced energy security by using modern technologies, thereby reducing reliance on imported energy.

**Figure 2. Import dependency of selected least developed and landlocked developing countries, 2004**



Source: Derived from United Nations Energy Statistics database, 2006 (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

Note: The import dependency is calculated as the total energy imports divided by the total primary energy supply, both commercial and non-commercial energy, adjusted to stock changes, energy export and energy used for international bunkers.



### III. ENERGY INFRASTRUCTURE FOR SUSTAINABLE DEVELOPMENT

#### A. Access to energy services

15. Access to energy services is widely recognized as a major developmental constraint and this was reemphasized by the World Summit on Sustainable Development in 2002, the 2005 World Summit<sup>8</sup> and the Commission on Sustainable Development at its fourteenth session.<sup>9</sup>

16. As of 2002, approximately 1.7 billion people from developing countries in Asia relied on biomass for cooking and heating. Out of 1.6 billion people globally without access to electricity, 63 per cent or 1.02 billion people were in Asia and the Pacific, with almost 200 million of these living in the least developed countries of the region. In order to meet the long-term objectives of national development goals, including the Millennium Development Goals, energy policies need to adequately address issues related to the widening of access to energy services, particularly for the poor, as well as environmental issues to promote sustainable development.

17. As access to commercial energy resources in most of the least developed countries and some landlocked developing countries is limited, they usually meet their basic energy needs using traditional sources of energy, such as biomass. Table 4 shows the final energy consumption and its composition by fuel types. For example, in 2004 the consumption of fuelwood in Afghanistan was almost 70 per cent of total energy consumption. For Bhutan, this was more than 90 per cent during the same year.

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<sup>8</sup> General Assembly resolution 60/1 of 16 September 2005.

<sup>9</sup> See *Official Records of the Economic and Social Council, 2006, Supplement No. 9 (E/2006/29)*.

**Table 4. Total final consumption in selected least developed and landlocked developing countries, 2004 (Thousands of toe)**

Country/ Region	Electricity and power		Gaseous fuels total	Liquid Fuels				Solid Fuels			Total final consumption
	Electricity	Total		Gas- diesel oil	Motor gasoline	Residual fuel oil	Total	Animal wastes	Fuelwood	Total	
Afghanistan	43	43	0	0	38	0	38	0	333	397	478
Armenia	342	366	839	110	200	1	311	1	14	15	1 530
Azerbaijan	1 576	2 118	3 039	740	492	8	1 570	4	5	9	6 736
Bangladesh	1 567	1 567	2 550	1 591	285	123	2 798	8 143	6 469	20 598	27 513
Bhutan	41	41	0	22	8	0	48	0	1 045	1 049	1 138
Cambodia	0	0	0	0	42	0	42	0	0	23	65
Kazakhstan	4 027	4 035	10 836	2 539	2 529	1 151	8 356	74	78	12 027	35 254
Kyrgyzstan	610	907	278	139	309	59	559	4	4	604	2 348
Lao People's Democratic Republic	66	66	0	0	25	0	88	0	0	0	154
Maldives	13	13	0	0	0	0	10	0	0	0	23
Mongolia	177	177	0	262	284	11	580	0	0	193	949
Myanmar	425	425	324	1 145	402	102	1 688	9 817	8 567	18 587	21 024
Nepal	147	147	0	252	56	8	706	7 792	2 963	11 426	12 279
Samoa	9	9	0	0	20	0	20	0	16	18	46
Solomon Islands	0	0	0	0	13	0	13	0	32	80	93
Tajikistan	1 224	1 315	294	79	1 089	28	1 360	0	0	101	3 071
Timor-Leste	0	0	0	10	13	0	23	0	0	0	23
Turkmenistan	544	677	6 445	941	767	953	3 052	0	0	0	10 174
Uzbekistan	3 619	6 203	30 596	1 639	1 782	8	3 939	0	0	122	40 860
<i>Least developed and landlocked developing countries total</i>	<i>14 428</i>	<i>18 107</i>	<i>55 200</i>	<i>9 468</i>	<i>8 352</i>	<i>2 451</i>	<i>25 201</i>	<i>25 836</i>	<i>19 526</i>	<i>65 249</i>	<i>163 757</i>

Source: Derived from United Nations Energy Statistics database, 2006 (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

<sup>a</sup> Total electricity and power includes steam, hot water and electricity generated from all sources (primary and secondary).

<sup>b</sup> Total gaseous fuels is natural gas.

<sup>c</sup> Total liquid fuels include aviation gasoline, jet fuel, gas-diesel oil, kerosene, LPG, motor gasoline, naphtha, residual fuel oil, petroleum coke and other petroleum products.

<sup>d</sup> Total solid fuels include animal wastes, bagasse, charcoal, coke-oven coke, fuelwood, hard coal, brown coal, lignite, briquettes and vegetable wastes.

18. With a large population base and a considerable unmet demand for energy for the poor, the energy consumption per capita in least developed countries of the region was only 0.23 toe per person in 2004, almost one third of the regional average of 0.73 toe per person (table 5). The global consumption figure was 1.1 toe per person, almost five times as much as the consumption in the least developed countries.

**Table 5. Consumption per person and gross domestic product for 2004**

	Energy (toe) per person	Intensity (kg of oil equivalent) per unit of GDP (US dollar value in 1990)
Least developed countries in ESCAP region	0.23	0.68
Landlocked developing countries in ESCAP region	0.85	1.53
ESCAP region	0.73	0.32
World	1.13	0.24

*Source:* Derived from United Nations Energy Statistics database, 2006 (<http://unstats.un.org/unsd/energy/edbase.htm>) accessed in 2006.

19. This relatively low consumption per person in the least developed countries is a reflection of the inadequate access to basic energy services in many of these countries. Limited information exists regarding the access to electricity but it is quite apparent that access is low. For example, only 20 per cent of the population in Cambodia, 11 per cent of the population in Myanmar and 7 per cent of the population in Afghanistan had access to modern energy services in 2005. Although in some cases the absolute number of people without access to electricity has increased due to population growth, the percentage figures show an improvement in access since 2002 as shown in table 6. Although the figures in table 5 include both commercial and traditional forms of energy, it is likely that much of the commercial energy is used by the relatively more affluent sections of the population, raising concerns about current policies to widen access for the poorer sections of society.

**Table 6. Access to electricity for selected countries, 2002 and 2005**

Country	Development status	Percentage electrified		Population without electricity (millions)		Population with electricity (millions)	
		2002	2005	2002	2005	2002	2005
Afghanistan	LLDC/LDC	2.0	7.0	22.5	27.0	0.5	2.0
Bangladesh	LDC	26.3	32.0	100.5	96.2	35.8	45.3
Cambodia	LDC	18.3	20.1	11.3	10.9	2.5	2.7
Mongolia	LLDC	90.0	64.6	0.3	1.0	2.3	1.8
Myanmar	LDC	5.0	11.3	46.4	45.1	2.4	5.7
Nepal	LLDC/LDC	25.9	33.0	17.9	18.1	6.2	8.9

*Source:* OECD/IEA, 2004 and 2006, *World Energy Outlook*.

*Note:* LDC = least developed country; LLDC = landlocked developing country

20. Per capita, energy consumption in landlocked developing countries accounted for 0.85 toe, which was higher than the regional average. Some landlocked developing countries, particularly those in Central Asia, appear to have achieved 100 per cent access to electricity by the population. Despite this, the reliability and efficiency of energy services may not be ideal and, though people may be connected to an electricity source, they may not necessarily be able to afford the service.

21. It is important to note that the initiatives for meeting the energy needs of the un-served portion of the population would be dealt with at the national level. The resource mismatch between countries could provide an opportunity for cooperation at the subregional level through the development and sharing or trading of these resources for their mutual benefit.

### **B. Energy intensity of the economy**

22. In terms of energy consumption per unit of GDP (that is, the amount of energy consumed per dollar of the economy produced), least developed and landlocked developing countries appear to be much less efficient. As shown in table 5, the global average energy intensity is 0.24 kg of oil equivalent per United States dollar (1990 value) in 2004, whereas the least developed country average in the ESCAP region was almost three times as high at 0.68 per United States dollar (1990 value). The figure for landlocked developing countries was 1.53 kg of oil equivalent per United States dollar (1990 value) or more than six times higher than the global figure. As many landlocked countries are in Central Asia, this may reflect the poor efficiency of the older infrastructure contributing to high energy consumption per GDP figure in these countries.

23. Recent studies suggest that incorporating energy efficiency and promoting renewable energy development could actually reduce costs substantially over the long term. A recent study by the International Energy Agency (IEA) indicates that implementing energy-efficient practices and supporting further renewable energy development can substantially reduce investment costs over the next three decades. Estimates indicate that for every \$1 invested in demand-side management and energy conservation measures, \$2 is saved in supply-side investment.

24. This provides a unique opportunity for least developed and landlocked developing countries to plan and develop their energy infrastructure in an efficient and cost-effective manner. This is particularly relevant for Central Asian countries, which form the majority of landlocked developing countries. As much of their energy infrastructure is nearing the end of its usable life, new and alternative energy infrastructure could change this situation in the future. According to IEA, countries with economies in transition, including Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, could save about \$69 billion in the electricity sector alone between 2005 and 2030. The potential for developing Asia as a whole over this period for the supply side of the electricity sector is \$590 billion, and further savings could also be realized in other energy sectors.<sup>10</sup>

25. Innovative planning and strong policy for alternative energy development methods could guide infrastructure development so that countries can improve their energy security by reducing dependence on volatile imported energy resources while enabling savings and greater efficiencies in the long term.

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<sup>10</sup> International Energy Agency/Organisation for Economic Co-operation and Development, *World Energy Outlook 2006* (Paris, OECD, 2006).

### C. Alternative energy supplies

26. Renewable energy resources are abundant in all of the countries of the region but are not readily utilized for a number of reasons. More countries are adopting policies to promote the utilization of renewable energy to satisfy unmet demand in rural areas and to play a vital role in reducing dependence on imported energy. Renewable energy can be important for widening access to energy services to rural areas, where providing modern energy through conventional means, such as extension of the electricity grid or transportation of fuel (e.g., in small island developing States or remote and difficult terrain) poses a serious constraint.

27. For some areas, it may be more economical or practical to decentralize the energy service and utilize more renewable energy sources. This is particularly prevalent in the Pacific island countries and those countries with difficult or expansive terrain over which they need to distribute power. From table 7, it can be seen that a number of countries are planning to utilize their renewable resources, particularly hydropower but also wind and solar resources.

**Table 7. Planned additions of renewable energy in selected least developed and landlocked developing countries (Mega watts)**

Country or area	Hydropower				Solar PV		Wind		Combustible renewables and waste	
	Mini & micro		Large & medium		Planned addition	Target year	Planned addition	Target year	Planned addition	Target year
	Planned addition	Target year	Planned addition	Target year						
Armenia	270	planned by 2025	270	planned by 2025	0	planned by 2025	450	planned by 2025		
Azerbaijan	-	-	692	2004-2015	2	2006	30	2005-2006	-	-
Bangladesh			100	2008-2009	0	2002-2005	2	2004-2005		
Bhutan	1	up to 2007	220 MW/year	up to 2022						
Mongolia	1	2004-2005	123	2003-2010	36	2004-2010	21	2004-2010	25	2004-2008
Myanmar			1 859	2001-2007	n/a	n/a	n/a	n/a	n/a	n/a

Source: Economic and Social Commission for Asia and the Pacific, *Electric Power in Asia and the Pacific 2001 and 2002* (ST/ESCAP/2350), United Nations publication, Sales No. E.05.II.F.6, table 9b.

### D. Energy outlook and investment needs

28. A reference scenario of energy demand developed by IEA estimates that commercial energy demand for the Asian and Pacific region will grow at an average annual rate of 2.1 per cent, exceeding 7,000 mtoe in 2030 from 3,890 mtoe in 2002. To develop energy infrastructure of that magnitude, enormous investments, estimated at over US\$ 5,200 billion for the region as a whole, would have to be mobilized.

29. The energy demand growth rate for the developing countries of Asia and the Pacific, excluding China, India and Central Asian countries, has been estimated at 3 per cent. Given the high

unmet energy demand in least developed countries and poor energy efficiency (high energy intensity) in least developed and landlocked developing countries, the energy demand growth rate in these countries is expected to be even higher in the future as discussed below.

30. Out of the TPES in least developed countries of 77 mtoe (table 1), the commercial energy supply in 2004 was only about 21 mtoe. Although the bulk of the energy needs would continue to be met from traditional sources of energy in the foreseeable future, the contribution of commercial energy is expected to grow faster than total energy supplies. Based on the recent trend of commercial energy demand growth, which was close to 5 per cent on average during 1999-2004 and the corresponding GDP growth rate of over 5 per cent per annum in the least developed countries, the need for commercial energy supply could be almost 3.5 times higher, rising to 72.6 mtoe (table 8) in 2030. That would mean adding over 50 mtoe of commercial energy supplies together with the necessary infrastructure, which would require an investment of US\$ 85 billion. This is likely to be much more if a sizeable part of the 75 per cent of total energy supplies, currently met by traditional fuel sources, is to be substituted by commercial sources in the future.

**Table 8. Projected energy demand (TPES) in least developed and landlocked developing countries in 2030 (Mtoe)**

	Total primary energy supply (2004)			Projected commercial total primary energy supply (2030)	Energy supply to be added by 2030
	Commercial	Traditional	Total		
Least developed countries	21.47	55.77	77.25	72.56	51.09
Landlocked developing countries	173.79	14.30	188.09	454.65	280.86

*Source:* Secretariat's own estimation based on current energy statistics from the United Nations Energy Database (2006).

31. Applying methodology similar to that used for least developed countries, the total commercial energy supplies in the landlocked developing countries in 2030 is estimated to reach over 450 mtoe, or over two and a half times that of the 2004 commercial needs. The use of traditional energy is much less significant in these countries, contributing only to about 7 per cent. Still, more than US\$ 470 billion will be needed between now and 2030 in energy infrastructure investment to meet the projected energy demand.

32. As mentioned previously, these investment estimates could be substantially reduced by utilizing alternative, energy-efficient and renewable energy practices, policies and technologies.

#### **E. Opportunities and challenges for sustainable energy infrastructure development**

33. Along with the challenges in widening the access of the poor to energy services, the sustainability issue related to social development and environmental protection adds an emerging dimension for energy policy planners.

34. Most important challenge is to have or improve energy policy to address these issues. In that respect, the strategic planning and management approach, which promotes the inclusive participation of all stakeholders at all levels of planning and implementation, has been initiated in some least developed and landlocked developing countries of the region. However, in a recent workshop, the participating experts noted that high-level political support is needed to integrate the strategic plan of the energy sector with the national development plan and with rural development by strengthening legislative measures and institutional mechanisms.

35. As commercial energy resources in many least developed countries and some landlocked developing countries are limited, efforts to diversify to other sources of energy, in particular renewable energy resources are to be intensified. At the same time, efficiency in energy production and use needs to be enhanced by developing and implementing demand-side management strategies.

36. Although financing remains a formidable challenge, innovative options, such as public-private partnerships, the Global Environment Facility and the clean development mechanism may be available. Public-private partnerships in particular have been emerging as a viable option for investment in the management of energy systems. To take advantage of this, a conducive environment needs to be created to ensure a win-win situation for all.

37. Regional and subregional cooperation could supplement national efforts in developing energy infrastructure for sustainable development through the sharing of experiences and research and development outcomes. Some countries have made significant progress in developing and diffusing renewable energy technologies, such as mini- and micro-hydropower, biogas, bio-fuel, solar and wind energy technologies. In table 7, it can be seen that there has been good progress in identifying the potential for renewable energy utilization, and several projects in the least developed and landlocked developing countries are already planned.

38. Given the large dispersion of some least developed countries, particularly island developing States, cooperation is likely to take the form of technology- and knowledge-sharing about renewable resources, decentralized networks and energy planning.

39. Many developing countries that have gained considerable experience, such as China and India, are willing to share their experience with others, providing further opportunities for regional and subregional cooperation among developing countries in the development and diffusion of technology through South-South cooperation.

40. Subregional organizations already exist in the Pacific within the framework of the Council of Regional Organisations in the Pacific (CROP) and support national efforts in Pacific island developing States. Over the last few years, ESCAP has partnered with some members of the Energy Working Group of CROP in providing technical assistance in human resource development for the planning and implementation of renewable energy systems so that local skilled personnel is available to install and maintain renewable energy systems.

#### **IV. INTERCOUNTRY COOPERATION FOR ENERGY TRADE AND EXCHANGE**

41. Intercountry cooperation can play an important role in addressing issues related to energy supply and demand and the efficient distribution of energy resources through, among others, connectivity and trade. While improving energy security is primarily a domestic issue, transboundary energy cooperation could play an important complementary role. Currently, most Governments are individually seeking and taking measures to ensure a steady supply of energy resources to sustain their economic growth. In the era of globalization, a collective cooperation framework could supplement national efforts and bring mutual benefits.

42. A cooperation framework could include a coordinated planning and development approach for trade and exchange, which could lead to the integration of energy infrastructure aimed at facilitating the supply of energy to final consumption destinations beyond national boundaries. It is heartening to note that platforms for cooperation have already been initiated in some subregions, including South-East Asia, North-East Asia, South Asia and West and Central Asia. Least developed and landlocked developing countries in these subregions stand to benefit through active engagement in their respective regions. Moreover, another initiative for broad trans-Asian energy cooperation that ESCAP has been pursuing following the sixty-second session of the Commission could also benefit least developed and landlocked developing countries through synergies and linkages among various subregions.

#### **V. OPPORTUNITIES AND CHALLENGES**

43. The benefits of a coordinated energy system include better and enhanced access to a wider energy market for exporting countries, easy access to energy supplies for countries not endowed with fossil energy resources and less dependency on energy supplies from outside the region. Resource-rich least developed and landlocked developing countries could benefit from exporting their resources to the regional energy market, while resource-poor countries could benefit from better access to energy supplies and by providing transition facilities for energy export to a third country. Energy-exporting least developed and landlocked developing countries may use some of the revenues generated or expected to be generated from oil, gas or electricity exports more effectively to accelerate economic and social development and environmental sustainability.

44. For landlocked developing countries, cooperation may extend beyond technology and information transfer into policy cooperation to facilitate energy trade. This already happens to some extent; for example, Tajikistan, with its enormous water resources, could export electricity to neighbouring countries and to South Asia and China. Considering that a large portion of energy is lost in the transmission and distribution of energy, the potential for reducing losses or meeting an unmet demand may also be supplemented through intercountry cooperation by trading energy resources with neighbouring countries rather than extending a power grid to more remote areas.



45. As much of the current energy infrastructure in these countries is in poor condition, investments in energy-related infrastructure may facilitate access to the energy market of a third country or countries. This would enhance the economic prosperity of the border regions, benefiting neighbouring countries, and also support the development of international energy transmission infrastructure, such as pipelines and electricity networks, for exporting energy outside the subregion.

46. Energy-exporting countries could take the initiative to seek strategic partnerships with the concerned stakeholders, including the business community, as their longer-term economic development and investment strategies. In investment planning, attention should also be paid to sustainable energy development, taking into account social and environmental dimensions along with economic development.

47. While opportunities are high, there are also many challenges that need to be addressed by creating an environment conducive to intercountry cooperation to share the risks and benefits. In order to realize such benefits, it is necessary to develop an appropriate framework to facilitate energy trade and cooperation. The framework could be based on a shared vision and strategies among countries supported by effective institutional arrangements, programmes and projects, and a transparent process with an appropriate level of participation.

48. Steps that could be taken to facilitate further cooperation include developing strategic partnerships and formalizing arrangements for cooperation and knowledge sharing. This should begin with some initial policy studies and dialogues, consultations and policy directions, including the involvement of key stakeholders to realize the potential benefits. To achieve this, it may be necessary to facilitate and enhance the capacity of Governments to negotiate in a collaborative manner and identify possible programmes, projects and other opportunities for cooperation. Strong political support and trust-building are prerequisites to the development of strategic partnerships, but the long-term benefits could prove valuable to least developed and landlocked developing countries.

## **VI. CONCLUSIONS**

49. Per capita energy consumption in least developed countries is considerably low and consequently the access of the poor to energy services, particularly in rural areas, is limited, however, the energy intensity of their economies is high. This situation calls for effective measures, including the promotion of alternative energy supplies, the improvement of energy infrastructure and the efficient use of energy in both supply-side and demand-side management.

50. Great potential exists to plan for efficient, sustainable and cost effective energy services, in both least developed and landlocked developing countries. While major policy decisions are taken at the national level, national policies could include cooperation among countries that could support or supplement national efforts. As some countries are fortunate to have excess energy resources and others are highly dependent on imported energy, intercountry cooperation to develop and share regional/subregional resources could turn this resource mismatch into opportunities for their mutual

benefit. Regional/subregional cooperation could also benefit all in sharing knowledge, research outcomes and technology development/diffusion, through, among others, South-South cooperation.

## **VII. MATTERS CALLING FOR THE ATTENTION OF THE SPECIAL BODY**

51. Analyses in the present document indicate that a number of opportunities exist for least developed and landlocked developing countries to work together in order to supplement their national efforts to improve energy security and energy services in an efficient and cost-effective manner. However, some challenges must be overcome through closer cooperation among them. In that context, the Special Body may wish to consider the following possibilities:

(a) Establishing a cooperation framework, such as a least developed and landlocked developing country forum on energy security;

(b) Undertaking policy studies on how to accelerate cooperation among the least developed and landlocked developing countries and with other countries, through, among others, enhanced South-South cooperation in:

(i) The sharing of experiences in renewable energy development;

(ii) The promotion of energy exchange/trade;

(c) The launching of regular policy dialogues to initiate, review and guide policies and strategies designed to facilitate cooperation for energy security;

(d) An appropriate framework could be based on a shared vision and strategies among participating countries supported by effective institutional arrangements, programmes and projects with an appropriate level of participation. Existing partnerships and other regional and subregional initiatives could form a good foundation for strengthening further cooperation.

52. With a view to identifying policy options, the Special Body may wish to consider the following issues and suggest possible strategies to address them at the national and regional levels:

(a) What are the critical elements to be built into strategies for member States to collaborate in enhancing energy security for socio-economic development?

(b) How can appropriate measures be incorporated into energy infrastructure development strategies that address not only energy supply issues but also the promotion of energy-efficiency improvement and energy conservation?

(c) How appropriate are the current pricing mechanisms and what can be done better in order to improve access and efficiency while minimizing market distortions?

(d) What could be the cooperation areas among least developed and landlocked developing countries separately or in common?

(e) How can the cooperation mechanism be designed to ensure balanced participation of countries?

(i) What could be a vision and strategy for a cooperative mechanism?

(ii) How can political commitment be secured in order to support policy decisions to facilitate such cooperation?

(iii) Who are the critical stakeholders to be involved in such initiatives?

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