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INTRODUCTION

Mongolia has ratified the Energy Charter Treaty and the Protocol for Energy Efficiency and Related Environmental Aspects (PEEREA) in 1999. By ratifying PEEREA, countries commit themselves to formulate and implement policies for improving energy efficiency and reducing the negative environmental impact of the energy cycle (Art. 5). The guiding principle of the PEEREA is that contracting parties shall cooperate and, as appropriate, assist each other in developing and implementing energy efficiency policies, laws and regulations (Art. 3).

The country review process is a core activity in monitoring and facilitating the implementation of the PEEREA. In-depth energy efficiency reviews, carried out under the PEEREA, have proven to be an important tool in assessing the progress of member countries in fulfilling their commitments under the Protocol. They also provide peer guidance to governments in developing and implementing energy efficiency policies.

At the Energy Charter Conference Meeting in 2009 in Rome, the member states have discussed that to effectively monitor the progress made by the contracting parties in implementing the PEEREA obligations, in-depth reviews should be carried out every five years with completion of regular reviews in-between. The Conference also adopted an indicative schedule of reviews for 2010-2012 focusing on countries that are not covered by other international organisations.

Fully respecting the criteria discussed by the Conference, an in-depth review of energy efficiency policies of Mongolia was carried out in 2010. In fulfilling its commitments under the PEEREA, initially Mongolia has presented a regular review of its energy efficiency policies in 2003. The current in-depth review is the first for the country.

The review team, comprised of officials from three countries that are parties to the Protocol: Mr. Jean-Christophe Füeg from the Swiss Federal Office for Energy, Ms. Lisa Lundmark from the Swedish Energy Agency and Mr. Sergey Katyshev from the Kazakhstan Electricity Grid Operating Company KEGOC. The team also included Dr. Dario Chello and Ms. Bilyana Chobanova from the Energy Charter Secretariat and was supported by Ms. Valya Peeva, a consultant to the Secretariat. The team visited Ulaanbaatar between 5 and 9 July 2010 and discussed a range of issues with government agencies and other stakeholders (listed in Annex 4).

The main source of information on the country's energy efficiency policies and programmes included the Regular Review, presented by Mongolia to the PEEREA Working Group in November 2003, and information provided by Mongolian institutions during the country visit. Other relevant sources of information were also used (listed in Annex 5).

The in-depth review report was discussed by the PEEREA Working Group and the recommendations were endorsed by the Energy Charter Conference at its Meeting in November 2010.

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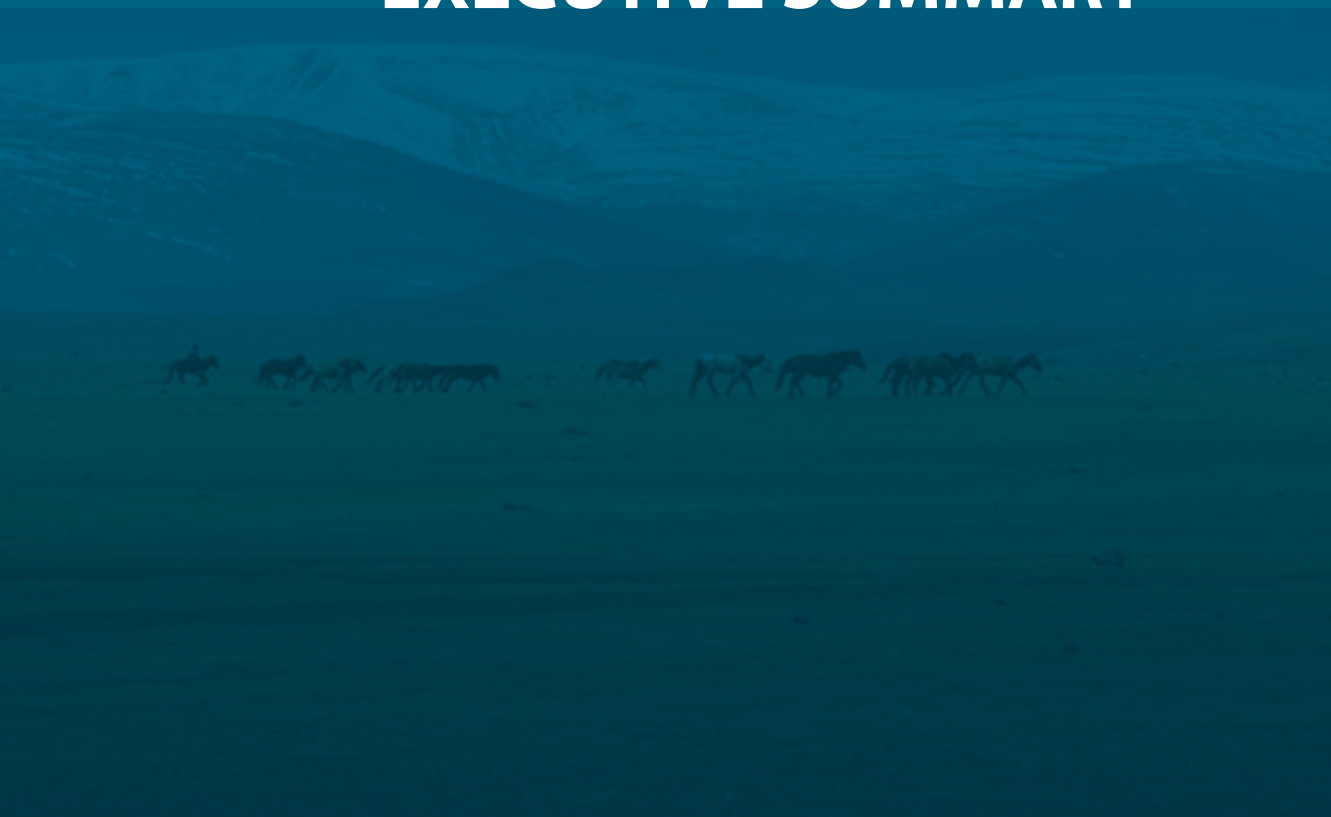


Background

Mongolia has ratified the ECT and the PEEREA in 1999. In fulfilling its commitments under PEEREA Mongolia has presented a regular review of its energy efficiency policies in 2003. The current in-depth energy efficiency review is first for the country.

Mongolia is a landlocked country in the North-East of Asia between Russia and China. With some 2.6 million people and a population density of 1.6 inhabitants per square kilometre, it is one of the most sparsely inhabited countries in the world. Mongolia is characterised by harsh natural conditions. During the eight-month winter season temperatures range between minus 20 °C and minus 40 °C. Nowadays 60% of the population live in urban areas. Cities and settlements have expanded. The population of Ulaanbaatar has nearly doubled since 1995, and the city is now home to more than one million inhabitants (about 40% of the country population). This has contributed to serious transportation problems and sharp increase of energy demand with a tendency of further growth. As a result, air pollution in Ulaanbaatar, one of the coldest capitals in the world, has become extremely severe, reaching about seven times World Health Organisation target values in the most polluted parts of the city in winter time.

Among transition economies, and more broadly among lower gross domestic product (GDP) per capita countries, Mongolia has achieved remarkable progress in setting the foundations for a democratic, open-market economy. Since 1990, the country has implemented broad economic and political reforms with a programme of privatisation, trade and investment liberalisation. Today, Mongolia's private sector produces more than 70% of the country's total output. GDP growth averaged nearly 5% per year in the period 2000-2004 and has increased up to 9.2% annually during 2005-2008. In 2009 the sustained period of rapid economic growth, driven by high mineral prices and strong global demand, gave way to an abrupt and steep downturn in Mongolia's economy. Mongolia has emerged as one of the East Asian countries hardest hit by the global economic crisis.

Mongolia's energy needs are met mainly by domestic generation in seven coal fired power plants, thirteen hydro power plants and small size solar and diesel generators. About 13% of the electricity – mostly peak demand – is imported from Russia. With the high increase of the final energy consumption in the recent years and the projections for further increase, there are expectations that the future electricity demand will not be met with the existing generation capacity. Mongolia is 100% dependent on imported petroleum products.

The transition period until 1995 is characterised by significant decrease of energy supply and final consumption in the country, followed by a period of modest increase of the supply and demand levels till 2005 (ranging 1.8-2.4% annually) with a more accelerated rise reaching 8.9% annual increase of final consumption for the period 2005-2008. Some estimations show that by the end of 2010 the levels of final energy consumption from 1990 will be reached and government expectations are that they will continue to increase by 4% per annum.

Because of the long winter and winter temperatures which routinely fall below minus 20°C to minus 40°C, heat access is a matter of human survival for Mongolia's citizens. There are three main sources of space heating in Mongolia:

(i) combined heat and power plants, which provide electricity, heat, and hot water to the urban centres in Ulaanbaatar and a few other cities;

(ii) heat-only boilers, which meet the heating and hot water needs of a small central network of several buildings; and

(iii) individual heat stoves, which burn coal and/or wood to meet residential heating needs in ger areas.

Energy and Energy Efficiency Policy

The Energy Law of Mongolia came into force on 1 February 2001 and provided the legal framework to allow the energy sector to be restructured from being centrally planned to market-based. This law authorised the creation of an independent energy regulator and gives powers and responsibilities to key institutions involved in managing and operating the energy sector.

Mongolia's Strategy for Sustainable Development of the Energy Sector 2002-2010 has been approved by the cabinet in July 2002 and revised in 2004. The aims of the Strategy include: sustainable development of the energy sector, reduced poverty and increased involvement of the private sector and public interest in the sector through a more secure energy supply. Moreover, Mongolia's energy sector should be developed within the regional energy context, while at the same time taking advantage of new technologies and sources of energy that might further promote economic efficiency and environmental sustainability.

Mongolia's energy sector has overcome a transition from a centralised, command-based system to a market-oriented one. Currently, within the Central Energy System (CES), electricity is traded through the main market – the "single buyer model" (SBM) – and two other accompanying markets: spot and competitive.

Since 2001, regulated energy tariffs have been increased 5 times, but they are still heavily subsidised with current level of subsidies for the end use price 72% on average for residential users and 58% for industrial consumers. However, there is general understanding among officials of the need to continue gradually to remove subsidies and the end-user price for electricity should be increased to reach level of 8 US cents/kWh in 2013, which ought to be cost-covering for electricity generators. After reaching cost-recovery tariffs, cross subsidies currently existing between industry and residential tariffs are planned to be removed. Other forms of subsidy are debt repayment waivers or deferrals granted by the Government to various energy sector companies.

Currently, there are no formally adopted energy efficiency priorities and policies by the Mongolian government. Two draft laws on energy efficiency were prepared in

2003, one by the former Ministry of Infrastructure, another one by the United States Agency for International Development (USAID) consultants. The Ministry's draft was discussed at the cabinet, but was not endorsed for submission to parliament. No progress was made from 2003 till recently for the development and approval of energy efficiency legislation, probably due to frequent changes of governments and restructuring of Ministries and low priority given to energy efficiency activities.

In July 2010 with the financial support of Asian Development Bank (ADB) the development of a new Draft Energy Conservation Law has been initiated as well as the development of a Medium and Long term Energy Efficiency Action Plan for Mongolia. Both documents are supposed to be finalised by November 2010 and submitted to government and Parliament for approval in the beginning of 2011.

The current Building Law, Housing Law, and Urban Planning Law of Mongolia provide the necessary legal basis for the updating of the Mongolian building code energy efficiency provisions systems and in 2010 in the framework of the Building Energy Efficiency Project, BNbD 23-02-2009 "Buildings Thermal Performance" was developed and adopted.

There is no agency in the country formally mandated to develop and implement the national and sectoral energy efficiency policies and programmes. Different Ministries and some other organisations are involved in a number of activities, but very often the activities between different stakeholders are not coordinated and no information is available for what has been already been initiated or implemented in certain areas.

Major sources of financing of energy efficiency activities in Mongolia are provided through international co-operation with a number of multilateral institutions such as the World Bank (WB), ADB, the European Union (EU) and the United Nations Development Programme (UNDP), as well as with foreign partners as the USAID, the Japan International Cooperation Agency (JICA), the German, Norwegian and other Governments. Mongolian government participates with co-financing (including in-kind) in a number of projects, but there is no national budget allocated so far for energy efficiency activities.

Renewable Energy Policy

Mongolia has very high solar radiation values as well as, in places, good water and wind-power resources. High comparative costs in energy supply, an extremely low population density and excellent renewable energy resources all translate into a high potential for utilising renewable energies.

In June 2005, the Mongolian Parliament approved the National Renewable Energy Programme which sets ambitious goals for broad-based renewable energy development increasing the share of renewable energy in total energy supply from 0.9% in 2005 to 3-5% by 2010 and to 20-25% by 2020.

The Renewable Energy Law of Mongolia came into force on 11 January 2007 and regulates the generation and supply of energy from renewable energy sources. The Law also sets out the tariffs for energy generated and delivered from renewable energy sources, which are valid for a period of minimum 10 years form entry into force of the Law.

The Government is seeking active engagements of donors and local and foreign private investors for the development of Mongolia's large renewable potential for utilising solar, wind, hydro and geothermal energy resources.

Overall Assessment of Progress

Mongolia is facing many challenges: modernising a Soviet-legacy infrastructure, many characteristics of developing countries including scarce financial resources, poverty, internal migration, a sizeable portion of the population relying on agriculture, a harsh climate (which induces large heating demand, but occasionally also decimates livestock), a land-locked and remote location. At the same time, it is blessed with abundant energy (coal) and mineral resources, it succeeded in establishing a stable democracy and consensual political culture, a favourable climate for foreign direct investments (FDI) and indigenous private entrepreneurs, and can boast well-educated professionals in Government and private business.

GDP and energy demand have displayed robust growth rates for many years. Adequate energy supplies – in existing consuming centres such as Ulaanbaatar and other towns and mines, but also for new mining projects – is a constant preoccupation for the Government. In this context, it is not surprising – and no exclusive attribute of Mongolian planners – that the Government tends to favour new power plants, largely based on domestic coal, but also renewables, over further efficiency projects. Nonetheless, efforts to promote energy efficiency, e.g., through building regulation or through an Energy Conservation Law in the making, are highly laudable.

Existing facilities (power and heat plants and networks) have been rehabilitated over the last two decades mostly with donor moneys. While there still remains a large potential for additional efficiency gains in the energy infrastructure and housing stock, some systems (mainly in buildings) technically do not lend themselves for efficiency measures (e.g., heat metering per dwelling). The Government has reformed the energy markets and prices through successive increases in tariffs, which appear to have been accepted by the population after extensive information campaigns. Also, the Government has scored successes in supplying energy to rural and peri-urban communities, and continues its efforts.

Recommendations

As a result of this in-depth review, the following recommendations are offered to promote energy efficiency in Mongolia.

General Recommendations

- The Government, in devising its medium and long term energy planning, should lay out the various supply and demand side options to fill the looming demand gap. Least cost options should be chosen among supply (new electricity generation and heat supply) and energy efficiency (conversion, transmission and end use efficiency). The Government should use and expand ongoing surveys of energy losses and end use;
- Energy efficiency work should focus on those sectors holding the largest potential: energy efficiency in buildings (heating system, building envelope, and lighting), district heating and reducing electricity production, transmission and distribution losses.

Energy Efficiency Policies, Legislation and Programmes

- The Government should finalise the Energy Conservation Law according to the announced timetable. Promulgating the Energy Conservation Law should send a strong signal to energy stakeholders and the wider public about the crucial importance of energy efficiency. The Government should reinforce cooperation with all relevant Governmental institutions and other stakeholders in drafting the Energy Conservation Law;
- Upon the adoption of the Energy Conservation Law the Government should ensure further the development of secondary legislation and regulations in different sectors, in close cooperation with relevant actors;
- The Government should undertake strong efforts to ensure implementation and enforcement of legislation and regulations, through continued training, ensuring sufficient human and financial resources for the inspectorate and enhancing its sanctioning power. This pertains particularly to energy efficiency and environmentally related legislation such as building and vehicle emissions regulations and Environmental Impact Assessment.

Institutional Framework

- The Government should allocate sufficient human and financial resources within the Ministry for Mineral Resources and Energy for overall energy efficiency policy. This should include appointing a high-level decision maker for energy efficiency policy, who should have sufficient authority and resources;
- The Government should ensure that the Energy Authority is given the adequate human and financial resources to implement energy efficiency policy;
- One of the assignments for the high level decision maker should be to organise a knowledge base by compiling information regarding energy efficiency projects (including donor financed projects), including lessons learned. This can assist the Government in developing a strategy and prioritising future donor financing of energy efficiency projects;

- Another assignment of the high level decision maker should be to clearly define the responsibilities and roles for different ministries and other stakeholders regarding energy efficiency;
- Cooperation between the Ministry for Mineral Resources and Energy and other relevant Governmental institutions should be enhanced. Cooperation with other actors such as NGOs, donor organisations, and private actors should also be improved, perhaps institutionalised in some way.

Energy Market and Pricing

- The Government should continue the planned efforts in energy pricing reform (eventual cost covering level of prices and removal of cross subsidies);
- The Government should continue to support the liberalisation of the energy market, at the same time as ensuring private energy investment.

Energy Efficiency Financing

- The Government should continue efforts to provide end-users with energy efficient equipment and solutions including stoves, solar panels, ger insulation, using instruments such as subsidies and micro credits;
- The Government should continue its efforts in attracting Clean Development Mechanism (CDM) financing for energy efficiency projects;
- The Government should explore the possibility of allocating financial resources which are freed as a consequence of end-user subsidy removal to funding of energy efficiency projects;
- The Government should consider consolidating the Green Credit Guarantee Fund and other similar funds in order to create revolving credit liquidity;
- The Government should examine possibilities of introducing tax incentives for energy efficiency projects.

Specific Energy Efficiency Programmes and Measures

Buildings

- The Government should put strong emphasis on implementation and enforcement of adopted building regulations. The Government should demonstrate an exemplary role in public buildings and in its own construction of new apartments;
- The Government should introduce individual heat metering in modern apartments where this is technically possible and in future buildings.

District Heating

- The Government should continue current efforts in decreasing energy loss in the district heating system.

Electricity

- The Government should continue current efforts for increased energy efficiency in the electricity sector;
- The Government should ensure that best available energy efficient technologies are used for new coal power plants.

Industry

- The Government should promote the use of energy audits and energy management in enterprises.

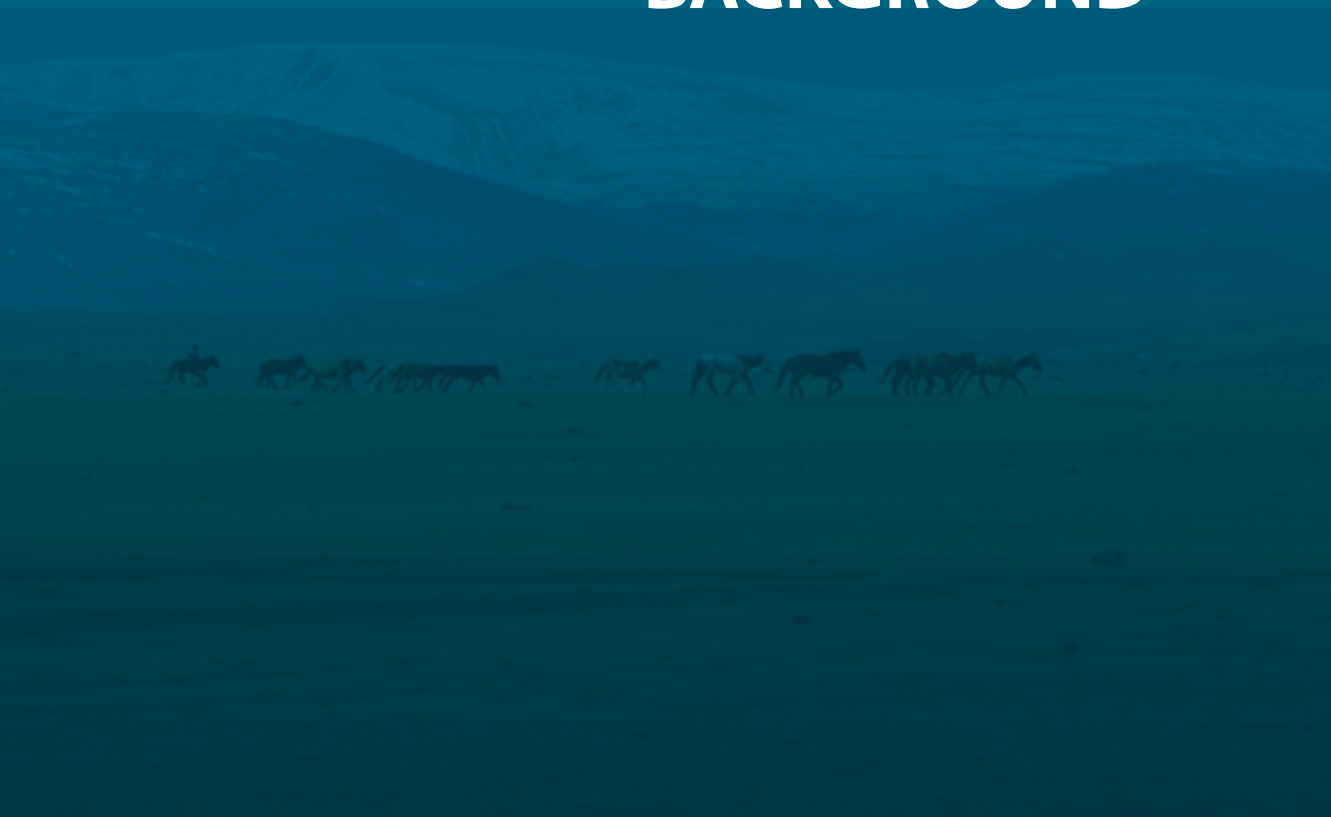
Information, Training and Awareness Raising

- The Government should promote energy efficiency awareness raising and training for Government officials and the wider public at local, regional and national level.

Renewable Energy

- The Government should pay particular attention to the implementation of provisions of the Renewable Energy Law when advancing the currently planned projects;
- Rural electrification efforts should be continued based on the positive results already achieved from some international donor projects like the 100,000 solar Ger project;
- The Government should continue their support to renewable energy generation solutions.

BACKGROUND



Brief Country Overview

Mongolia is a landlocked country in the North-East of Asia between Russia and China. With some 2.6 million people and a population density of 1.6 inhabitants per square kilometre, it is one of the most sparsely inhabited countries in the world. The territory ranges from the super-arid desert in the South to moist Taiga forest in the North, and from rolling steppe grassland in the East to alpine terrain and glaciated peaks in the West.

Figure 1: Map of Mongolia

Source: http://upload.wikimedia.org/wikipedia/commons/3/39/Un-mongolia.png

Of the total 1.56 million sq. km land area of Mongolia, 75% is capable of agricultural production, primarily extensive, pastoral livestock production. Cultivated land occupies only 13 500 sq. km of the total land area. The share of forest area is also small – some 130 000 sq. km, of which the area for potential commercial forestry totals about 50 000 sq. km. Some 16 000 sq. km of forest area have been lost between 1947 and 2000 due to fire, overgrazing, mining activities, improper and illegal logging.

Mongolia has extensive mineral deposits: copper, coal, molybdenum, tin, tungsten, and gold account for a large part of the industrial sector.

A landlocked territory with an extreme climate, Mongolia is characterised by adverse natural conditions. During the eight-month winter season temperatures range between minus 20 °C and minus 40°C. Growing seasons are short, and natural productivity is low. This physical environment defines Mongolia's unique set of demographic and development characteristics. Historically, this environment supported widely dispersed families dependent on herding sheep, cattle, horses, goats, and camels across the steppe. Nearly 40% of the population still lives in rural

areas, partly settled, partly as nomadic livestock farmers, although in recent years tremendous social changes have taken place. Nowadays 60% of the population live in urban areas. Cities and settlements have expanded. The great herds of animals are now tending to congregate in areas around the settlements in the northern and central Aimags (provinces) surrounding Ulaanbaatar.

As a result, the population of Ulaanbaatar has nearly doubled since 1995, and the city is now home to more than one million inhabitants (about 40% of the country population). This has contributed to serious transportation problems and sharp increase of energy demand with a tendency of further growth. As a result, air pollution in Ulaanbaatar, one of the coldest capitals in the world, has become extremely severe, reaching about seven times World Health Organisation target values in the most polluted parts of the city in winter time.

Specific problems go with Ulaanbaatar's large and growing peri-urban ger areas (a ger is the traditional round felt tent used by Mongolia's nomads). An inflow of migrants in recent years has resulted in the rapid expansion of ger areas, which cover hillsides around the city and now account for about 60% of the city's population (around 600,000 people). Ger area residents lack access to central heat, water, sewer systems, have higher rates of unemployment, lower incomes, rely more heavily on the informal sector, score lower on human development indicators, and pay higher prices for utility services than do more affluent apartment dwellers.

Mongolia is a parliamentary democracy. The supreme legislative body is the unicameral State Great Khural (Parliament), which is elected for a term of four years and consists of 76 members. Latest Mongolian legislative elections took place in 2008. There are two main parties in the Parliament: the Mongolian People's Revolutionary Party and the Democratic Party. The president is the head of state, commander in chief of the armed forces, and head of the national security council. The government, headed by the prime minister, has a 4-year term. The prime minister is nominated by the president and the cabinet proposed by the prime minister is subject to State Great Khural approval.

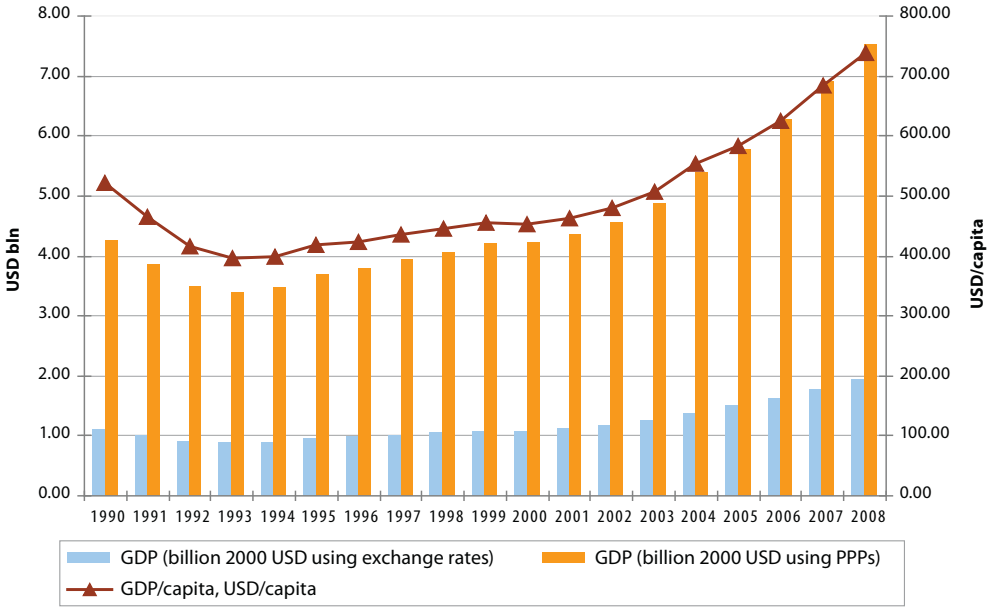
Mongolia is divided into 21 aimags (provinces). Each aimag is subdivided into several sums (counties) and bags (divisions of soums). The capital, Ulaanbaatar, is governed as an independent municipality. The Prime Minister appoints the governors of the 21 aimags of Mongolia, as well as the governor of the capital, Ulaanbaatar.

Economic Background

Among transition economies, and more broadly among lower GDP per capita countries, Mongolia has achieved remarkable progress in setting the foundations for a democratic, open-market economy. Since 1990, the country has implemented broad economic and political reforms with an active programme of privatisation, trade and investment liberalisation. Today, Mongolia's private sector produces more than 70% of the country's total output.

GDP growth averaged nearly 5% per year in the period 2000-2004 and has increased up to 9.2% annually during 2005-2008 (Figure 2). Poverty incidence has shown decline, though a third of the population lives below the poverty line, and there are significant disparities between and within urban and rural populations.

Figure 2: GDP Indicators for Mongolia



Source: IEA Statistics, Electronic Version, 2010

The sustained period of rapid economic growth, driven by high mineral prices and strong global demand, gave way to an abrupt and steep downturn in Mongolia's economy and macroeconomic situation starting in the second half of 2008. For 2009, the overall fiscal balance reflected a deficit equivalent to 5.4% of GDP. Unemployment is high, and more than a third of the population is classified as poor. Mongolia has emerged as one of the East Asian countries hardest hit by the global economic crisis.

The Government has introduced an ambitious macroeconomic programme designed to restore economic stability through fiscal and monetary reforms and to safeguard the poor and maintain social stability through improving the social safety net. The Government is also placing a high priority on bringing new strategic mineral deposits into production. For example in October 2009, the government passed long-awaited legislation on an investment agreement to develop Mongolia's Oyu Tolgoi mine, considered to be one of the world's largest untapped copper deposits. In addition, it is also mobilising donor budget support.

Mongolia's economy is heavily influenced by its neighbours. For example, Mongolia purchases 92% of its petroleum products from Russia. Trade with China represents

more than half of Mongolia's total external trade – China receives about two-thirds of Mongolia's exports.

The structure of Mongolia's economy is narrow with mining and agriculture sectors together accounting for around 50% of GDP and for over 90% of exports of few commodities such as coal, gold, copper, and cashmere. However, important turn around has been done by the services sector with substantial average value-added growth (9.1% in 2005). The grey economy is estimated to be at least one-third the size of the official economy.

Mining is the country's largest industry. It was responsible for 28% of GDP, 65% of industrial output and 69% of export earnings in 2008 and 56% of FDI. This dependence on mining was the reason of the significant effects of the global economic crisis on country's economy. Sharp drops in the price of Mongolia's export commodities in late 2008, particularly of copper, have led to major declines in government revenues (copper accounted for 43% of revenues in 2008).

FDI for mining projects have massively increased in recent years, particularly in the South Gobi desert. New mines will require building new power plants. Some 600 MW of new capacity will be required for new mines by 2020. This comes on top of the electricity demand growth in the CES system.

Other than agriculture and mining, important sectors in the composition of GDP are trade and service (24.8%) and transportation, storage, and communication (12.2%). Because of Mongolia's remoteness and natural beauty, the tourism sector has recently shown signs of rapid growth.

The Mongolian banking system has been growing rapidly for a number of years in line with the economy as a whole and supported by a range of financial sector reforms. However, some elements of the financial market infrastructure and the non-banking financial sector, including capital markets, insurance and leasing have not developed significantly.

Energy Supply and Demand

Coal Balance

Mongolia has significant coal resources with proven reserves of 50 billion tons. The coal reserves are located in more than 200 deposits and the current total production is 16 million tons per year. The coal production has rapidly increased in the period 2006-2009, due to three times increase of export (Table 1). More than 90% of coal supplied to the domestic consumers is used for thermal power plants. The most coal mines have a low quality brown /lignite/ coal with calorific value of 2500-3500 kcal/kg. Few coal basins exist with higher quality coal exists, but due to lack of infrastructure, long distance location and no modern technique and technology available the above mentioned coal mines are not developed so far. The total coal production of coal in 2009 is more than 14 mln tons of which almost 50% were exported.

Table 1: Coal Balance Table (thousand tons)

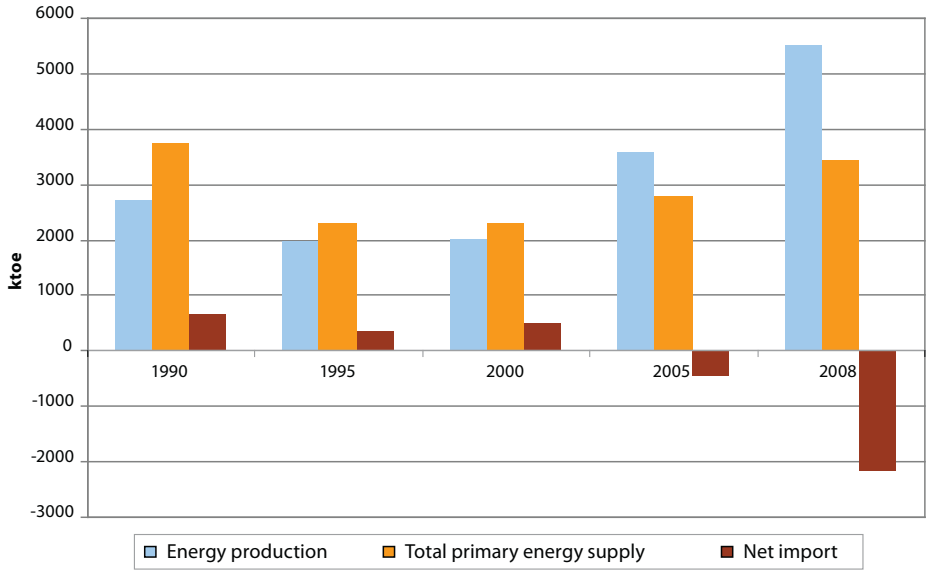
	2006	2007	2008	2009
Produced	8 074	9 238	10 072	14 442
Total consumption	5 691	5 906	5 843	6 610
by thermal power plants	4 595	4 935	4 849	5 078
industry/construction	237	203	190	226
transport/communication	121	122	41	41
agriculture	8	3	7	14
household	550	455	581	632
other	180	188	174	619
Export	2 457	3 268	4 169	7 113

Source: Mongolian Ministry for Mineral Resources and Energy

Energy Balance

Mongolia's energy needs are met mainly by domestic generation in seven coal-fired power plants, thirteen hydro power plants and small size solar and diesel generators. About 13% of the electricity is imported from Russia. Both domestic production and import of energy has increased by 15% and 18% per annum respectively for the 2005-2008 period and the export shows some 30% average annual increase for the same period, thus making Mongolia a net energy exporting country (Figure 3).

Figure 3: Energy Production and Net Import (ktoe)



Source: Mongolian Ministry for Mineral Resources and Energy

Table 2: Energy Balance of Mongolia, 2008 (ktoe)

Energy Flows/ Energy Recourses	Coal	Oil	Petroleum products	Hydro	Electricity	Heat	Traditional fuel & other	TOTAL
Production	3 959.8	1 232.5	0.0	0.85	-	-	326.4	***5 519.5***
Import	0.0	0.0	957.9	-	16.9	0.0	0.0	***974.8***
Export	-2 013.3	-1 112.1	0.0	-	-1.3	0.0	0.0.	***-3 126.7***
Stock Changes	110.3	-	0.3	-	-	-	0.0	***110.6***
Total Primary Energy Supply	***2 056.7***	***120.3***	***958.2***	***0.85***	***0.0***	***0.0***	***326.4***	***3 462.5***
Transformation sector	-1 771.2	0.0	-10.8	-8.55	250.3	723.8	0.0	***-816.5***
Electricity only plants	0.0	-	-5.6	-8.55	2.0	-	0.0	***-12.1***
Heat only plants	-185.7		0.0	-	-	214.4	0.0	***28.6***
Refinery		0.0	0.0	-	-			***0.0***
CHPs	-1 564.4	-	-4.0	-	341.9	561.6	0.0	***-664.8***
Other	-15.1	-	0.0	-	0.0	0.0	0.0	***-15.1***
Own use & losses	-6.1	-	-1.2	-	-93.6	-52.2		***-153.1***
Own use	0.0	-	0.0	-	-56.2	-39.7	0.0	***-95.8***
Losses	-6.1	-	-1.2	-	-37.5	-12.5	0.0	***-57.3***
Final Consumption	***285.5***	***-***	***974.4***	***-***	***266.0***	***723.8***	***326.4***	***2 549.0***
Industry	68.4	-	152.4	-	167.7	305.1	0.0	***693.7***
Transportation	0.0	-	722.3	-	6.3	0.0	0.0	***728.5***
Residential	122.0	-	0.0	-	42.0	258.6	274.8	***697.4***
Service and others	95.0	-	72.7	-	50.0	160.1	51.6	***429.4***

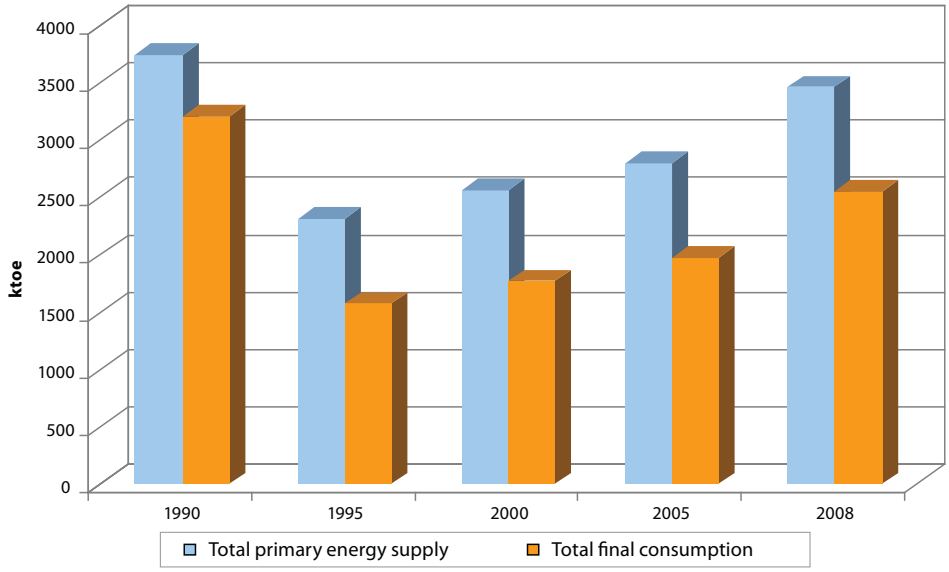
Source: Mongolian Ministry for Mineral Resources and Energy

Since Mongolia doesn't have own refineries, it is 100% dependent on imported petroleum products (diesel fuel, gasoline, jet fuel, heavy oil). 92% of the petroleum products are imported from the Russian Federation, and 5% of them are imported from China, the rest from Kazakhstan, Korea and some other countries.

Energy Supply and Final Consumption Trends

The transition period until 1995 is characterised by significant decrease of total primary energy supply (TPES) and total final consumption (TFC) in the country, followed by a period of modest increase of the energy supply and demand levels till 2005 (ranging 1.8-2.4% annually) with a more accelerated raise reaching 8.9% annual increase of final consumption for the period 2005-2008 (Figure 4 and Table 3). Government expectations are that they will continue to increase by 4% per annum.

Figure 4: Trends of TPES and TFC in Mongolia (ktoe)



Source: Mongolian Ministry for Mineral Resources and Energy

Table 3: Variation in Primary Energy Supply and Final Consumption in Mongolia (% p.a.)

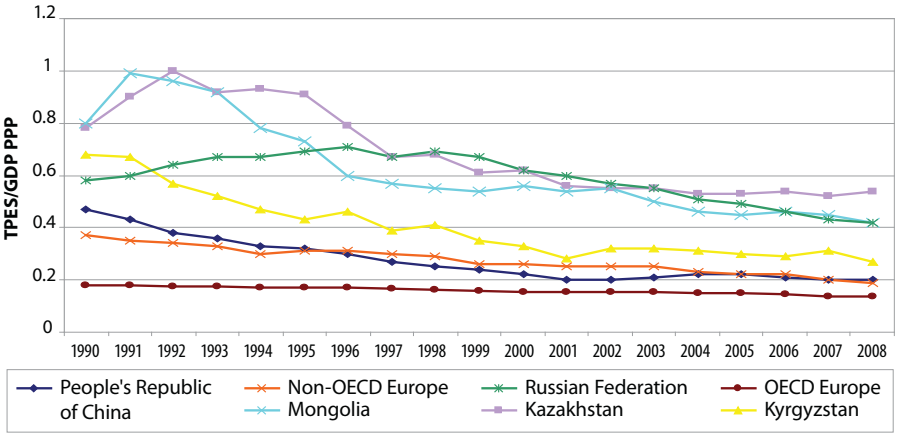
	1990-1995	1995-2000	2000-2005	2005-2008
Total primary energy supply	-9.20%	2.00%	1.80%	7.30%
Total final consumption	-13.30%	2.40%	2.20%	8.90%

Source: Mongolian Ministry for Mineral Resources and Energy

The energy intensity of Mongolia's GDP in real terms follows a general tendency of reduction after 1991, to reach levels below 2 toe per thousand US dollars after 2003. Considering the Purchase Power Parity (PPP), the energy intensity of the GDP comes to a level about 0.5 toe per thousand US dollars, which is still much higher than the both OECD Europe and non-OECD Europe countries and higher than this indicator for some neighbouring countries, but comparable to Kazakhstan, a country with a similar industrial profile and geographic and climate conditions. (Figure 5).

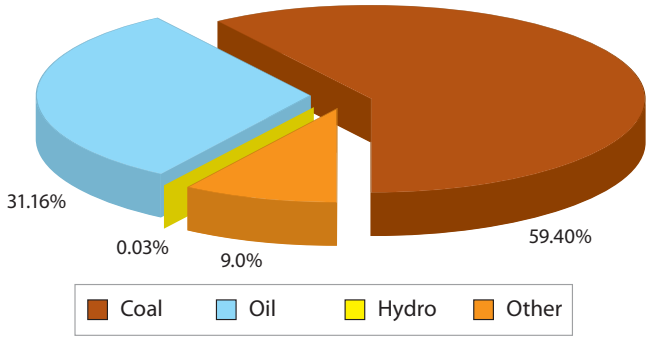
TPES is dominated by coal (59% in 2008), electricity production in the country largely being based on coal (Figures 6 and 7). Petroleum products comprise second largest share at 31% of TPES. Other sources including combustible renewables have a small share of 9% and hydro less than 1%. The share of coal in TPES has been continuously decreasing from 73% in 1995 to 59% in 2008, while oil share has more than doubled from 15% in 1995 to 31% in 2008.

Figure 5: Energy Intensity of Mongolia, 1990-2008



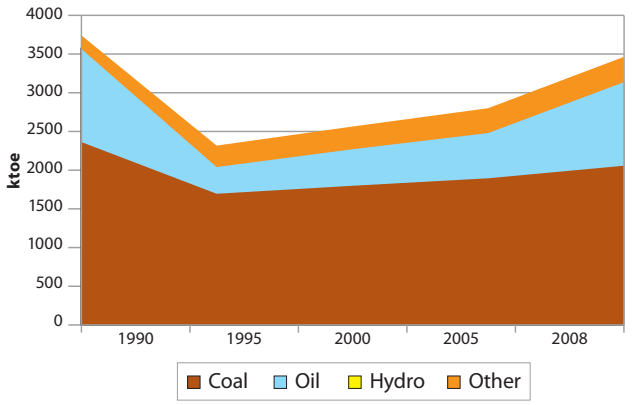
Source: IEA Statistics, Electronic Version, 2010

Figure 6: TPES in Mongolia, by Fuel (2008)



Source: Mongolian Ministry for Mineral Resources and Energy

Figure 7: TPES Development, by Fuel



Source: Mongolian Ministry for Mineral Resources and Energy

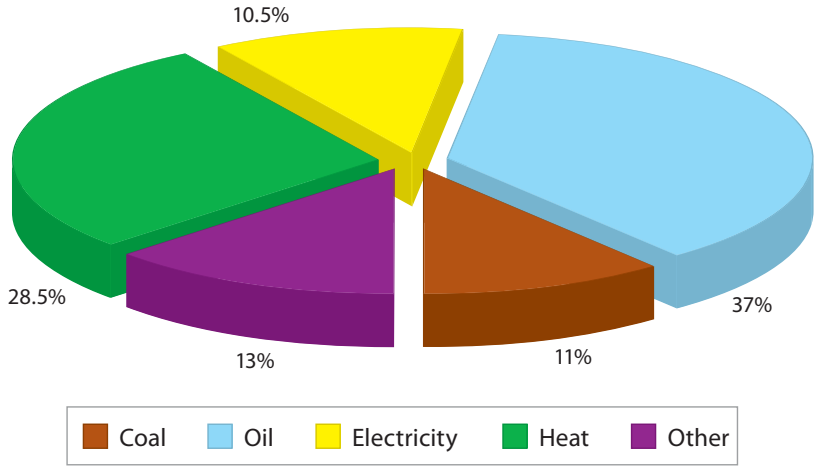
Table 4: Structure of TPES in Mongolia, by Fuel (ktoe)

	1990	1995	2000	2005	2008
Coal	2 365	1 695	1798	1 895	2 057
	63%	*73%*	*70%*	*68%*	*59%*
Oil	1 206	345	472	584	1 079
	32%	*15%*	*18%*	*21%*	*31%*
Hydro	0	0	0.25	0.28	0.85
	0%	*0%*	*0%*	*0%*	*0%*
Other	175	277	293	321	326
	5%	*12%*	*11%*	*11%*	*9%*
Total	**3 746**	**2 317**	**2 563**	**2 800**	**3 463**

Source: Mongolian Ministry for Mineral Resources and Energy

Similar to TPES, TFC has passed through a period of decline during the first years of transition to a market economy, and has been on the rise since 1995. The current structure of the final energy consumption in Mongolia by source, as by national statistics, is dominated by petroleum products (37%) and heat[1] (28%), followed by other fuels (13%), coal (11%) and electricity (10%) (Figure 8). Compared with the first years of transition, there is evidence of substantial more than three-fold decrease of coal consumption and increase in the use of other fuels (Figures 9 and 10, Table 5). Electricity, oil and heat keep constant absolute levels in the total energy consumption during the years.

Figure 8: TFC in Mongolia, by Fuel (2008)



Source: Mongolian Ministry for Mineral Resources and Energy

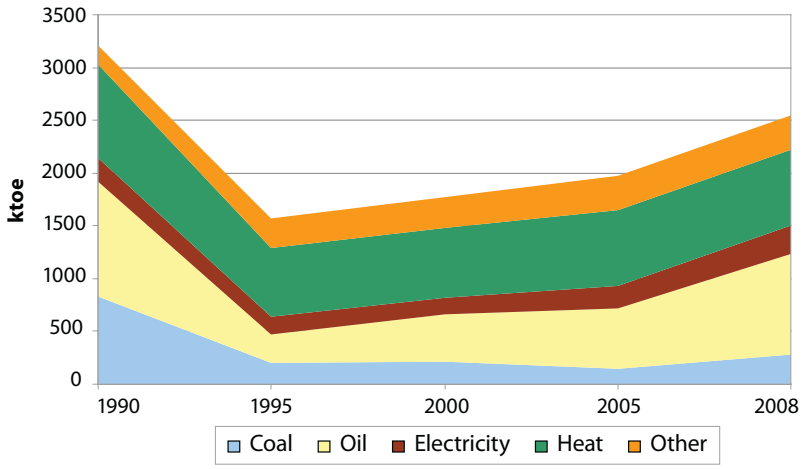
1 Coal-fired centralised and de-centralised heating systems.

Table 5: Structure of TFC in Mongolia, by Fuel (ktoe)

	1990	1995	2000	2005	2008
Coal	826	201	217	148	285
	26%	*13%*	*12%*	*8%*	*11%*
Oil	1 092	273	443	570	947
	34%	*17%*	*25%*	*29%*	*37%*
Electricity	228	161	154	216	266
	7%	*10%*	*9%*	*11%*	*10%*
Heat	884	658	663	718	724
	28%	*42%*	*37%*	*36%*	*28%*
Other	174	277	293	321	326
	5%	*18%*	*17%*	*16%*	*13%*
Total	**3 204**	**1 570**	**1 770**	**1 973**	**2 548**

Source: Mongolian Ministry for Mineral Resources and Energy

Figure 9: Development of TFC in Mongolia by Fuel (ktoe)



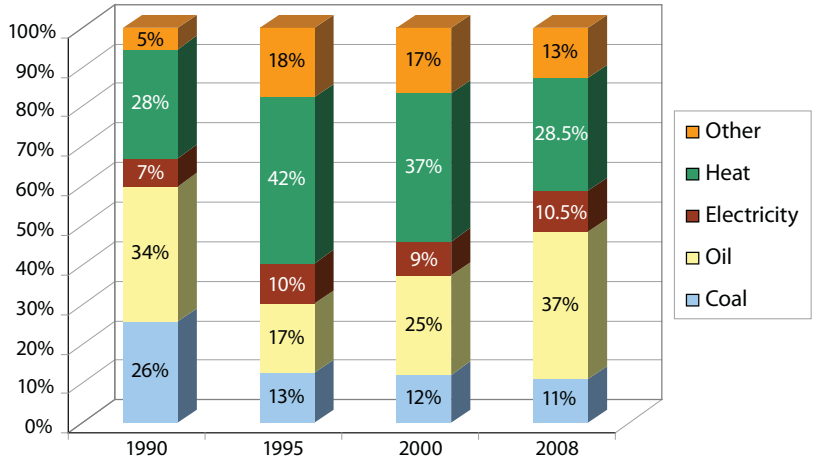
Source: Mongolian Ministry for Mineral Resources and Energy

Electricity Supply

The energy sector in Mongolia is designed around an integrated system of coal production for the generation, transmission and distribution of power and heat. The concept is technically efficient, with coal-fired Combined Heat and Power (CHP) plants producing steam for electricity, space heating, domestic hot water, industrial processes. The electric power system in Mongolia consists of four independent electric power systems: CES, the Western Energy System (WES), the Eastern Energy System and Altai-Uliastai energy system. Major part (79%) of electricity is produced

in CHP with installed capacity of 823 MW, 4% from 46 MW diesel plants, some small hydro, solar and wind plants. Energy lack during peak load in CES and almost all electricity demand in the WES is supplied by electricity imported from Russia.

Figure 10: Development of TFC in Mongolia by Fuel (%)



Source: Mongolian Ministry for Mineral Resources and Energy

Table 6: Existing Combined Heat and Power Plants in CES

	Installed Capacity (MWe)	Available Capacity (MWe)	Capacity Boilers (MWth)	District Heating (MWth)	Industr. Steam (MWth)	Constructed
TPP 2	21.5	17.6	80	43	58	1961-1969
TPP 3	178	105.1	1 448	562	105	1968-1982
TPP 4	540	432	477	210	49	1983-1991
Darkhan TPP	48	38.6	477	210	49	1966-1986
Erdenet TPP	28.8	21	318	140	24	1987-1989

Source: Energy efficiency study of TTP 4 Ulaanbaatar – A Technical Study Report, PREGA

The CES is the main system with five generation, one transmission and four distribution companies. It supplies energy to the capital city and 13 aimags in central Mongolia and covers over 90% of the country's total energy consumption. The CES power supply is comprised of five coal burning generating thermal power plants (TPP) (3 in Ulaanbaatar, one each in Darkhan and Erdenet, see Table 6 below) and an interconnection to Russia. Ulaanbaatar TPP 4 accounts for almost 70% of capacity. Donor-financed boiler and turbine rehabilitation in the past fifteen years resulted in plant efficiency increases of 1 to 8 percentage points, although efficiency levels still remain low – 28% to max 34.3% for Ulaanbaatar TPP 4 (Tables 6 and 7). Additional rehabilitation is ongoing at Ulaanbaatar TPP 4.

Figure 11: Electrification Map of Mongolia

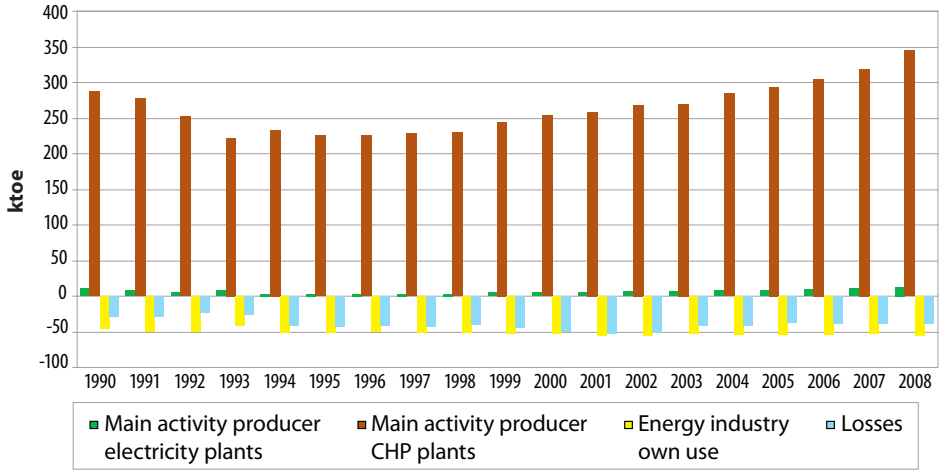
Source: Energy Regulatory Authority of Mongolia

Table 7: CES Electrical Efficiency of Power Plants (%)

	1997	1998	1999	2000	2001	2002	2003	2004
TPP 2	28.4	28.0	32.6	28.4	28.9	28.9	29.0	29.1
TPP 3	20.4	21.7	23.9	27.7	26.8	25.6	28.1	28.2
TPP 4	29.7	30.4	31.0	31.6	32.3	31.6	33.9	34.3
Darkhan TPP	28.0	26.3	29.3	27.2	29.5	29.4	29.5	29.6
Erfenet TPP	29.1	32.1	29.5	32.5	32.9	33.2	33.1	33.9

Source: Energy efficiency study of TTP 4 Ulaanbaatar – A Technical Study Report, PREGA

Figure 12: Electricity Generation in Mongolia in 1990-2008 (ktoe)



Source: IEA Statistics, Electronic Version, 2010

The power system, including transmission and distribution networks, has been in operation for 40 years and more without major technical rehabilitation. Some work on maintenance, renovation and replacement of power plants boilers has been completed with the support of international projects and attempts to increase producing capacity are being made. Distribution losses in the period 1994-2002 have been in the range of 17.10 to 19.60%, and started to go down after that to reach 11.7% in 2009 (Figure 12 and Table 8). Non-technical (commercial) losses are also high, but the situation has improved lately (including with some positive influence by the WB Energy Project for Mongolia).

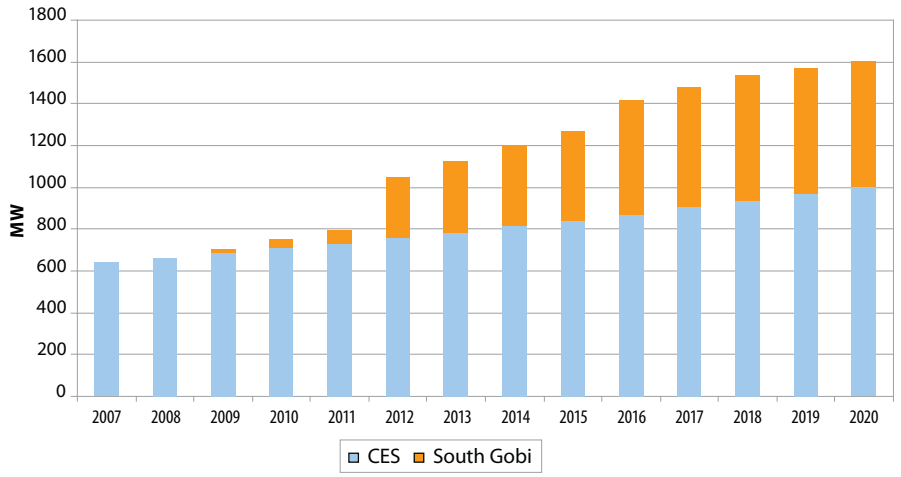
Recent demand forecast till 2020 developed by Economic Consulting Associates for the world bank assumes that electricity demand on the CES will grow at an average of 3.5% annually as well as demand in the South Gobi region is assumed to grow to 600MW by 2020, driven by the opening from 2012 of the open-cast operations of the Oyu Tolgoi copper and gold mine with a demand of 200MW and of 300MW from 2016 with expansion and the beginning of underground mining and of differing areas of the Tavan Tolgoi coal mine with a demand rising to 300MW by 2018 (Figure 13).

Table 8: Balance of Electricity (mln kWh)

	2006	2007	2008	2009
Total distribution	3 713	3 896	4 198	4 195
Gross generation	3 544	3 701	4 001	4 039
Import	168	195	198	157
Consumption	2 620	2 829	3 093	3 034
industry and construction	1 627	1 746	1 918	1 883
transport and communication	109	117	129	126
Agriculture	24	26	33	32
Household	629	695	742	728
Other	230	246	272	265
Losses in transmission and distribution	442	442	436	494
Station internal use	630	615	653	649
Export	21	10	16	18
Electricity produced per capita	1 374	1 415	1 504	1 491

Source: Mongolian Ministry for Mineral Resources and Energy

Figure 13: Peak Demand Forecast 2007-2020 (MW)



Source: Mongolia: Power Sector Development and South Gobi Development, Economic Consulting Associates September 2008

Heat Supply

Because of the long winter and winter temperatures which routinely fall below minus 20 to minus 30°C, heat access is a matter of human survival for Mongolia's citizens. There are three main sources of space heating in Mongolia:

(i) combined heat and power plants, which provide electricity, heat, and hot water to the urban centres in Ulaanbaatar and a few other cities

(ii) heat-only boilers, which meet the heating and hot water needs of a small central network of several buildings, and

(iii) individual heat stoves, which burn coal and/or wood to meet residential heating needs in periurban areas.

The central heating systems in Ulaanbaatar, Darkhan, Erdenet and Choibalsan are an integral part of the energy sector and supply nearly 40% of the urban population. However, small coal-fired heat-only boilers are used for heating by a small but increasing share (10%) of the urban population, and coal and wood-burning stoves are used by the remaining 50%, which live in peri-urban ger areas and present a large and growing share of the urban landscape. Heat demand growth has been high in recent years and demand forecasts are based on growth of up to 3% p.a.

The combined total capacity of the central heating systems is about 2011 megawatts thermal, of which Ulaanbaatar accounts for 67%. Most of the district heating systems are highly deteriorated and missing any environmental standards. The management capabilities are poor and the applied tariff systems are neither recovering the cost, nor do they provide any incentive for an efficient use of energy. Energy loss in heat distribution systems is high. As a result, heat supply is highly unreliable and it burdens public and private budgets with high cost for heating. Due to the large number of existing heating systems and their low efficiency, heating systems have a great potential with regard to energy efficiency.

Outside of Ulaanbaatar, 19 of the 21 aimags are connected to the central power network, with about five aimags having their own central heating plants. The total heat generated in 2009 is 8321 thousand Gkal, 43% of which is used by the residential sector, 24% in industry (Table 9).

Table 9: Balance of Thermal Energy (thousand Gkal)

	2006	**2007**	**2008**	**2009**
Gross generation	7 850	7 724	7 760	8 321
Power and thermal station internal use	435	415	397	335
Total distribution	7 271	7 165	7 238	7 829
industry and construction	2 019	2 068	2 168	2 002
Transport and communication	289	286	279	264
Agriculture	39	38	40	38
Household and services	4 923	4 773	4 752	5 524
Losses in transmission and distribution	145	144	125	157

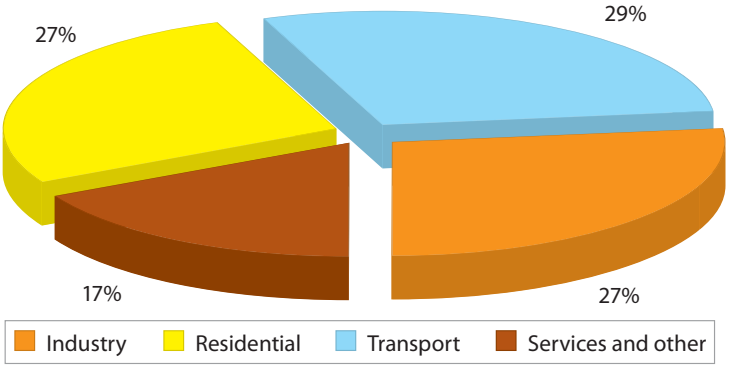
Source: Mongolian Ministry for Mineral Resources and Energy

All over Mongolia approx. 450 small capacity heating stations with approx. 1 200 boilers and a total heat load of 800 MW have been under operation in the country (in Aimag centres, Soum centres and city suburbs not connected to centralised heating systems). The individual heat load of the heating stations is between 0.8 and 2.1 MW. Almost 100% of these district heating plants are using coal as fuel. According to a study of the Mongolian Energy Association (MEA) in 2002 the efficiency of the small district heating systems is between 45-50% with a specific coal consumption of 140-155kg/GJ (1,000 to 1,500 tons/a per boiler) which is 3-3.5 times higher than in centralised systems in Mongolia.

Around 60% of urban families live in ger areas in a mixture of traditional Mongolian felt tent ger and in slightly larger informally constructed private houses that are generally built with minimal levels of insulation and high ventilation heat losses. In ger areas, buildings are heated with highly inefficient traditional stoves. Over 75,000 coal-fired urban stoves are concentrated in the poor ger districts in Ulaanbaatar. This inefficient use of heating energy significantly contributes to the extremely bad winter ambient air quality that poses a serious threat to human health in urban areas of Mongolia, particularly in Ulaanbaatar city. Both ger and small private houses are estimated to use on average around 5 tons of coal and 1.5 tons of (mostly unsustainable) fuel wood per year for fuel (large private houses use around 7 tons of coal per year and around 1.5 tons of fuel wood per year). Inefficient ger stoves produce a wide range of toxic air pollutants well above national and World Health Organisation standards. Reducing Mongolia's reliance on wood and coal-based fuels for household heating is paramount for better health of the people and reducing air pollution in Mongolia.

Energy Consumption Trends by Sector

Figure 14: Final Energy Consumption in Mongolia in 2008, by Sector

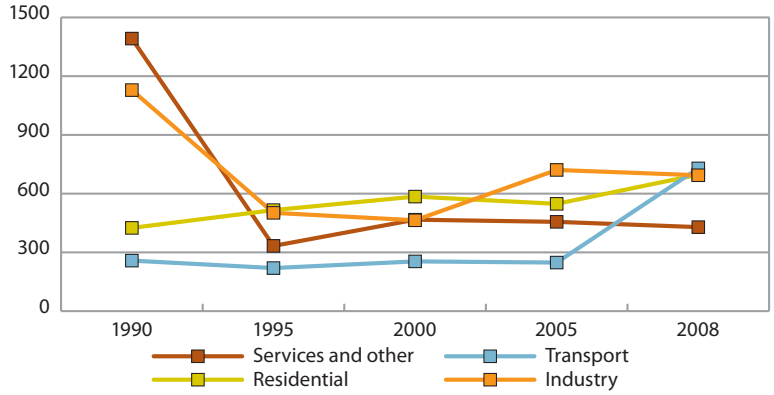


Source: Mongolian Ministry for Mineral Resources and Energy

The energy consumption of transport has increased substantially in the period 2005-2008 with an annual increase rate of 43% and this is currently the greatest energy consumer among the end-use sectors in Mongolia with a share of 29% (Figure 14). Energy consumption by industry has been reduced substantially after 1990, but recent

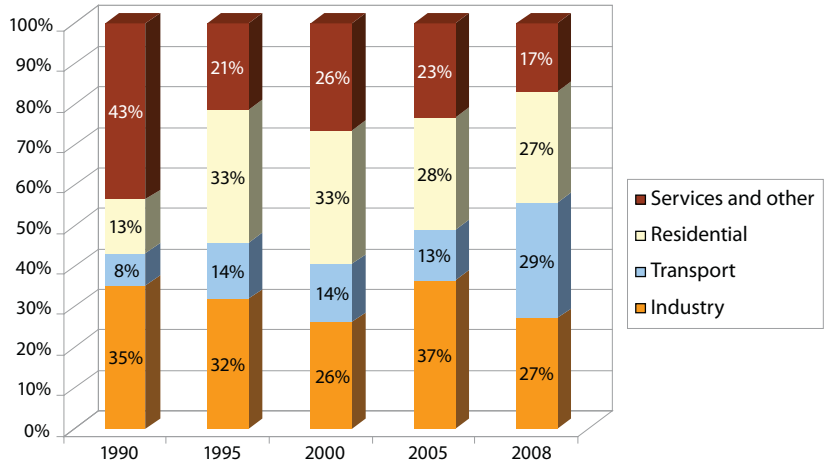
data show that it is gradually increasing after the year 2000 and industries' current share in the total final consumption is 27%. The residential sector is also rapidly increasing its final consumption with a rate of average 8% p.a. after 2005 and currently has a share of 27%. Services and other sectors have 17% of the total consumption.

Figure 15: Development of Final Energy Consumption in Mongolia, by Sector (ktoe)



Source: Mongolian Ministry for Mineral Resources and Energy

Figure 16: Development of Final Energy Consumption in Mongolia, by Sector (%)

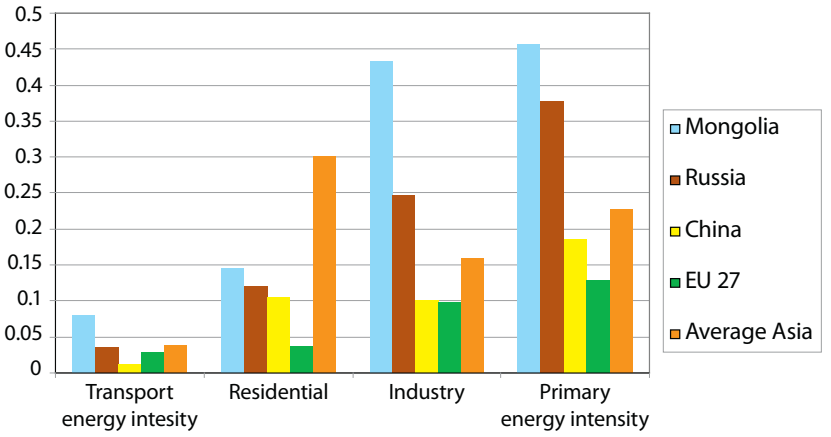


Source: Mongolian Ministry for Mineral Resources and Energy

Though the energy intensity of industry and residential sectors have significantly decreased after 1990, comparison of the energy intensity of different sectors in Mongolia with other countries show in all sectors the intensity is on average more than two times higher than the intensity of similar sectors in China, Russia or the average indicator for Asian countries and few times higher the EU 27 levels (Figure 17). The industry sector has the highest energy intensity amongst all sectors – 0,43 koe/$05ppp with similar figure for Russia and China 0,25 koe/$05ppp and 0,1 koe/$05ppp

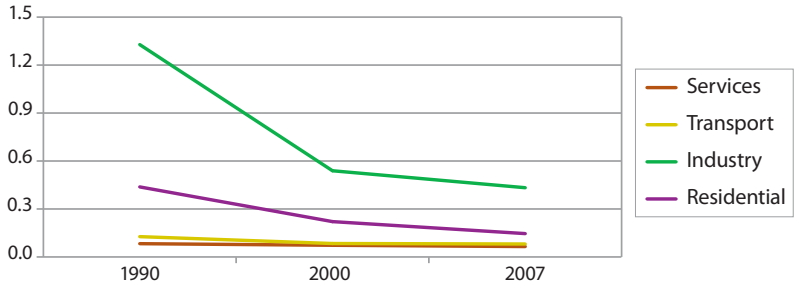
respectively. Residential sector is next with energy intensity of 0,15 koe/$05ppp (China 0,106 koe/$05ppp and Russia 0,12 koe/$05ppp) and transport is third with intensity of 0,081 koe/$05ppp (China 0,012 koe/$05ppp and Russia 0,036 koe/$05ppp).

Figure 17: Energy Intensity Development, by Sector (koe/$05ppp)



Source: Energy Efficiency Indicators on www.enerdata.fr

Figure 18: Energy Intensity Development Trends in Mongolia, by Sector (koe/$05ppp)



Source: Energy Efficiency Indicators on www.enerdata.fr

Industry

The total industry consumption in 2008 is 694 ktoe, which is 27% of total final consumption in the country and is almost half the consumption in 1990 (Table 10).

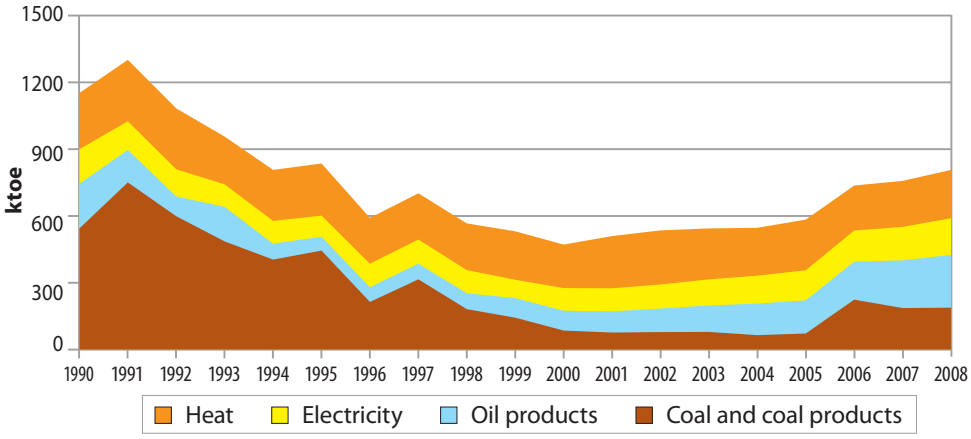
Reduced industrial energy consumption is caused by the reduced industrial activity in the country – in most aimag centres it is between 50% and 90% less than the industrial activity some 20 years ago. The reduced energy consumption is mainly in reduced use of coal (Figure 19). While in 1990 coal accounted for about half of the energy used in industry, nowadays the energy use structure of the sector is rather balanced between heat, electricity, coal and petroleum products (Figure 20).

Table 10: Energy Consumption in Mongolia's Industry Sector (ktoe)

	1990	1995	2000	2005	2008
Industry	1 129	502	464	721	694
Share in TFC	*35%*	*32%*	*26%*	*37%*	*27%*

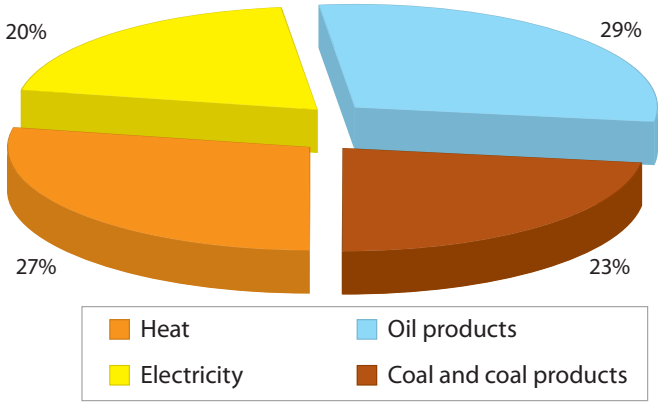
Source: Mongolian Ministry for Mineral Resources and Energy

Figure 19: Development of Final Energy Consumption in Mongolia's Industry Sector, by Fuel (ktoe)



Source: IEA Statistics, Electronic Version, 2010

Figure 20: Final Energy Consumption in Mongolia's Industry Sector in 2008, by Fuel



Source: IEA Statistics, Electronic Version, 2010

Most process technology in the Mongolian industry is of Russian or Eastern European origin, having a low efficiency in terms of energy usage and capacity (product-rate related to size and cost of equipment) compared to Western European technology and huge potential for reducing energy consumption.

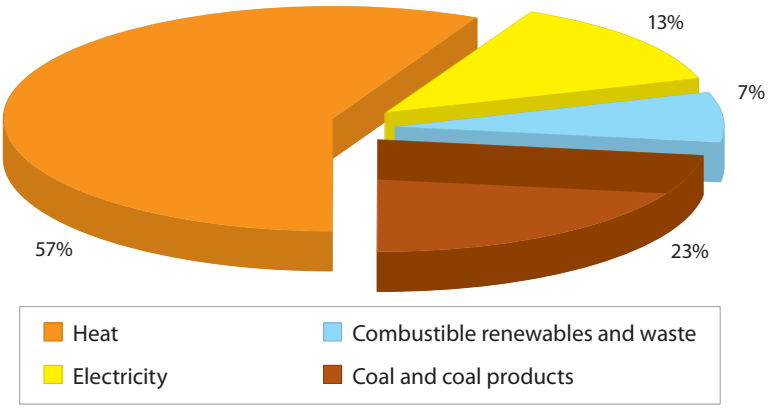
Some feasibility studies for example show that total coal consumption for cement production could be reduced by 40-45% by replacing the cement processing wet technology with dry technology. Also audits performed show that electric motors and drives used are generally oversized and badly maintained with a significant decrease in efficiency – the load of such machinery to be as low as 20-30%, typically resulting in efficiencies in the range of 50-60%. This should be compared to an efficiency of more than 80% for properly designed and maintained motor-installations. Many steam systems are badly operated and maintained. The losses in the audited steam sub-stations and piping systems are estimated to be as high as 20% of total heat consumption (or even more) due to steam traps out of operation, lack of insulation for piping and valves, leakages in valves and fittings, and loss of condensate.

In addition it has been estimated that Mongolian industry has considerable potential to save 15-25% energy through good housekeeping and energy management.

Residential and Services Sectors

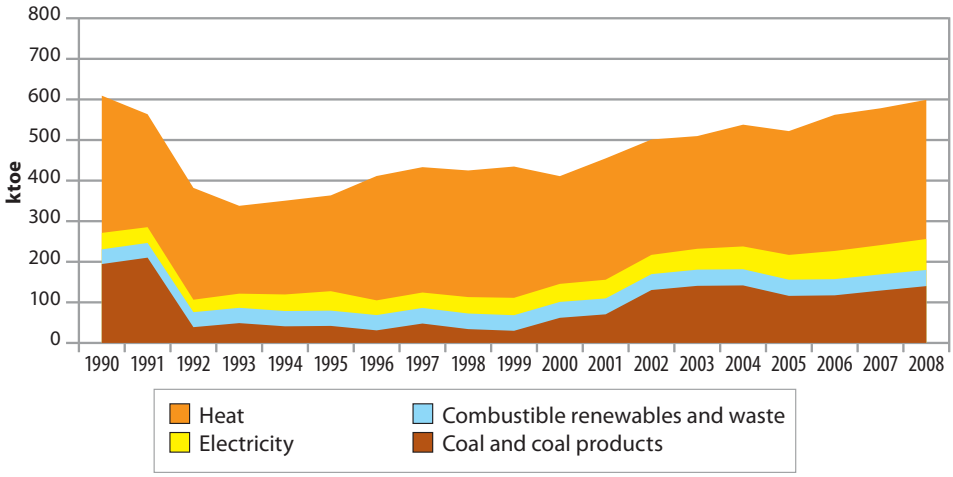
Residential sector consumes 27% of the total final consumption and uses mainly heat and coal, electricity, some fuel wood and dung (Figures 21 and 22). The International Energy Agency (IEA) statistics provides information about the services sector as consuming mainly heat (84%) and some coal. Typical small heating boiler in provincial centres uses 800-1200 tonnes of coal a year in average in order to produce 0.8-1.2 MW power and heating. These boilers provide heating for schools, hospitals, kindergartens and other public institutions with very low efficiency (0.4-0.5) due to outdated equipment. While the shares of heat, electricity and combustible renewables have been more or less stable through the years after 1999, the share of coal in the total consumption in the residential sector has increased three times from 7% in 1999 up to 23% in 2008.

Figure 21: Final Energy Consumption in Mongolia's Residential Sector in 2008, by Fuel (%)



Source: IEA Statistics, Electronic Version, 2010

Figure 22: Development of Energy Consumption in Mongolia's Residential Sector, by Fuel (ktoe)



Source: IEA Statistics, Electronic Version, 2010

According to the 2000 Census, nearly 72% of urban households in Mongolia lived in conventional housing (i.e., apartment units, private houses, and all-weather houses in the ger areas), 38% lived in apartment buildings, virtually all of which had been privatised.

The urban population of Mongolia comprises 1.6 million people or over 60% of the total population. The rapid rate of urbanisation in the country over the past 10 years heightened demand by residential and commercial consumers of urban services and it has outstripped supply, particularly in Ulaanbaatar and in provincial towns, and has even become a constraint to the growth of economic activity in these areas. There is an urgent need to expand the physical infrastructure in the urban development sector, as well as to improve the management and sustainability of the urban infrastructure network to meet this demand.

In 2005 the construction sector expanded by 15.5%, slowing to 5% growth in 2006-2008. In the Mongolian context, the formal "construction sector" refers to heavyweight, multi-storey commercial and residential apartment buildings (and a few private houses), since these are the only buildings connected to water supply, sewage, district heating and domestic hot water systems. While the economic crisis has temporarily hampered construction projects, there are projections for a long-term trend of continued growth in the sector. A priority of the Government is its "40,000 Houses" programme, which envisages construction of 15,000 suburban houses, 15,000 homes in ger ("informal urban") areas and 10,000 apartment units. This is in line with the Government's thrust to narrow the gap between the urban and rural areas in terms of development. This will be done through provision of infrastructure to aimag centres and promotion of economic development.

A combination of extreme winter conditions, a long heating season of eight months, very low existing heating energy supply system efficiencies, inadequate metering and tariff structures, and generally inadequate building insulation levels and quality are major contributors to Mongolia's extremely high per capita fossil fuel use.

The majority of pre-cast panel buildings in Ulaanbaatar were constructed in 1970s, 80s and early 90s, they are all in a poor state and no systematic professional maintenance and repair has been done. The buildings have no added external wall insulation, have poorly insulated external doors, poorly insulated roofs that are often also not fully waterproof either, still have mostly old double wooden framed high air ventilation heat loss windows (although around 10-25% of windows have been retrofitted with more airtight locally sourced PVC framed double-glazed windows – which however are likely to have high edge heat losses and uncertain air sealing). The pre-cast panel apartments generally have excessive heat losses and cold apartment external wall surfaces with subsequent condensation and poor comfort conditions in Ulaanbaatar's extreme winter conditions (outside design air temperature of -39 °C over the 7 month heating season).

Virtually all apartments in the city, including the new ones, (with very few exceptions) were constructed in a way which renders it practically impossible to measure and meter heat and water consumption of the individual apartments. It is not only the service suppliers who do not have a chance to measure the consumption of individual apartments and to establish a fair pricing system for heat charging those more who consume more. As the radiators are not equipped with control valves, the consumers themselves do not have the possibility to adjust their heat consumption according to desired room temperatures.

The energy efficiency in centrally and district heated buildings leaves much room for technical and managerial improvement. The specific heat consumption of the buildings is about five times higher than in modern systems in Europe. This can be explained to some extent by the very cold climate, but mainly by poor technology and by missing incentives to save energy. On the other hand, the supplied heat is often not sufficient to reach room temperatures of 21°C, as it is set in the relevant law. Very often room temperatures are not higher than 12 to 15°C in the wintertime.

On the consumer side the very low building standards create high heating losses and resulting high heat demand. Many apartments have no heat meters and their heating fee and price is calculated based on fixed tariff that does not reflect the actual amount of heat used. No heat regulation devices are installed in the rooms to be heated and heat regulation is done by using the windows.

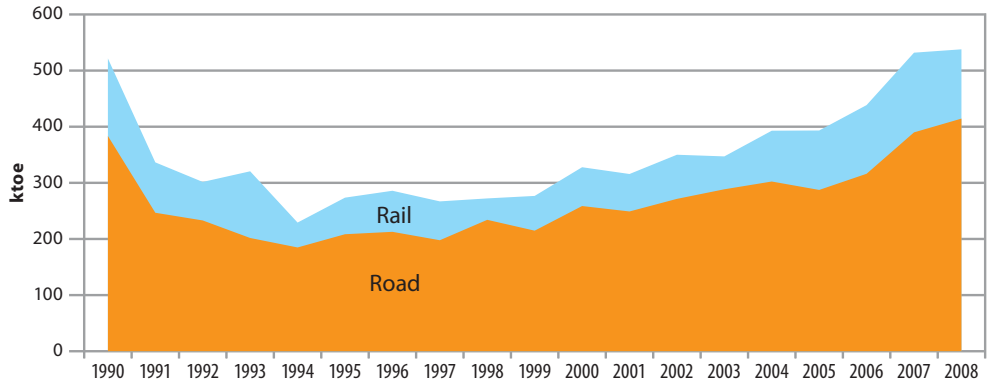
Heating costs in Mongolia have traditionally been subsidised by the Government, either through the provision of cheap coal or cheap district heating. As a result, energy conservation and building insulation have not been high priorities for energy consumers and all the buildings suffer from great heat losses during the winter months. On the other side, there is information, that heating of buildings requires almost 50% of the annual budget of state organisations and a substantial

amount of individual households' income. Poor households spend about a third of their annual budget on coal purchases.

Transport

Transport in Mongolia is increasing its energy consumption and has a share of 24% of TFC recently.

Figure 23: Energy Consumption in the Transport Sector (ktoe)



Source: IEA Statistics, Electronic Version, 2010

Road transport is the biggest energy consumer of imported petroleum products, although rail transport also uses petroleum products for 63% of its energy needs. Another 30% of rail energy is provided by coal and only 7% by electricity.

Only about 13% of all roads in Mongolia are paved. Another 30% of the roads are gravel or formed earth, and more than half of the country's roads are simply earth tracks. Given the dependence of the Mongolian economy on railways and roads, despite the advances in construction and fleet capacity, two pressing issues remain in the transportation sector: maintenance of existing roads and construction of new ones. Budget constraints in recent years have resulted in minimal investments in road maintenance, while the large territory and sparse population provide little incentive to develop new roads. Transportation on current roads is problematic and is often impossible in winters.

ENERGY POLICY

Strategy and Legal Framework

Mongolia's Strategy for Sustainable Development of the Energy Sector 2002-2010 was approved by the cabinet in July 2002 and revised in 2004. Its aim is sustainable development of the energy sector, reduced poverty and increased involvement of the private sector and public interest in the sector through a more secure energy supply. Moreover, Mongolia's energy sector should be developed within the regional energy context, while at the same time taking advantage of new technologies and sources of energy that might further promote economic efficiency and environmental sustainability. The strategy focuses on the following main principles:

- Financial sustainability to transform the sector from a drain on state finances to a net contributor to economic growth;
- Restructuring to foster commercialisation and private sector participation;
- Capacity building to ensure success of market transformation;
- Energy access and affordability to ensure that poor and rural areas benefit from reforms; and
- Energy conservation to promote efficiency, consumer choice, and environmental sustainability.

The Energy Law of Mongolia came into force on 1 February 2001 and provides the legal framework for restructuring the energy sector from centrally planned to market-based. The Energy Law aims to create competition and increase private participation and investment. It also provides regulations for energy generation, transmission, distribution and supply activities, as well as the construction of energy facilities and the use of energy resources. This law authorises the creation of an independent energy regulator and gives powers and responsibilities to key institutions involved in managing and operating the energy sector.

The Government has adopted a policy to ensure reliable power throughout the country and its capital city and will develop new generation capacity to meet increasing demand. In 2007 Programme on integrated power energy system was adopted by the Parliament with the following objectives:

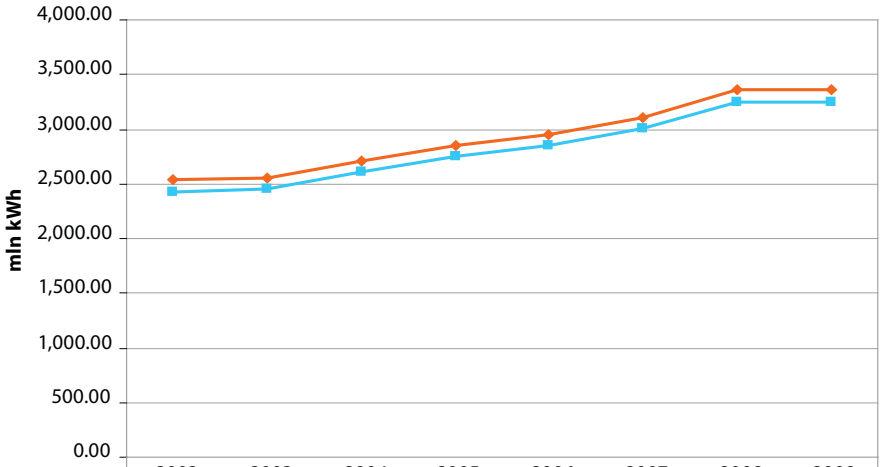
- to create independent and reliable power system with efficient energy generation facilities with as less as possible loss;
- to secure power supply reliability in regions by constructing hydro power plants and high voltage transmission lines to connect the plants;
- to restructure energy generation sources and make power supply in urban and settled areas reliable by introducing new and efficient technology and equipment and utilising renewable energy sources;
- to develop laws and legal basis and management principles applicable in the market economy principles and increase participation of private sector in the energy sector.

The Mongolian government has recognised the need to secure a sustainable energy supply by developing renewable energy potential and improving the current power system. A new legislative framework on renewable sources of energy has been adopted as a part of the Government Action Plan (see more in section Renewable Energy).

Energy Sector Reform

Mongolia's energy sector has overcome a transition from a centralised, command-based system to a market-oriented one. Currently, within the CES, electricity is traded through the main market – the SBM – and two other accompanying markets: spot and competitive. As a first step in transforming the energy sector into a market-oriented operation, the SBM introduced in the Central Energy System as an operational model since the 4th quarter of 2002. In 2009 the Single Buyer purchased 3364.4 million kWh, which is almost equal to the amount from 2008. Figures 24 and 25 show the electricity purchased and the average price over the last 8 years.

Figure 24: Electricity Purchased and Sold through the Single Buyer in 2002-2009 (mln kWh)

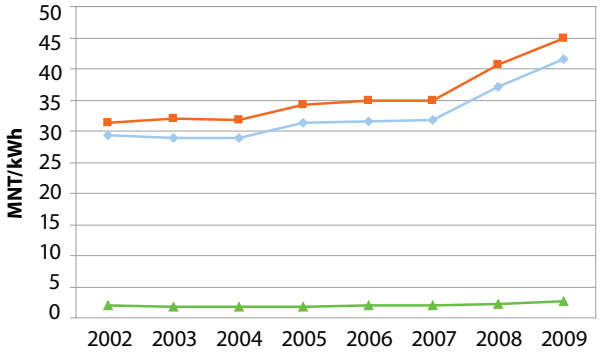


	2002	2003	2004	2005	2006	2007	2008	2009
Purchased electricity	2,540.00	2,558.00	2,713.00	2,844.00	2,952.00	3,112.00	3,363.00	3,364.00
Transmitted electricity	2,422.00	2,458.00	2,608.00	2,745.00	2,851.00	3,008.00	3,252.00	3,253.00

Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

In the spot market, the differences between actual dispatch and the contractual commitments of each generator can be traded. The National Dispatching Centre has been acting as an operator of the spot market. In 2009, about 4.1 million kWh of electricity, valued at Mongolian tugrik (MNT) 89.7 million, was traded on the spot market in Mongolia, which was about 40% less than in 2008 (Figure 26).

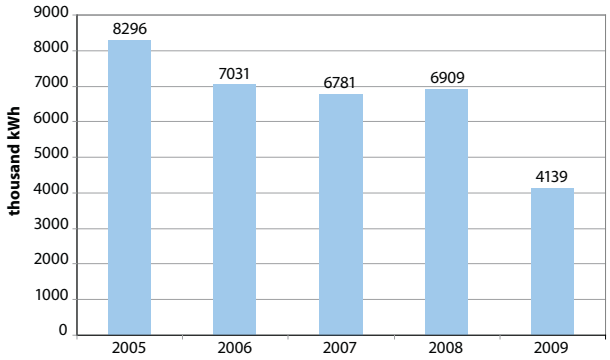
Figure 25: Average Prices of Electricity Purchased and Sold through the Single Buyer in 2002-2009 (MNT/kWh)



	2002	2003	2004	2005	2006	2007	2008	2009
Average price of purchased electricity	29.4	28.9	28.8	31.3	31.6	31.8	37.1	41.6
Average price of sold electricity	31.3	31.9	31.7	34.3	34.9	34.9	40.7	44.8
Transmission cost	1.9	1.8	1.8	1.8	1.9	2	2.3	2.6

Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Figure 26: Electricity Traded in the Spot Market in 2005-2009 (thousand kWh)



Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

On the competitive or auction market in Mongolia, the generation company that offers to reduce its generation tariff by the largest percentage is awarded the right to supply electricity. This gives a chance for the power plants with significantly different tariffs to have an equal right to participate in the auction market.

In 2001, before the inception of the SBM, the rate of revenue collection within the sector was only about 75%. However, since the SBM was introduced in 2002, the collection rate has increased consistently year-on-year and in 2009 the single buyer was able to collect 100% of the sales revenues.

When the Energy Regulatory Authority (ERA) started operations in 2001, 18 large energy companies had licences for energy activities. In March 2010 the ERA had granted 155 licences in 10 categories to 72 enterprises and organisations (Table 11).

Table 11: Energy Regulatory Authority's Issuance of Licenses for Energy Activities in March 2010

	Granted licenses	Granted licenses to State Owned Joint Stock Companies	Granted licenses to State Owned Co., Ltd
Energy construction	6	1	
Electricity generation	8	7	
Electricity transmission	3	3	
Electricity distribution	16	6	
Regulated electricity supply	19	8	
Electricity import	15	3	
Heat generation	10	9	
Heat distribution	38	9	
Regulated heat supply	39	10	
Dispatching regulation	1		1
Total	155	56	1

Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Energy Pricing Policy

According the Energy law, ERA is the authority to develop methodology to determine tariffs, define the structure of tariffs and review, approve, inspect and publish tariffs of licensees. The tariffs are then discussed at the Regulatory Board meetings and final decisions are issued in the form of resolutions. Originally, tariffs were artificially low, which did not allow the licensed energy companies to recover their costs and expenses. By setting tariffs, the ERA aimed to ensure the financial viability and sustainable operation of the licensees, while balancing their interests with those of the consumers.

In 2001 when ERA was established there were 3 types of electricity and 4 thermal tariffs, while today 12 electricity and 8 thermal types of tariffs are applied (Table 12). Tariff levels are very sensitive issue in Mongolia and are subject to a heavily political pressure, making it difficult to propose and implement changes. However there is general understanding between ERA and Ministry for Mineral Resources and Energy official of the need to continue gradually to remove subsidies for both electricity and heat. By 2010 ERA increased tariffs 5 times (Table 13) and the intentions is for the end-user price for electricity to reach the level of 8 US cents/kWh in 2013 (Figure 27) which is deemed as cost recovering. After reaching cost recovering tariffs, cross subsidies currently existing between industry and residential tariffs are planned to be removed. The current level of subsidies for the end use price is 72% average on residential users and 58% for industrial consumers. Other forms of subsidies are debt repayment waivers of deferrals granted by the Government to various energy sector companies.

Table 12: Type of Applied Electricity and Heat Tariffs

Electricity		
2001	**2009**	**Future improvements**
1. Consumers with simple metering	1. Consumers with simple metering	1. Modify tariffs for industrial consumers and enterprises (depending on size of industry)
2. Consumers with three tariffs meters (day, evening, night)	2. Industrial consumers and enterprises with three tariffs meters (day, evening, night)	2. Increase electricity capacity tariff for consumers and enterprises
3. Consumers without meters	3. Residential consumers with two tariffs meters (day, night)	3. Introduce voltage tariff, depending on voltage level
	4. Public lighting (2 tariff meters)	
	5. Lighting for apartment entrance (2 tariff meters)	
	6. Residential consumers in ger area	
	7. Consumers without meters	
	8. Average consumption tariff (without meter)	
	9. Vulnerable low-income consumers	
	10. Electrical transportation	
	11. Increasing block tariff for residential consumers depending on consumption level	
	12. Monthly supply charge for residential consumers	
Heat		
1. Meter measuring	1. Meter measuring	1. Modify tariff to real cost based tariff
2. Calculated on m^3	2. Calculated on m^3	
3. Calculated on m^2	3. Calculated on m^2	
4. Calculated on number of persons (for hot water)	4. Calculated on number of persons (for hot water)	
	5. Hot water for residential consumers (based on meter reading)	
	6. Hot water for residential consumers on number of persons (seasonally different)	
	7. Wholesale hot water tariff	
	8. Hot water for enterprises renting office at 1st floor of apartment building)	

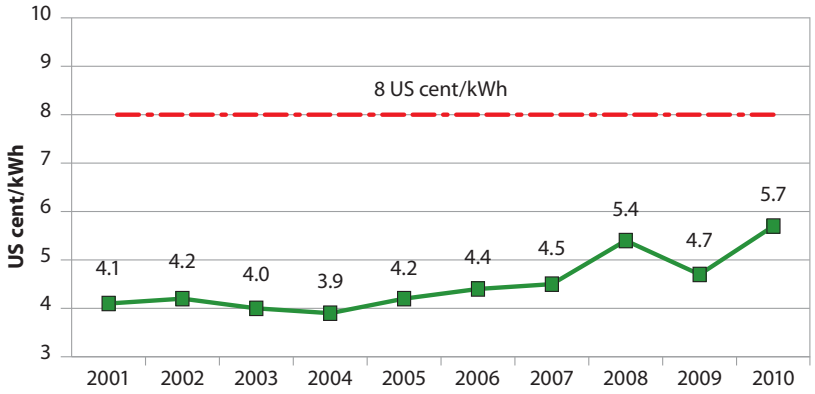
Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Table 13: Average Increase in Tariffs for Energy for 2002-2009

	2002	2005	2007	2008	2009
Electricity	4.4%	8.5%	4.4%	27.8%	17.35%
Heat	12.4%-30%	19.3%	20.1%-26.4%	39% – heat 61.3%-141.9% – hot water	14.5%

Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Figure 27: Comparison between Current Electricity Price and Future Target (US cent/kWh)

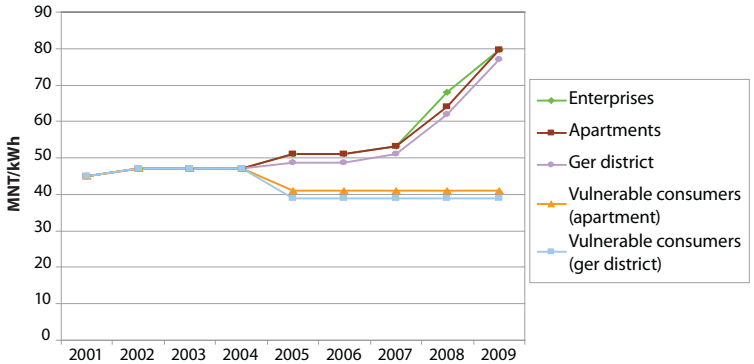


Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

To protect most vulnerable consumers in 2005 a tariff system for low income consumers was introduced (Figure 28). As of 2009 the tariff for this type of consumers is almost half the average price paid by residential and industrial consumers, however only few household seem to benefit from it.

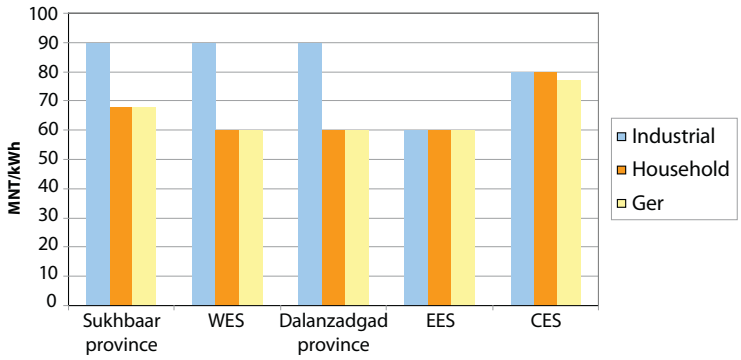
To reduce demand in peak hours and to increase consumption in night hours a three phased tariffs was introduces for industries. At the same time two-tariff was introduced also for residential consumers and now over 60000 consumers have purchased and installed two tariff electricity meters. As an energy saving incentive, a tariff depending on the monthly consumption of residential users is applied as of 2008. Currently, 9 districts of Ulaanbaatar and 7 aimag centres are using discounted tariff for lighting of streets and squares at night time. In terms of this measure the lighting of public streets and squares has been gradually improved (Annex 3: Electricity and Heat Retail Tariffs).

Figure 28: Trends in Electricity Tariffs in the Central Energy System of Mongolia (MNT/kWh)



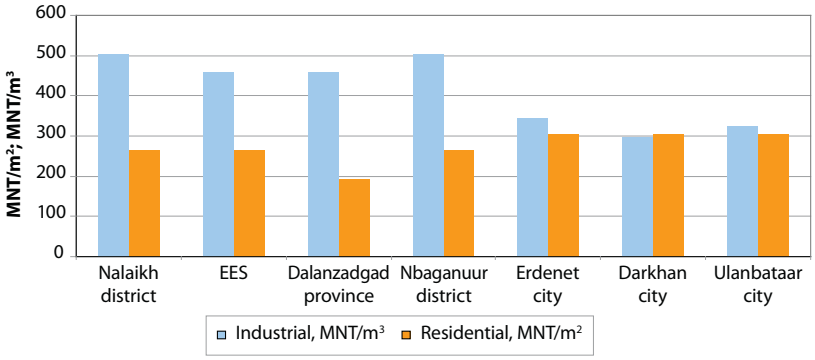
Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Figure 29: Current Electricity Tariffs in Major Cities in Mongolia (MNT/kWh)



Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Figure 30: Current Heat Tariffs in Major Cities in Mongolia (Industry: MNT/m³; Residential: MNT/m²)



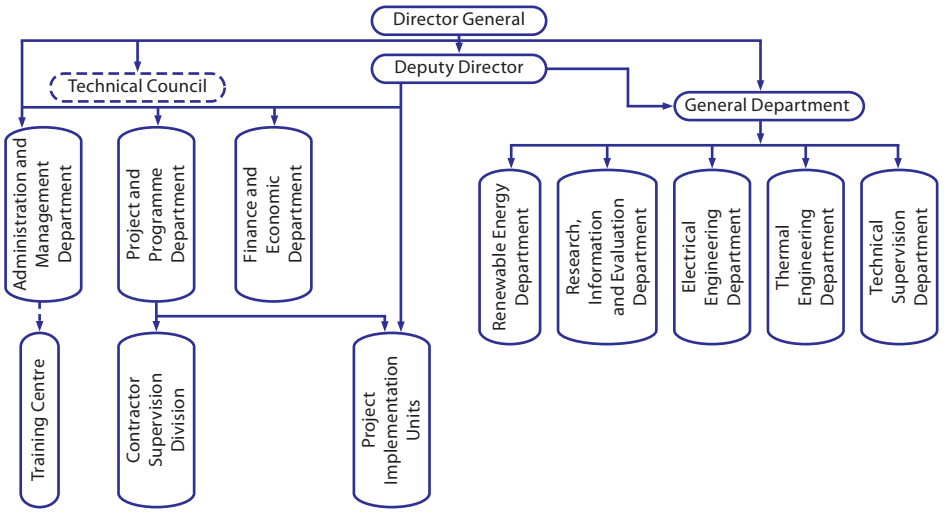
Source: Energy Regulatory Authority of Mongolia, http://www.era.energy.mn

Institutions

The key institutions involved in policymaking, managing and operating the energy sector according to the Energy Law of 2001 are:

- the State Ikh Khural (Parliament) formulates state policy on energy and makes decisions regarding the construction of nuclear power plants;
- the Ministry for Mineral Resources and Energy (MMRE) (previously Ministry of Fuel and Energy) is in charge of the development of policy, including the development of energy resources; energy use; import and export of energy; Construction of power plants; transmission lines and networks; energy conservation; use of renewable sources; regulation; and international cooperation;
- the Energy Regulatory Authority is in charge of issuing licences, approving tariffs and protecting the rights of consumers and licensees.

Figure 31: Energy Authority Organisational Chart



Source: Mongolian Energy Authority

Previously, all state-owned power enterprises operated under the management of the Energy Agency within a centralised vertical management structure. With the 2001 Energy Law, this structure was unbundled and separated, independent companies dealing with generation, transmission, distribution and supply were created.

The main policy areas of responsibility of the Ministry for Mineral Resources and Energy and its Energy Policy Department include: development of energy resources; energy use; import and export of energy; construction of power plants, lines and networks; energy conservation; use of renewables; monitoring the sector; approving rules and regulations for the sector; and international cooperation. The Department is also in charge of collecting and providing all data regarding energy production, supply, demand, etc. The Ministry employs 40 specialists in total and the Energy Policy department has six full time employees.

In 2009 the Energy Research and Development Centre was transformed to Energy Authority (EA) and has been given a mandate of an implementing agency under MMRE. The main activities that EA as mandated include:

- Organise projects and activities funded by the State budget and Development fund of Mongolia; carry out the technical supervision, commissioning of project facilities;
- Implementation of programmes and projects of the sector; supervise, monitor and evaluate the policy implementation;
- Develop and implement projects and activities for efficiency improvement and loss reduction of utilities and companies in the energy sector;
- Develop feasibility studies for projects financed by technical assistance of foreign and international organisations;

- Prepare calculations and studies required for the development of policy and strategy in the energy sector, provide guidance for regulations and policy implementation;
- Carry out studies for utilisation of solar, wind, biomass and geothermal energy resources; introduction of environmentally friendly technologies and new energy sources.

The Energy Regulatory Authority of Mongolia is an independent organisation that regulates generation, transmission, distribution, dispatching and supply of energy in accordance with the provisions of the Energy Law and related legislation. ERA was established in 2001. Its main responsibilities are to issue operational licences, to review and approve the tariffs of licensees (energy companies that sell to the end-user), to protect equally the rights of the consumers and licensees, and to create and maintain conditions for fair competition among the generation and supply companies.

The independence of the regulatory body, the ERA, is guaranteed through the following principles, set out by the Energy Law of Mongolia:

- The appointment of the regulatory board is made by the president of Mongolia, the parliament or the prime minister;
- The term of service of the regulator is staggered so that it does not coincide with the parliamentary election cycle;
- The regulatory board can only be dismissed in conformity with law;
- The regulatory authority is funded by licensing fees and charges for regulatory services provided to licensees.

The National Dispatch Centre is responsible for coordinating daily system operation of all power and heat sector entities including real time coordination of power plant operation, transmission and distribution switching operation, and operation of the heat transmission network in coordination with combined heat and power operation. The NDC is also responsible for providing the information necessary for settlement of spot market transactions within the context of the wholesale electric power market.

Mongolian Energy Association is a non-profit organisation providing services for Member Committees in the framework of Constitution of MEA. The main aim of MEA Is to contribute to the development of Energy sector of Mongolia through cooperating with the World Energy Council and other international organisations. MEA is an Intermediary and supporting organisation between the international organisations and the Mongolian Energy Communities. It includes over 40 local member organisations: power stations, mining companies, Ulaanbaatar heating and electricity transmission Companies, Ulaanbaatar Electricity Distribution Company, regional electricity distribution companies, the Energy Regulatory Authority, Energy Research Development Centre, Renewable Energy Corporation, Metering Adjusting and Regulation Company, Energy Institute, and a number of energy and energy-consulting companies.

ENERGY EFFICIENCY POLICY

Overview of Energy Efficiency Policies and Legal Framework

Mongolia's Strategy for Sustainable Development of the Energy Sector 2002-2010 sets energy conservation and environmental sustainability as one of its five main principles. The Government of Mongolia has included energy efficiency strategic goals in its Millennium Development Goals, targeting "incorporating sustainable development principles into and implement national policy and programmes, and clean up air pollution of settlements, especially in Ulaanbaatar City". An integral part of meeting that target is defined to be "Developing and approving standards and norms for energy efficient building, introducing heating energy assessment system for buildings, support production of construction insulating materials, works on additional insulation of plants, public sites and housing units are important to reduce air pollution gradually."

Currently there are no formally adopted energy efficiency priorities and policies by the Mongolian government. Two draft laws on energy efficiency were prepared in 2003, one by the former Ministry of Infrastructure, another one by the USAID consultants. The Ministry's draft was discussed at the cabinet, but was not endorsed for submission to parliament. No progress was made from 2003 till recently for the development and approval of energy efficiency legislation, probably due to often changes of governments and restructuring of Ministries and low priority given to energy efficiency activities.

In July 2010 with the financial support of ADB the development of a new Draft Energy Conservation Law has been initiated as well as the development of a Medium and Long term Energy Efficiency Action Plan for Mongolia. Both documents are supposed to be finalised by November 2010 and submitted to government and Parliament for approval in the beginning of 2011.

The current Building Law, Housing Law, and Urban Planning Law of Mongolia provides the necessary legal basis for the updating of the Mongolian building code energy efficiency provisions systems and in 2010 in the framework of GEF/ UNDP Building Energy Efficiency Project, BNbD 23-02-2009 "Buildings Thermal Performance" was developed and adopted. The norms are applied to residential, public, industrial, agricultural and storage buildings that are regularly heated during winter months and set out requirements for:

- specific consumption of thermal energy for heating in buildings;
- limiting the temperature and preventing moisture condensation on the inner surface of the enclosing structures;
- protection of building envelopes against over moisturising;
- thermal stability of building envelope;
- heat absorption of floor surface;
- energy efficiency part in the design of new buildings;
- energy passport and Building Energy Performance Certificate (label).

Table 14: Energy Efficiency Label Classification for Buildings

Levels	Classification vs. Energy Efficiency	Deviation of design (actual) values of specific thermal energy consumption of for building heating, q_h^{des} from normative, %	Recommended Actions by Authorities
For new and reconstructed buildings			
A	Very good	Less than minus 51	Economic incentives
B	Good	Minus 10 to minus 50	Economic incentives
C	Normal	Plus 5 to minus 9	Increase the efficiency level
For existing buildings			
D	Poor	Plus 6 to plus 75	Preferred refurbishment of the building
E	Very poor	More than 76	Insulate the building in the near future

Source: BNbD 23-02-09, Building Norms and Regulations of Mongolia – Thermal Performance of Buildings

In the near future new building codes, norms and standards are planned to be developed, covering thermal performance, HVAC systems, insulation materials, lighting systems and hot water systems.

Institutional Set-up

There is no formally mandated agency in the country, delegated to develop and implement the national and spectral energy efficiency policies and programmes. Different Ministries and some other organisations are involved in a number of activities, but very often the activities between different stakeholders are not coordinated and no information is available for what has been already been initiated or implemented in certain areas.

Ministry for Mineral Resources and Energy is the government body, responsible for energy efficiency and renewable energy, in addition to its major responsibilities for the energy sector. There is no department/unit, specifically mandated with energy efficiency policies development and implementation and there are no staff members dedicated to work on energy efficiency full time.

Ministry for Nature, Environment and Tourism (MNET) plays an important role for energy efficiency activities in Mongolia. Most of these activities are initiated to protect the environment, affected badly by the coal based energy sector. The CDM National Bureau is positioned at the Sustainable Development and Strategic Planning Department of the MNET and since its establishment the Bureau has approved 6 CDM energy efficiency projects, which are at different stages of preparation.

Ministry of Roads, Transport, Construction and Urban Development (MRTCUD) is the policy making body with a mandate to develop Government policies and strategies for a wide range of sectors including land affairs, urban development, onstruction, housing, building materials, public utilities, roads, and transportation. The Ministry has six departments, employing 70 staff. Its Construction, Housing and Public Utilities Policy Department (8 staff) is responsible for developing policies and strategies for construction, housing and public utilities (water supply and sewerage). Within the Department one official is responsible for housing policy formulation and another one for reviewing building codes and processing them for approval. is involved in projects and activities related to building codes, norms and standards. It is the local executive partner for the on-going project Energy Efficiency in New Construction in the Residential and Commercial Buildings Sector in Mongolia.

The Ulaanbaatar District Heating Company (UBDHC) was established in 1959 and in August of 2001, the company was converted into an independent operating agency, one of the 18 new state owned corporations, as a result of the restructuring of the energy sector of Mongolia. 41% of its shares are owned by the Ministry of Mineral Resources and Energy, 20% by the Ministry of Finance and 39% by the State Property Committee. In order to improve the district heating system, the UBDHC encourage end-user efficiency, and thus ensure the reliability and adequacy of the heat supply in Ulaanbaatar. UBDHC was the main executing agency in the ADB funded Ulaanbaatar Heat Efficiency Project.

The Mongolian Energy Association, a non-profit organisation, playing the role of an intermediary and supporting organisation between the international organisations and the Mongolian Energy Communities, has organised workshops on the following topics related to energy efficiency and renewable energy. In 2005-2007, MEA implemented the project "Introduction of Renewable energy subject to Mongolian secondary schools of Western aimags of Mongolia" financed by GTZ.

The Mongolian National Chamber of Commerce and Industry (MNCCI) is the main representative body of the Mongolian business community and engages businesses, enterprises, and trade organisations in a wide range of activities and services in protecting common interests. The Chamber has a special Department "Clean Production & Clean Industry Development" with the main goal to contribute in sustainable development by promoting, introducing and implementing Cleaner Production principles in Mongolia. Its activities include, among others:

- To establish Cleaner Production National Centre, to disseminate principles of the cleaner production into Mongolian industrial and services sectors, and to work out a national programme supporting a Cleaner Production;
- To create a favourable legal environment for cleaner production development with a support of governmental policy;
- To create a favourable legal and financial environment for the development of energy efficiency improvements and ESCO business in Mongolia;

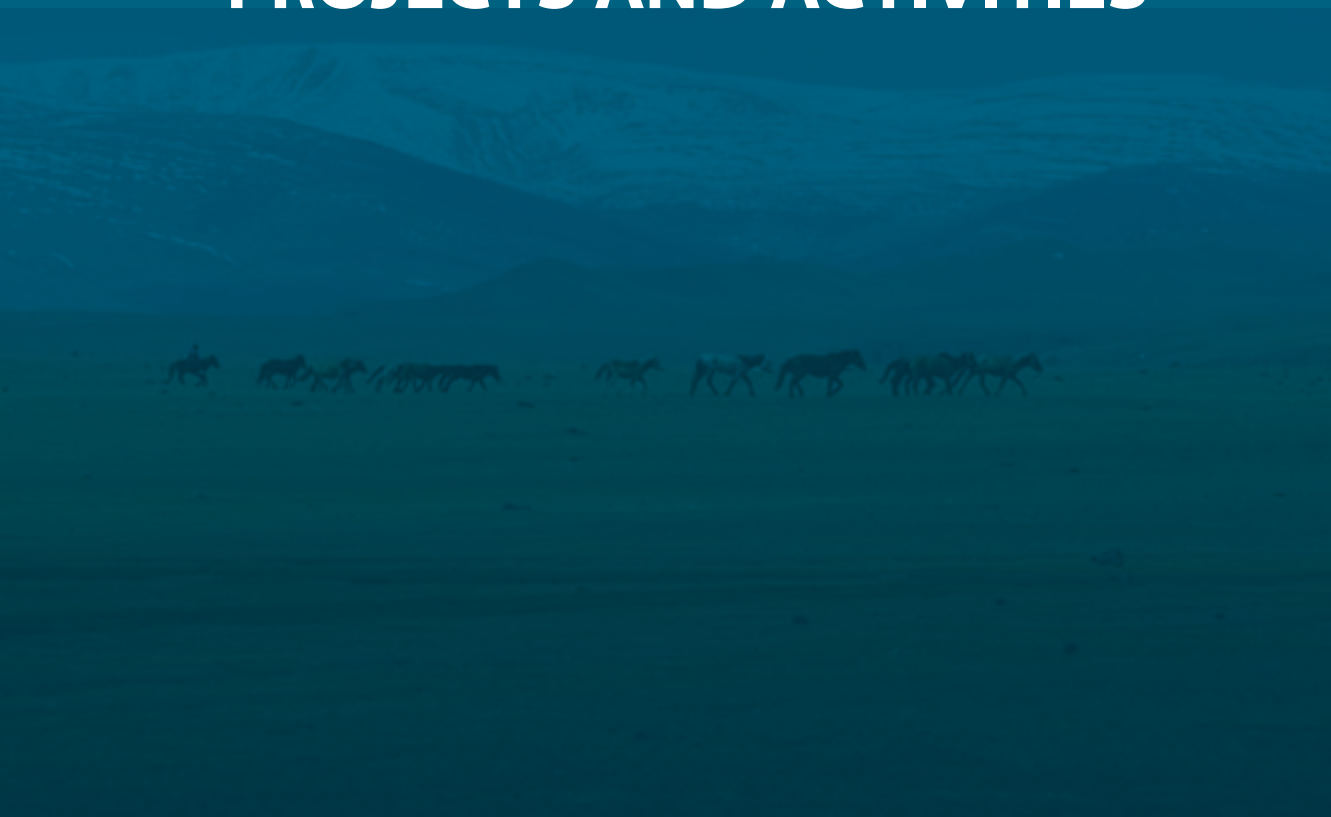
- To facilitate investment mechanism development towards Cleaner production and ESCO in Mongolia.

It is also involved in Energy Efficiency/ESCO services by:

- Conducting energy audits to identify potential energy savings;
- Undertaking specialised training on energy efficiency and ESCO services;
- Introducing energy management systems into companies;
- Developing and implementing projects focused on increasing energy efficiencies;
- Consulting on energy efficiency options;
- Conducting technical assessment on energy efficiency projects;
- Raising awareness of ESCO services: www.esco.mn web site.

The objective of the National Renewable Energy Centre (NREC) of Mongolia is to provide an equal, stable and simultaneous development of economy and energy that respects the environment by the use of environmentally friendly renewable energy sources. The NREC has been formed under the Ministry of Fuel and Energy, based on the former Renewable Energy Corporation, "Solar Ger" project implementation unit and PV assembling factory of information, Communication and Technology Authority. NREC has Environment and Energy Efficiency Section.

ENERGY EFFICIENCY PROJECTS AND ACTIVITIES



Electricity and Heat Generation and Distribution

As a result of economic development and construction works in Ulaanbaatar, Darkhan and Erdenet cities as well as consistent connection of remote aimags and soums to the centralised power supply systems the power consumption is increasing by 5-8% on average annually and is expected to continue rising. Investments in power infrastructure did not keep pace with demand, which has significantly lowered the reliability of electricity supply and has increased overloading of aging distribution network. The overall energy system is characterised by low operational efficiency and poorly maintained and obsolete equipment. Mongolian government understands the urgent need of investment in system rehabilitation, improvement of system management, and strengthening of reforms to improve efficiency of electricity generation and distribution and commercial viability. Some projects to improve energy efficiency in the electricity and heat generation and distribution have been already initiated and implemented with the support of various international financing institutions and donors. The government considers construction of a new thermal power plant to meet the increasing power demand in Ulaanbaatar.

Two Energy Sector Projects, financed by the WB aimed to improve the reliability and financial sustainability of electricity distribution companies in Mongolia, so that consumers are provided dependable, high-quality distribution services by commercially-operated distribution utilities.

Table 15: Results in Electricity Distribution Loss Reductions in Ulaanbaatar and Aimags, Total Losses (%)

	2004	2007
Ulaanbaatar	30.64	23.07
Bayankhongor	46.3	16.6
Gobi-Altai	43.2	9.2
Umnugobi	33.76	12
Dornod	19.46	6.7
Huvsqui	41.3	21.8
Suhbaatar	18.33	4.8

Source: Proceedings from the International Congress "Energy Efficiency Experiences and Vision", Ulaanbaatar, 6-8 July 2009

GTZ has been involved since 1998 in a project "Promotion of energy efficiency and renewable energy in Mongolia" which contains a number of actions to support supply side energy efficiency. Core activities included technical and economical analysis of power plants and network systems, measures were introduced to increase power efficiency factors both in heat and power generation and finally support was provided to distribution networks to measure and reduce energy losses.

'Energy conservation project' was initiated and financed by ADB's soft loan in 1998-2005 aiming to improve district heating reliability and reduce losses by rehabilitating critical sections of Ulaanbaatar's district heating systems, to encourage end-use energy conservation through improved metering and demonstration projects, and to improve operation and maintenance (O&M) of the district heating system through on-the-job training and technical support. Within the framework of the project activities old pipes of the district heating transmission system were replaces and insulation of pipes has been renewed, new variable speed pumps were installed at Thermal Energy Station 3. The demonstration subproject was designed to show consumers how much energy could be saved by making cost-effective technical changes in their installations. However due to absence of heat meters in individual households and a tariff structure based on metered consumption, it was not possible to show consumers how much energy could be saved by making cost-effective technical changes in their installations. Under the electricity metering component, 50 electronic meters were installed in power plants and at key points of the power transmission network. The project evaluation report noted the need of concrete institutional changes and tariff reforms to make the supply side more commercially orientated and the demand side more conscientious about energy conservation.

The project Improvement of District Heating Systems in Urban Centres of Mongolia funded by EuropeAid improved he energy efficiency of district heating systems with a capacity of 0.8-2.5 MW and reduced their coal consumption. Main activities in Uliastai municipality included a number of technical and capacity building measures: rehabilitation of the heating plant (boilers, regulation, distribution system); training and capacity building of local operator to manage and operate the local heating plant. The project provided a management manual, training manuals and materials and technical standards for refurbishment to support further training courses to the target groups and to enhance their capacities on regional and national level.

Residential and Services Sector

Efficient Household Stoves

Typically, gers use small stoves for cooking and heating. The stoves are simple in design and tend to produce high levels of air pollution because they rely on short chimneys and are continuously in use.

In 2001-2007 World bank project has been implemented with the support of the Mongolian Government, with the aim to promote the design and dissemination of stoves with improved fuel efficiency, to reduce coal fuel consumption-and corresponding CO_2 emissions and levels of air pollution (indoor and outdoor) in the ger area of Ulaanbaatar. Very limited information and no documentation was available for the actual implementation and results achieved from the project, however during discussions with various experts it was noted that the main barriers

to wider dissemination of the stoves designed during the project were related to high initial purchase cost of those stoves compared to traditional ones, as well as the lack of technical laboratory able to test and prove the higher efficiency achieved by the new stoves.

The Ulaanbaatar Clean Air project initiated in 2009 aims to overcome the barriers identified by implementing efficient stove research and development, establishing a testing laboratory and certification system for stoves, develop and launch awareness raising campaign for the benefits of using improved household stoves and propose subsidy mechanism (Voucher system).

Straw Bale Housing and Ger Insulation

Energy Efficient Housing Project (also named Commercialisation of Super-Insulated Buildings in Mongolia) has been implemented throughout 2002-2007 to promote the use of straw-bale building (SBB) and other energy efficient technologies for building and ger insulation. During the project 72 new SBB constructed, 95 new conventional insulated houses constructed, 53 existing houses retrofitted with insulation, three SBB built and 440 ger insulated. Fuel consumption of households involved was lowered by a factor of 2 to 3. Thus, a household saved MNT 110,000-180,000 (USD 90-150) annually for fuel cost which accounted for 30-50% of annual expenditure. Ger insulation blankets were provided to around 50,000 under-insulated ger in Ulaanbaatar alone. Norms and standards for straw-bale housing have been developed in close cooperation with the Ministry of Urban Construction and Development.

As a continuation of these activities "Energy Conservation and emission reduction from poor households" project staring this year (2010) will provide high insulation ger to the most vulnerable part of the households in Ulaanbataar ger district.

Buildings Envelope and District Heating Systems

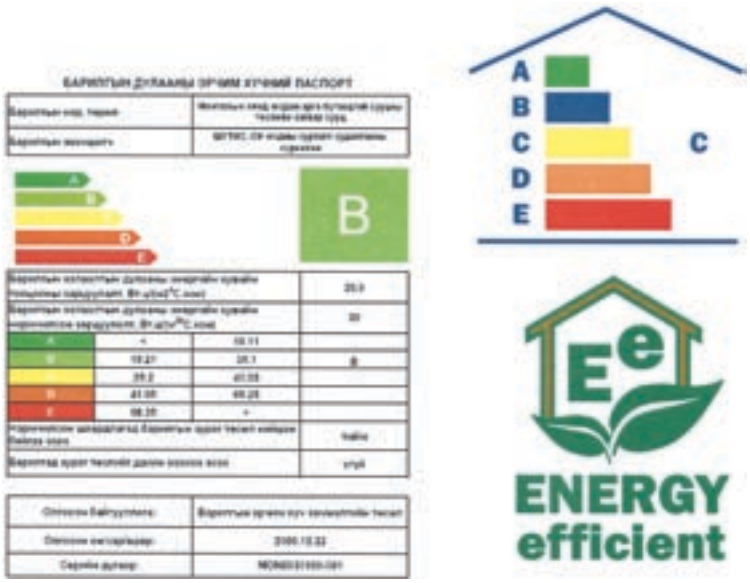
Energy Efficiency in New Construction in the Residential and Commercial Buildings Sector in Mongolia (BEEP) is a project, funded by GEF though UNDP. Local executive partner to the project is MRTCUD. The implementation will continue till 2013.

The project objective is the reduction of green house gas (GHG) emissions from the buildings sector in Mongolia, by improving the energy utilisation efficiency in new construction in the residential and commercial buildings sector. This objective will be realised through the removal of barriers to the uptake of building energy efficiency construction systems, construction practices, and investment patterns. The building sub-sectors being addressed in the project comprise new construction sector commercial, apartment buildings and private houses, and new large private houses not connected to infrastructure systems.

With the successful implementation of the envisioned activities, the direct GHG emission savings as a result of the project is expected to be 63,000 tonnes of CO_2 over a 20 year period.

This first project component involves the development of new mandatory building codes and standards that would be simpler to understand, would require higher or new energy efficiency levels in some critical building elements (currently poorly covered), that would be more strictly enforced and that would lead to higher overall energy efficiency levels being achieved in practice across new buildings. As of July 2010 the main achievement by the project was the development and adoption of BNbD 23-02-2009 "Buildings Thermal Performance" norm and the introduction of building energy label.

Figure 32: Building Label



Source: BNbD 23-02-09, Building Norms and Regulations of Mongolia – Thermal Performance of Buildings

Other building norms and standards are under development, including buildings thermal performance, insulation materials, lighting systems, HVAC systems and domestic hot water systems.

Component 2 involves the development and implementation of capacity building technical development, certification and awareness measures for enhanced energy efficiency in buildings as well as the training and technical support needs of construction sector stakeholders, including building control bodies and officials, financial and funding bodies, testing and certification bodies and providers, designers, specifies, developers, construction companies, and building owners and tenants.

Component 3 involves facilitating access to financing for energy efficient building approaches. Under this component, the project will provide technical assistance to help identify suitable projects, raise awareness of the demand-side, i.e. prospective customers, on the availability of financing, build the capacity of those customers to apply for loans, and build the capacity of XacBank to evaluate the proposed

energy efficiency projects, and hence manage the loan risks by appropriate loan due diligence and risk management mechanisms for the disbursement and credit management of the new building energy efficiency loans. Discussions are ongoing with the local XacBank to provide low-interest building energy efficiency loans.

While the previously mentioned ADB-financed Energy Conservation Project was very successful in increasing the energy efficiency of the heat distribution system, it did not succeed in introducing a new billing system based on heat consumption, nor the collection of data to monitor individual consumer's heat use. The demonstration subproject was designed to show consumers how much energy could be saved by making cost-effective technical changes in their installations. However, during project implementation most of these changes – such as installation of new plate type heat exchanges, heat and hot water meters, and adoption of the mixing loop technology for heat-hydro elevation took place only at the substation or in the buildings rather than at the end-user level. In the absence of heat meters in individual households and a tariff structure based on metered consumption, it appeared difficult to show consumers the benefits of these efficiency measures and unrealistic to expect them to adopt energy efficiency measures at home.

A pre-feasibility study within ADB Cities Development Initiative for Asia Technical Rehabilitation Programme for panel Buildings in Ulaanbaatar was completed in May 2009.

The pre-feasibility study has successfully provided the basis for a long-term investment programme for the thermo-technical rehabilitation of the 426 pre-cast panel buildings in Ulaanbaatar, including introduction of individual metering for households.

A CDM baseline study is currently under development for a selected cluster of panel buildings. The typical Ulaanbaatar precast panel buildings have no added external wall insulation, have poorly insulated external doors, poorly insulated roofs that are often also not fully waterproof either, still have mostly old double wooden framed high air ventilation heat loss windows (although around 10-25% of windows have been retrofitted with more airtight locally sourced PVC framed double-glazed windows – which however are likely to have high edge heat losses and uncertain air sealing). The pre-cast panel apartments generally have excessive heat losses and cold apartment external wall surfaces with subsequent condensation and poor comfort conditions in Ulaanbaatar's extreme winter conditions (outside design air temperature of -39^{o}C) over the 7 month heating season).

The proposed thermo technical rehabilitation would address the excessive heat loss of the pipe work from the pump station to building heat distribution loops, apartment buildings heat pipe work distribution and common areas (foyers, stairs, lifts) heat losses and in particular the heat losses of the individual apartments in a particular cluster by:

- adding suitable exterior wall and door insulation;
- reducing air leaks, primarily through leaky windows;

- insulating heating distribution system and building level heat supply and return pipes;
- changing the heating system from a separate vertically stacked single pipe system to each apartment radiator to an individual apartment horizontal two pipe loop system with individual radiator thermostatic control valves – if the cost/benefit of such changes justifies this and if the disruption caused is acceptable to apartment owners); and
- introducing consumption based billing directly through individual apartment heat meters – or if the cost and disruption are not acceptable then indirectly through individual radiator heat allocators where building level metered heat supply is allocated to the radiators in individual apartments from indirect heat evaporation readings.

Within the framework of third phase of German-Mongolia Technical cooperation in the energy sector 2010-2013 (GTZ operated) in addition to continuing activities for improved energy efficiency of thermal power plans, a number of demand side energy efficiency activities will be initiated including a study of end-use consumption of various user groups and implementation of cost-effective energy efficiency measures in the residential sector (building envelope and lighting). 1.7 million Euro will be provided as grant by GTZ and KfW will supply 4.5 mln Euro grant for end-use energy efficiency and 8.5 mln Euro soft loan for power plants energy efficiency.

Industrial Sector

Within the framework of the project funded by Swedish International Development Cooperation Agency (SIDA) "Greenhouse Gas emission Reduction from Industry in Asia and the Pacific" (GERIAP) more than 40 companies from the cement, chemicals, ceramics, iron & steel and pulp & paper sectors participated in the project in nine Asian countries: Bangladesh, China, India, Indonesia, Mongolia, Philippines, Sri Lanka, Thailand and Viet Nam. Demonstration projects in four Mongolian companies were implemented under GERIAP:

1) Da-Mon Trade Company Limited (a producer of spirits): Circulate Drained Water from Agent Tank for Reuse in Agent and Fermentation Tanks;
2) Darkhan Metallurgical Plant: Improved boiler combustion process and insulation of pipelines and building; Reduced melting cycle through improved management of reasons for delays;
3) Erel Cement Ltd.: Improved sealing of dust control system; Reducing the number of kiln shutdowns and efficiency improvement; Reuse of cooling water from central motors and compressors;
4) Hutul Cement Company: Rehabilitation and/or Replacement of Existing Boilers.

Mongolian Chamber of Commerce and industry is organising and conduction regular workshops and training for their members focused on capacity building

to develop and implement energy efficiency projects. They were also involved in a few projects to promote Energy Efficiency/ESCO services in industry.

The NEW 21 Project was implemented in 2001-2007 with the financial support Royal Netherlands Embassy in Beijing and the beneficiary was the Mongolian National Chamber of Commerce and Industry. The project organised series of specialised trainings for potential ESCO companies' staff and three demonstration projects were implemented at two private enterprises and in one government building. The project involved modifications to air compressors and improvements to a building heating system, and all have relatively short pay-back periods (3 to 5 years). A Green credit Guarantee Fund (see ee financing) was also established during the project.

The project Capacity Building of Mongolian and Inner Mongolian (Chinese) Energy Service Companies (ESCO) was implemented from 2008 to 2009 by Mongolian National Chamber of Commerce and Industry together with Centric Austria International and China Council for the Promotion of International Trade. The project objective was to upgrade the capacity, skills and energy efficient equipment know-how of Mongolian and Inner Mongolian potential ESCO (energy service) companies through dissemination of information regarding of energy efficiency, ESCO operations and performance. The project facilitated exchange of best practice in energy efficient techniques, energy management, energy audit, energy efficiency project technical and financial proposals.

Transportation Sector

Total of 200,288 vehicles were registered in Mongolia only in 2007. The vehicle fleet has increased 1.9 since 2000. 80% of the vehicles – most of them imported as second-hand – do not meet national or international emission standards. More than 50% of the vehicles are over 11 years old, and 30% are 7-10 years old. Automobile growth causes regular traffic jams. At low speed, automobile engines are very inefficient and thus emit greater concentrations of pollutants, especially particulates. So, the rapid growth of traffic and transportation load has intensified negative impacts on the public health and environment pollution.

Rapidly increasing number of vehicles in recent years in Ulaanbaatar has intensified negative impacts on the public health and environment pollution. To try to overcome this and to promote use of more environmentally friendly types of transportation, the National transportation strategy includes a number of measures and policies will be introduced in the near future, including:

- Promotion of import of fuel efficient vehicles;
- Promote use of electrified public transport in cities;
- Introduce economic incentives for LPG using vehicles, such as tax incentives and vehicle registration tax exemption.

ENERGY EFFICIENCY FINANCING

Major sources of financing of energy efficiency activities in Mongolia are provided through international co-operation with a number of multilateral institutions such as the WB, ADB, the EU and the UNDP, as well as with foreign partners as USAID, JICA, the German, Norwegian and other Governments. Mongolian government participates with co-financing (including in-kind) in a number of projects.

The Green Credit Guarantee Fund was established with financial support of USD 400 000 from the Dutch Government to support cleaner production and energy efficiency in industry sector in Mongolia. The Fund supports energy efficient and green investments or cleaner production initiatives by providing supplement collateral guarantee as an addition to material collateral assets for projects applied by professional energy efficient servicing companies and other companies and entities for banking loans. Additionally, the Fund conducts trainings on cleaner production, energy efficiency, finance and business matters with an aim to contribute to the development of energy efficient and environmentally friendly economy and society in Mongolia.

In the last two years the Green Credit Guarantee Fund has issued a total of USD 330 000 to eight business entities in the areas of fuel and energy efficiency, recycle and purification of waste water from leather tanneries, waste reduction, and its recycle for a three-year period. Of these loans 20-80% were offered through collateral guarantees of Fund's own assets. In addition, the Green Credit Guarantee Fund obtained USD 800 000 loans from the Government of Mongolia at a discounted loan rate in 2007, and has issued loans in total to thirteen small and medium business enterprises on a preferential basis with a particularly low interest rate. As of July 2010, the fund was illiquid, all its means having been committed. The Mongolian Chamber of Commerce and Industry is discussing possibilities with the Government institutions for additional financial support to be provided for continuing funds operation.

RENEWABLE ENERGY POLICY

Overview of Renewable Energy Policies and Legislation

Renewable energy is one priority for the Mongolian energy sector, as set out by the Government in policy documents such as the Government Action Plan,[2] Millennium Development Goals and Mongolia's Strategy for Sustainable Development of the Energy Sector 2002-10. For the government, the use of renewable energy is vital for improving and securing a sustainable energy supply, particularly for rural electrification and heat supply. It attaches great importance to the research and exploitation of new energy sources.

Nonetheless, power supply scenarios reveal that renewable power will cover only a smaller portion of growing demand. To meet demand in Ulaan Baatar, the Government pins large hopes on a new, 300 MW thermal power plant (TPP 5). Some observers, are sceptic whether the plant can be realised within a few years so as to prevent major power disruptions. Power for mining activities is to be covered by thermal plants too (see earlier chapter). By comparison, the largest renewable projects are the Egiin hydro plant (200 MW) and Newcom's wind farm (50 MW).

In June 2005, the Mongolian Parliament approved the National Renewable Energy Programme which sets ambitious goals for broad-based renewable energy development: increasing the share of renewable energy technologies in total energy supply from 0.9% in 2005 to 3-5% by 2010 and to 20-25% by 2020. The programme also aims to provide power to all district soums and settlements, which are currently not connected to the power grid by introducing renewable energy generating systems. Some of the main outcomes for the achievement of the programme goals and objective include:

- Develop detailed technical surveys of the existing renewable energy (solar, hydro, geothermal, hydrogen and biomass) potential in Mongolia;
- Reach full achievement of the "100 000 solar gers" National programme to supply all herder household in rural area with renewable energy;
- Create favourable legal environment for the use of renewable energy and for energy conservation;
- Develop feasibility studies for construction of large hydropower stations (Eg river, Artsat, Lelenge river, Orkhon).

The Government is seeking active engagements of donors and local and foreign private investors for the development of Mongolia's large renewable potential for utilising solar, wind, hydro and geothermal energy resources and for implementation of activities laid out in the National renewable programme.

The Renewable Energy Law of Mongolia came into force on 11 January 2007 and regulates the generation and supply of energy from renewable energy

2 Approved by the Parliament in November 2004, the plan defines the main objectives of the Cabinet.

sources. According the Law the State Ikh Hural is the competence body for policy development in the renewable energy sector and for ownership transfer of state-funded independent renewable energy power sources. The Cabinet is responsible for the implementation of the Law and for the approval of a list of soums to be supplied with electricity ad heat generated by an independent renewable energy power source. The Minsitry for Mineral Resources and Energy is the main government body in charge for the development of implementing regulations under the Law.

The main provisions of the law are as follows:

- ERA shall issue licenses for construction of Renewable energy sources and for generation and transmission of renewable energy;
- A generator connected to transmission network should deliver the electricity to the nearest power source connection of the transmission network and cover electricity transmission cost from generating source to the transmission network connection;
- A generator using independent renewable energy power source should deliver the produced electricity to local networks using calibrated meter and shall be compensated (with the exception of state-funded generators) from the Renewable Energy Fund for any other tariff difference induced by supply of electricity to local consumers;
- The transmission licensee shall purchase the electricity supplied by a generator at tariffs approved by the Law;
- Power purchase/sale agreement between generator and a transmission licensee shall be developed in compliance with a model agreement approved by ERE and should specify capacity of electricity generated and delivered, its quality, amount, tariff, location of commercial meters, payment and settlement conditions, duties of the parties and provisions for termination;
- Relations with respect to establishment of a Renewable energy fund, shall be regulated by the law on Government Special Purpose Fund.

The Law also sets out the range for tariffs for energy generated and delivered from renewable energy sources, which are valid for a period of minimum 10 years from entry into force of the Law. ERA may set tariffs for electricity generated and supplied by renewable energy source connected to a transmission network within the following limits:

- 8-9.5 US cents per kWh for electricity generated and delivered by a wind power source;
- 4.5-6 US cents per kWh for electricity generated and delivered from a hydropower plant with a capacity of less than 5 000 kWh;
- 15-18 US cents per kWh for electricity generated and delivered from a solar power source.

Regulatory boards of Aimags and the Capital City may set tariffs for electricity generated and supplied by independent renewable energy source within the following range:

- 10-15 US cents per kWh for electricity generated and delivered by a wind power source;
- 8-10 US cents per kWh for electricity generated and delivered from a hydropower plant with a capacity up to 500 kWh;
- 5-6 US cents per kWh for electricity generated and delivered from a hydropower plant with a capacity of 510-2000 kWh;
- 4.5-5 US cents per kWh for electricity generated and delivered from a hydropower plant with a capacity of 2001-5000 kWh;
- 20-30 US cents per kWh for electricity generated and delivered from a solar power source.

Renewable Energy Potential and Utilisation

Hydropower

With an estimated 3,800 rivers and streams and a total length of 6,500 kilometres, Mongolia has significant hydropower potential. The majority of hydro energy resources belong to the western and northern mountain areas of the country. There are currently 13 hydro plants operating with capacity from 150 kW to 12.0 MW.

Table 16: Operating Hydro-Power Stations in Mongolia

Location	Capacity	Start Year of Operation
Kharkhorin	525 KW	1959
Ondorkhangai	200 KW	1989
Guulin	480 KW	1998
Mankhan	150 KW	2003
Monkhairkhan	150 KW	2003
Bogdiin	2.0 MW	2005
Tosontsengel	375 KW	2006
Uench	930 KW	2006
Erdenebulgan	200 KW	2006
Zavkhanmandal	110 KW	2009
Tsetsen-Uul	110 KW	2009
Dorgon	12 MW	2009
Taishir	11 MW	2009

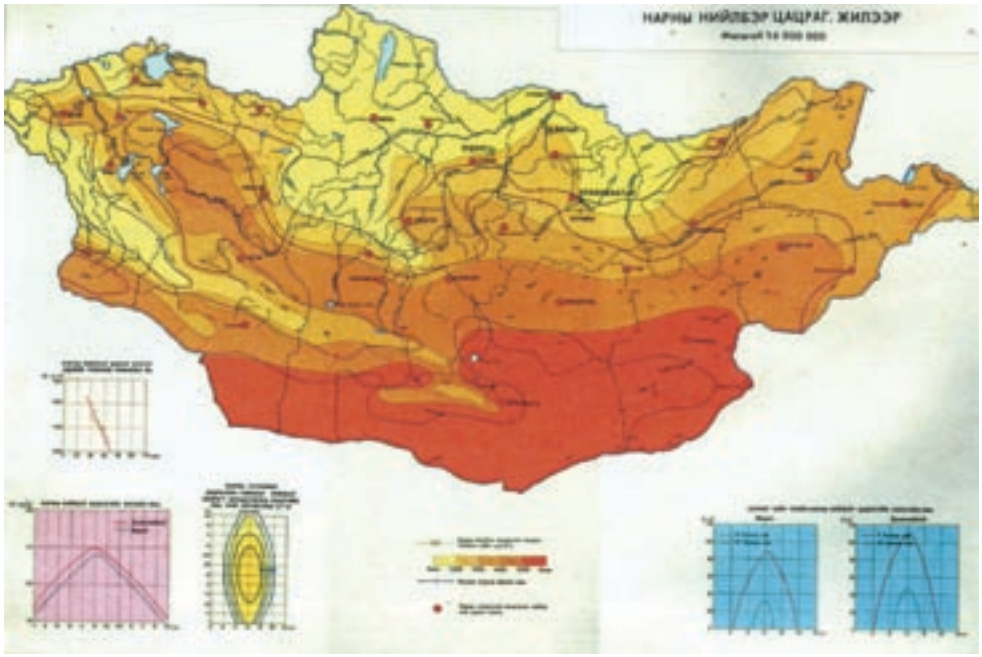
Source: Proceedings from the International Congress "Energy Efficiency Experiences and Vision", Ulaanbaatar, 6-8 July 2009

The small hydro plants are run-of-river designs that provide electricity to neighbouring rural areas except during the winter. Consideration is being given to further develop small hydro plants in order to reduce diesel imports. Hydropower development is one of the best options for electricity supply in remote and consumers with limited demands. The Programme on Integrated Power energy system of Mongolia points out that in a short and mid term timeframe hydropower plants with total capacity of 700 MW can be build in western and northern regions.

Solar

Known as the "land of eternal blue skies," Mongolia has substantial solar potential. Approximately 71% of the total land area receives solar intensity at a rate of 5.5-6.0 kWh/m^2 per day, and 2900-3000 sunshine hours per year. An additional 18% of the country receives intensity at the rate of 4.5-5.5 kWh/m^2 per day, and 2600-2900 sunshine hours per year.

Figure 33: Solar Radiation Map of Mongolia



Source: Mongolian National Renewable Energy Centre

In 1999 Government has adopted the 100 000 Solar Gers programme, which contained of three phases and up to now 74 000 gers were provided with solar panels form the state budget and 36 000 families has participated with 50% of the cost and at present, 100,000 gers (out of 170 000 gers for the whole country) have independent solar PV systems using electricity lights, radios, TVs and satellite dishes. The programme currently is negotiating additional financing to be provided for 25000 more gers to be provided with solar PV systems.

Installation of large scale PV systems in the Gobi region of Mongolia has been considered, as it may contribute to both protecting against air pollution and supporting regional development and feasibility study is under development.

Figure 34: Soum Centre Solar Electrification Application

Source: Mongolian National Renewable Energy Centre

Wind

Up to 70% of the country has wind resources that may be suitable for development. In particular, the Gobi desert area, Dornod and Sukhbaatar provinces have wind regimes of 150-200 W/m^2 with wind duration of 4000-4500 hours per year.

Wind power is anticipated by the government to play a major role in the rural electrification programme. Recently wind power stations as well as combined Solar-Wind stations were built in many soums. In last years, a number of feasibility studies were made for the construction of wind power farm at "Salkhit Uul", near capital city Ulaanbaatar. This will be the first project of its kind in Mongolia and also will be the first renewable project to be implemented by a private investor Clean Energy – a local company wholly-owned by the Mongolian Newcom group and will be supported by EBRD to provide 25% stake in. Furthermore, wind conditions in the Gobi desert are propitious for wind energy to be exported to China and cooperation between the two counties is intensifying recently.

Table 17: Wind and Wind-Solar Power Stations

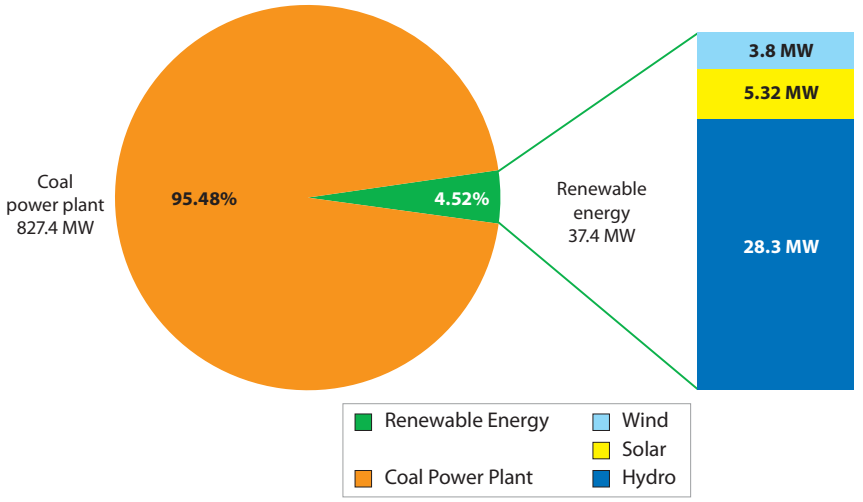
Location	Capacity	Star year of operation
Wind power stations		
Bogd	80 kW	2008
Khatanbulag	150 kW	2008
Mandakh	80 kW	2007
Sevrei	80 kW	2008
Erdenetsagaan	100 kW	2004
Wind-solar power stations		
Manlai	150 kW	2007
Matad	120 kW	2007
Tseel	150 kW	2008
Bayantsagaan	150 kW	2008
Sinejinst	150 kW	2008
Bayar-Ondor	150 kW	2008

Source: Proceedings from the International Congress "Energy Efficiency Experiences and Vision", Ulaanbaatar, 6-8 July 2009

Geothermal

A geophysical study has identified 42 small hot springs in Hangai, Hentii, Huvsgol, Altai Mountains, Dornot-Darigangiin Steppe, and the Orhon-Selenge region. Although the local population makes some use of the hot springs, no commercial power or heat development has occurred so far.

Figure 35: Current Utilisation of Renewable Energy Sources



Source: Proceedings from the International Congress "Energy Efficiency Experiences and Vision", Ulaanbaatar, 6-8 July 2009

Renewable Energy Projects

Since 1998 GTZ has been implementing the project Development of renewable energy resources in Mongolia by promoting the economically efficient use of renewable energy potential in rural areas. The activities were mainly targeting two western aimags Zavkhan and Khuvsgol and involved measures at three levels:

- At the national level: providing support to the government to integrate renewables into its national energy policy. Furthermore, it has assisted the government in the elaboration of a draft law on renewables;
- Support cooperation ventures with foreign companies and promotes business associations that bring together renewables companies;
- In rural areas: Small, decentralised energy units have been set up that can grow in line with demand (the supply concepts provide for the expansion of simple stand-alone plants into regional networks in line with economic and financial development), as this is the most economically efficient option for power supplies to rural population centres.

More than 3,000 nomadic households in the pilot area now have solar-powered energy supply systems. This move also brought about a reduction in energy costs and improvement in living conditions. Within the RE-programme the first renewable energy training centre in Mongolia has been established in Uliastai. The training centre is offering capacity building programmes for operators and maintenance personnel. Furthermore the RE-programme started to examine options for improving the performance of the local urban heating system and to improve local air quality during the heating period in 2004. In cooperation with NREC a base line study on the rural energy development options in Mongolia and a feasibility study and a plan on the refurbishment of the heating plant in Uliastai have been executed.

Renewable Energy and Rural Electricity Access project is a GEF/WB five years project, started in 2006. The objectives are to (i) increase access to electricity to the nomadic herder population; (ii) reduce the costs and increase the reliability of electricity service in off-grid soum centres; (iii) remove barriers to the scale-up of renewable energy use; and (iv) reduce emissions of carbon dioxide.

These objectives are achieved by:

- facilitating herders' investments in solar PV systems and small wind turbine systems;
- rehabilitating isolated soum centre mini grids, improving their operations and management practices, followed by introduction of renewable-diesel hybrid generation systems by use of wind, solar/wind, or hydro blended with existing diesel generators; and
- strengthening the institutional and regulatory capacity at national level to develop grid-connected and off-grid renewable energy supplies.

A number of small grants have been provided by GEF/UNDP in 2004-2009 for the implementation of small projects for promoting the adoption of renewable energy by removing barriers and reducing implementation costs in Mongolia. These projects are mainly directed to rural areas and include:

- Solar energy – a "Do-It-Yourself" project among some people to assemble low cost Amorphous Silicon solar panels (one panel costs US $ 2.5 only) for lighting and charging radio and dry cells;
- Coiled pump and solar concentrator – to experiment manufacture of a number of coiled pumps (rotating with water flow with nothing used), solar concentrators and solar cookers and to assist in commercialisation of these solar facilities in rural communities;
- Briquette – spreading the coal-animal dung mixed briquette making practice;
- Experimental Solar Cooks – manufacturing a number of experimental solar cookers and showers;
- Production of Solar cookers – by establishing a Solar Cooker Manufacturing Workshop;
- Experimental production of Solar powered refrigerators;
- Manufacturing of "Asgat", solar powered refrigerators for utilisation by herders and hospitals in rural areas;
- UYER water pump – manufacturing 4 pieces of a newly designed model of surface water pump operated with river flow without any fuel.

The construction of two hydropower plants Taishir and Durgun are registered as a CDM projects with Japan as a partner and are currently under implementation. The 12 MW Durgun power plant will be constructed on the Chono Kharaih River. The facility is expected to generate an estimated 38,000 MWh of electricity per year. The electricity generated by will be provided to Bayan Ulgii, Khovd and Uvs provinces for commercial and residential purposes. The expected CO_2 emission reductions are 28,800 tCO_2/yr by displacing electricity that would otherwise be generated by a coal-fired power plant. The 11 MW Taishir hydropower facility, is expected to generate 37,000 MWh of electricity per year, which will be provided to Gobi Altai and Zavkhan provinces. The expected CO_2 emission reductions are approximately 29,600 tCO_2/yr by displacing electricity that would otherwise be generated by diesel generators.

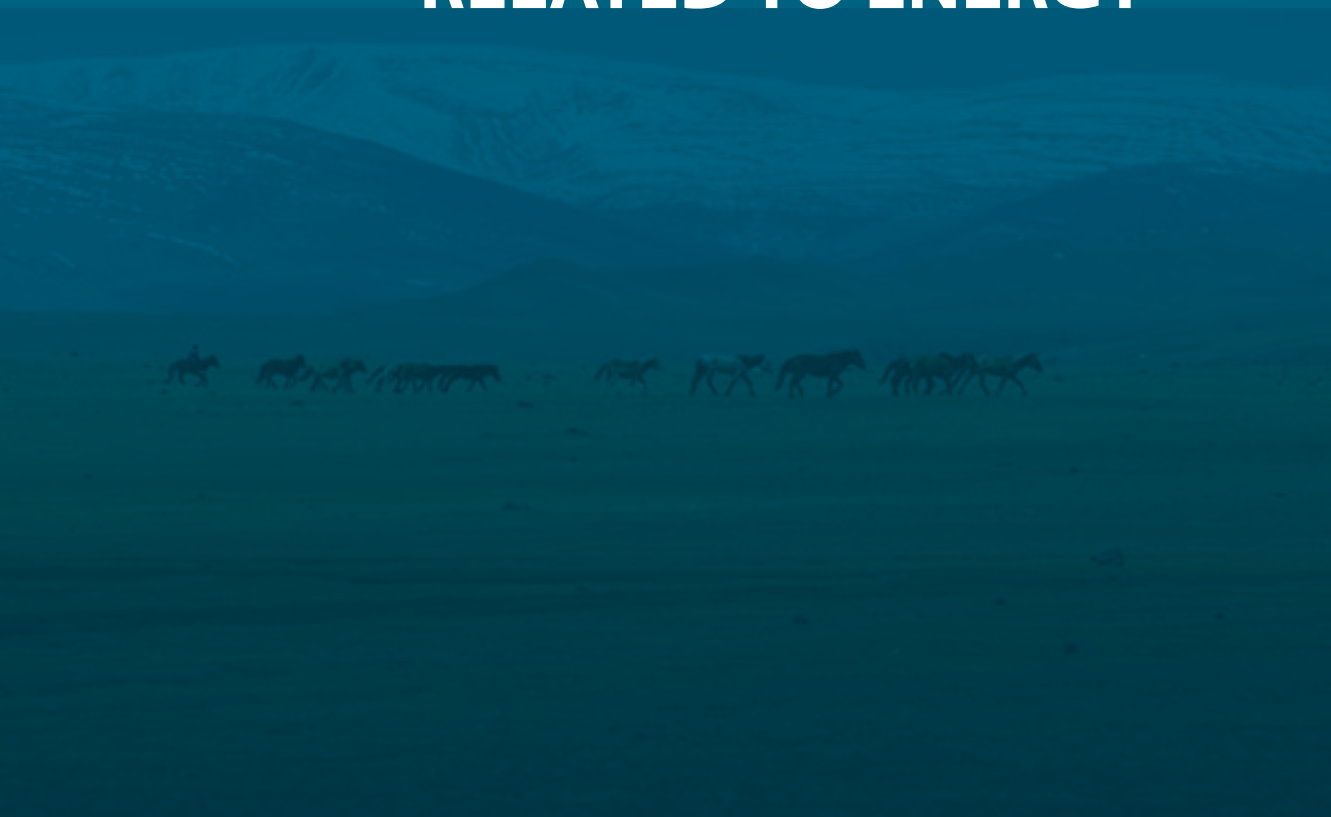
Within the framework of the 100 000 Solar Gers programme, 74 000 gers were provided with solar panels form the state budget and 36 000 families has participated with 50% of the cost and at present, 100 000 gers have independent solar PV systems using electricity lights, radios, TVs and satellite dishes. The programme currently is negotiating additional financing for 25 000 more gers to be provided wit solar PV systems.

Table 18: Renewable Projects in Mongolia

Ongoing Projects		
Name	**Description**	**Financing**
Taishir hydro power project	Hydro energy-The government of Mongolia and "Abu Dabu" development fund	CDM Japan
Durgun hydro power project	Hydro energy-The group "Shanghai" of foreign economic and technology cooperation of China	CDM Japan
"100,000 narnii ger" National programme	Solar PV system-The government of Mongolia	Government subsidy/ World Bank
Promotion of Renewable Energy Utilisation	Wind energy, Solar PV System, Hydro energy-GTZ (German Technical cooperation)	Grant Aid
Development of renewables	Rehabilitation of Bogdiin Hydro Power project Rehabilitation of Uliastai Electricity Network project	GTZ, Germany
Wind Park project with 50MW	Wind Energy – group "Newcom" LLC	Private Ownership
Renewable energy and rural electricity access project	Wind Energy, Solar Energy – The WB	Grant Aid
Proposed Projects		
Name	**Status**	**Capacity**
Erdeneburen hydro power project	Technical and economical feasibility study completed	60MW
Egiin hydro power project	Technical and economical feasibility study completed	200MW
Chargait hydro power project	Technical and economical feasibility study completed	24.6MW
Khust aral hydro power project	Pre-Feasibility study completed	15MW
Orkhon hydro power project	Pre-Feasibility study completed	100MW
Taishir wind park project	Pre-Feasibility study ongoing	10MW
Large scale solar power plant project	Pre-Feasibility study ongoing	25MW

Source: Proceedings from the International Congress "Energy Efficiency Experiences and Vision", Ulaanbaatar, 6-8 July 2009

ENVIRONMENTAL POLICY RELATED TO ENERGY



General Trends and Objectives

Mongolia's locally deteriorating environment has become a major concern. Air quality is a significant environmental problem in urban areas of Mongolia, particularly in Ulaanbaatar. The burning of soft coal by individual home or "ger" owners, power plants, and factories as well as increase road traffic in Ulaanbaatar is the major polluting factor. Topography and meteorology worsen ambient air quality conditions in the country, particularly Ulaanbaatar. During the bitterly cold and long winter, smoke sits on the towns and is the major cause of the respiratory complaints and diseases that account for half of the child deaths and a major part of child and adult mortality. Mongolia has started addressing these problems. In 1995 the Law on Air (Pollution) was adopted. The improvement of household stoves was identified as a high priority action in the 1995 National Environmental Action Plan.

Mongolia is very sensitive to climate change due to its geographic location and socioeconomic condition. The impacts of climate change on the ecological system and the natural resources in the last forty years are real and will continue to dramatically affect environment, desertification, water supply and natural disasters leading to financial, environmental and human losses.

Environmental Policy

Since 1992, the Parliament of Mongolia has passed several laws directed toward environmental protection including the State Policy on the Environment (1997), which forms the legal basis for the protection of the environment and Mongolia's natural resources. In 1995, the Mongolian Environmental Action Plan was presented. The plan of action outlines the country's priorities for environment and resource management. The Mongolian Action Programme for the 21st Century (MAP 21), the National Action Plan to Combat Desertification, the National Biodiversity Action Plan, the Action Programme to Protect Air, the National Action Programme to Protect Ozone Layer were developed. Especially, the MAP 21 includes concrete considerations and recommendations related to adaptation to climate change and mitigation of GHGs emissions. The Law on Air (1995) and Law on Environmental Protection (1995, 2007) are the main legal instruments for protection of air and environment of the country.

At the moment, the legal environment for sustainable development is on the formation stage. The requirements for sustainable development will serve as a basis for the design and the implementation of laws that deal with the relations between nature, environment, society, and economy.

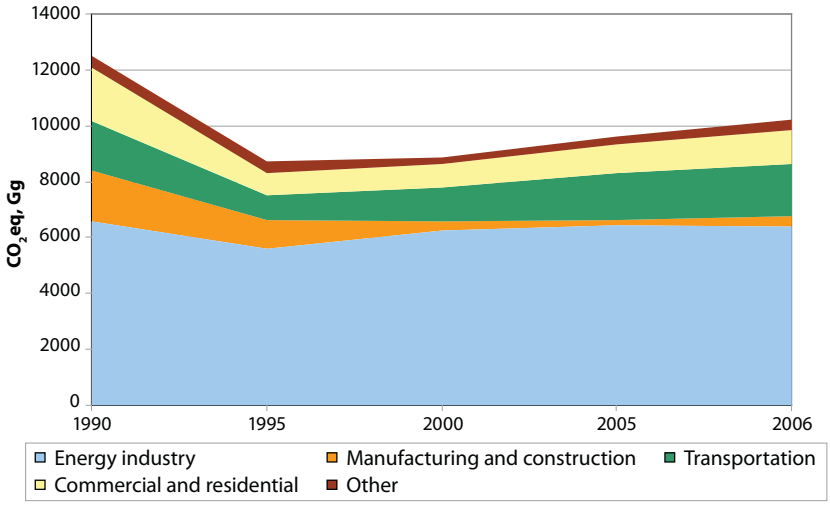
The Ministry for Nature, Environment and Tourism (MNET) is the Government's central administrative body, which is directly responsible for matters regarding the environment. Environmental Protection Agencies were established in each 'aimag' in 2000, which work in close co-operation with the MNET.

CO_2 Emissions and Energy Efficiency

The country ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1996. Mongolia as a Non-Annex 1 country submitted its First National Communication dated November 2001. A National Action Programme for Climate Conservation (NAPCC) was approved by the Government in July 2000 and contained incentives, measures, strategies and actions to enable vulnerable sectors to adapt to potential climate change and GHG emissions.

In 2006, Mongolia's net GHG emission was 15.628 $MtCO_2eq$. The energy sector (including stationary energy, transportation and fugitive emissions) was the largest source of GHG emissions comprising 65.4% (10.22 $MtCO_2eq$) of total emissions. The second largest source was the agricultural sector (41.4%). Other relatively minor sources currently include emissions from industrial processes and the waste sectors. As a whole, this translates to a CO_2 emissions per capita at 6 ton CO_2eq.

Figure 36: CO_2 Emissions from Fuel Combustion in Mongolia, by Sector

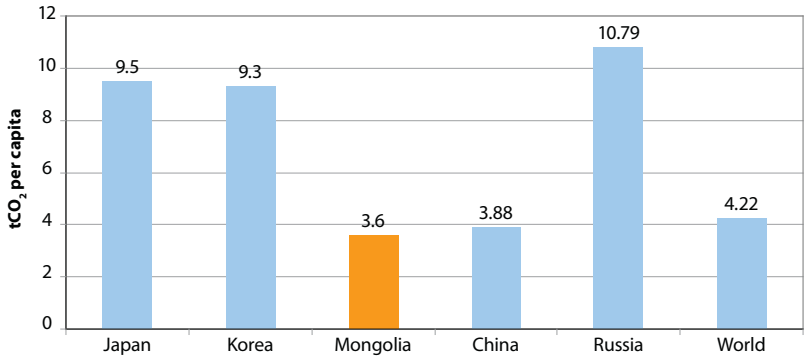


Source: Mongolia: Assessment Report of Climate Change 2009, Mongolian Ministry of Nature, Environment and Tourism

Comparison of Mongolia's with other Asian countries and the world average shows that, due to its heavy reliance on coal for its energy supply, Mongolia has one of the most GHG-intensive economies in the world. GHG emissions per GDP are ten times higher than the world average, also CO_2 per TJ energy supply is also almost double other Asian economies.

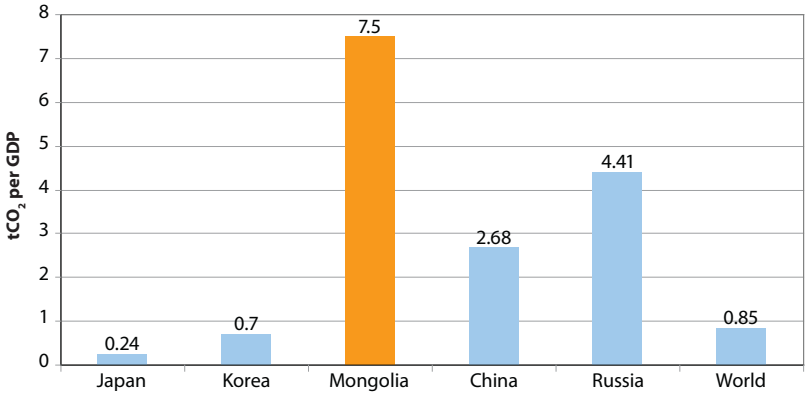
Based on the projections made during the preparation of the Initial National Communication by Mongolia regarding future emissions, by 2020 total emissions will rise by more than five times over. Although Mongolia as a developing country has made no definitive commitments to reduce GHG emissions, the NAPCC aims to curb their growth.

Figure 37: CO_2 Emissions Comparison, by Country (tCO_2 per capita)



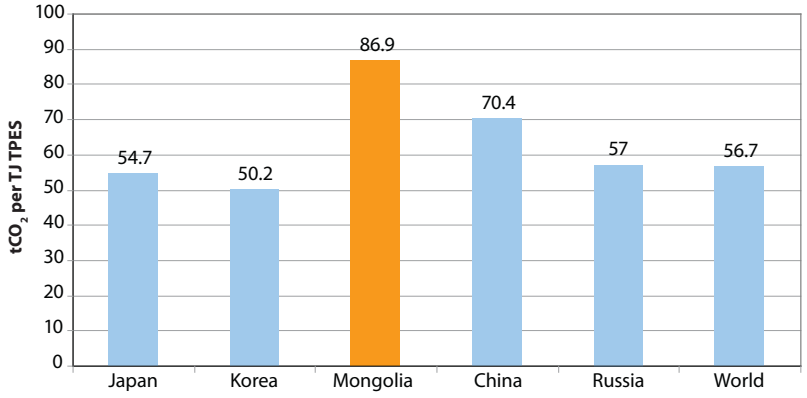
Source: Greenhouse Gas Inventories of Mongolia, www.mne.gov.mn

Figure 38: CO_2 Emissions Comparison, by Country (tCO_2 per GDP)



Source: Greenhouse Gas Inventories of Mongolia, www.mne.gov.mn

Figure 39: CO_2 Emissions Comparison, by Country (tCO_2 per TJ TPES)



Source: Greenhouse Gas Inventories of Mongolia, www.mne.gov.mn

Mongolia announced its association with actions with the Copenhagen Accord in January 2010. Major mitigation actions included as nationally appropriate for Mongolia refer to energy efficiency and renewable energy (Table 19).

Table 19: Major Mitigation Actions Supported by Mongolia

1.Energy supply: Increase renewable options	a. PV and solar heating b. Wind power generators and Wind farms c. Hydropower plants
2. Improve coal quality	a. Coal beneficiation b. Coal briquetting
3. Improve efficiency of heating boilers	a. Improve efficiency of existing HOBs and Install boilers with new design and high efficiency b. Convert hot water boilers into small capacity thermal power plants
4. Improve household stoves and furnaces	a. Change fuels for household stoves and furnaces b. Modernise existing and Implement the new design for household stoves and furnaces
5. Improve CHP plants	Improve efficiency and Reduce internal use
6. Increase use of electricity for local heating in cities	Use of electricity from grid for individual households in cities
7. Building Energy efficiency Improvement	A. Improve district heating system in buildings b. Install heat and hot water meters in apartments c. Make insulation improvements for existing buildings and implement new energy efficient standards for new buildings d. Improve lighting efficiency in buildings
8. Energy Efficiency Improvement in Industry	a. Improve housekeeping practices b. Implement motor efficiency improvements c. Introducing dry-processing in cement industry
9. Transport	Use more fuel efficient vehicles

Source: Copenhagen Accord, Appendix II, Mongolia: Nationally Appropriate Mitigation Actions of Developing Country Parties

Clean Development Mechanism Projects

Mongolia has accepted[3] the Kyoto Protocol on 15 December 1999. The CDM National Bureau (DNA) was established at the Ministry of Nature, Environment and Tourism on November 14, 2004. The National Bureau was officially registered with the Secretariat of United Nations Framework Convention on Climate Change. Since 2006 the supervision of the CDM National Bureau has been delegated to the Sustainable Development and Strategic Planning Department of the MNET. Since its establishment the Bureau has been dealing with acceptance of CDM

3 The instruments of "acceptance" of a treaty have the same legal effect as ratification and consequently express the consent of a state to be bound by a treaty.

project proposals for comment, assessment, support, and approval and issuance of official letters.

Table 20: CDM Registered Projects

Renewable Energy			
12MW Durgun Hydropower plant	Monitoring report for 2009 is being prepared. Working under its full capacity	Japan	30400 t CO_2
12MW Taishir Hydropower plant	48 CER issued for electricity produced in November and December of 2008; monitoring report for 2009 is being prepared	Japan	29600 t CO_2
Energy Efficiency			
Retrofit programme for decentralised heating stations	Practically dead due to legal disputes between project participants	Germany	12000 t CO_2

Source: Mongolia: Assessment Report of Climate Change 2009, Mongolian Ministry of Nature, Environment and Tourism

The role of the DNA is as follows:

- To develop national policies, strategies, criteria and guidelines for the implementation of CDM projects;
- To issue the formal letter of host country approval and conditional letter of approval to project developer;
- To ensure CDM projects are being monitored and executed by the project developers after the host country approval has been given according to the monitoring plan, an integral part of the project tracking system which is based on an monitoring methodology and provides collection of data necessary for estimating the baseline as well as the emissions within the project boundary;
- To maintain a CDM Registry of CDM projects in Mongolia;
- To respond to requests related to the national CDM policies;
- To monitor and keep account of certified emission reductions (CER) from Mongolia.

Two projects, Taishir and Durgun HPPs, are registered as CDM projects in 2007 with CER of 29,600 and 30,000 tons CO_2 per year respectively. Japan is the partner to these projects. One energy efficiency project was registered – Retrofit programme for decentralised heating stations with CER of 12,000 tCO_2, but the actual implementation may not start due to some legal disagreements between project participants. As of July 2010, 10 other CDM projects are approved and endorsed by the Mongolian CDM DNA and are at different stages of project documentation development. Three of the approved projects are dealing with energy efficiency retrofit of buildings or improvement in district heating systems.

Table 21: Projects Approved and Endorsed by CDM DNA

Name	Date of Endorsement	Annual emission reduction	Current state
Energy conservation and emission reduction from poor households	2010.04.08	75.0-90.0 thousand ton CO_2 eq	PDD drafting
Community based heating supply in rural remote areas of Mongolia	2010.02.18	17.0-23.0 thousand ton CO_2 eq	PDD
Biogas Plant Project in Mongolia	2010.01.18	2,312 thousand ton CO_2 eq	PIN
Sainshand wind farm project	2010.01.18	174.0 thousand ton CO_2 eq	PIN
Maikhan hydro plant project	2009.11.19	47.3 thousand ton CO_2 eq	PDD drafting
WGGE-waste gas to green energy	2009.11.24	28.5 thousand ton CO_2 eq	PDD drafting
7 250MW Khanbogd high power wind farm	2009.11.19	1,412 thousand ton CO_2 eq	PDD drafting
Replacement of coal and wood fired heating by renewable heating system	2009.09.18	15,445 thousand ton CO_2 eq	PIN 9
Reconstruction boilers in Power Plants of Darkhan and Erdenet cities	2009.09.18	32.0-33.0 thousand ton CO_2 eq	PIN 10
Energy efficiency rehabilitation for pre-cast panel buildings	2009.09.18	100.0-110.0 thousand ton CO_2 eq	PDD drafting

Source: Mongolia: Assessment Report of Climate Change 2009, Mongolian Ministry of Nature, Environment and Tourism

OVERALL ASSESSMENT OF PROGRESS

Mongolia is facing many challenges: modernising a Soviet-legacy infrastructure, many characteristics of developing countries including scarce financial resources, poverty, internal migration, a sizeable portion of the population relying on agriculture, a harsh climate (which induces large heating demand, but occasionally also decimates livestock), a land-locked and remote location. At the same time, it is blessed with abundant energy (coal) and mineral resources, it succeeded in establishing a stable democracy and consensual political culture, a favourable climate for foreign direct investments (FDI) and indigenous private entrepreneurs, and can boast well-educated professionals in Government and private business.

GDP and energy demand have displayed robust growth rates for many years. Adequate energy supplies – in existing consuming centres such as Ulaanbaatar and other towns and mines, but also for new mining projects – is a constant preoccupation for the Government. In this context, it is not surprising – and no exclusive attribute of Mongolian planners – that the Government tends to favour new power plants, largely based on domestic coal, but also renewables, over further efficiency projects. Nonetheless, efforts to promote energy efficiency, e.g., through building regulation or through an Energy Conservation Law in the making, are highly laudable.

Existing facilities (power and heat plants and networks) have been rehabilitated over the last two decades mostly with donor moneys. While there still remains a large potential for additional efficiency gains in the energy infrastructure and housing stock, some systems (mainly in buildings) technically do not lend themselves for efficiency measures (e.g., heat metering per dwelling). The Government has reformed the energy markets and prices through successive increases in tariffs, which appear to have been accepted by the population after extensive information campaigns. Also, the Government has scored successes in supplying energy to rural and peri-urban communities, and continues its efforts.

Energy Efficiency Legislation and Institutional Framework

Energy conservation and environmental sustainability are among the main principles of the Mongolian Strategy for Sustainable Development of the Energy Sector 2002-2010 and energy efficiency is included in the Millennium Development Goals approved by the Government.

However no progress was made from 2003 till recently for development and approval of a energy efficiency legislation with the exception of the adoption of a Building Thermal Performance standard. While several drafts of an Energy Efficiency Law were developed, they were not approved by the Government and the Parliament. The initiation of the development of a Draft Energy Conservation Law and a Medium and Long Term Action Plan in 2010 is welcomed and further efforts for developing and adopting the secondary legislation and technical regulations need to be intensified.

No specific Ministry of Agency in Mongolia is mandated to develop and implement the national and sectoral energy efficiency policies, so far different Ministries and other organisations were involved in various projects, but usually without any coordination going on between the stakeholders, very often information for already implemented projects in various sectors is missing or scarce. The Ministry for Mineral Resources and Energy and its Energy Policy Department is the main government body involved in energy and renewable policy, however its resources seem to be limited with only six specialists involved in the department activities. Energy Authority, which is currently the Ministries' implementing Agency seems to be the most logical choice for a body to be mandated with energy efficiency policy implementation, but it should be ensured that adequate human and financial resources are allocated to it.

Energy Pricing

Energy Regulatory Authority develops methodologies to determine tariffs and proposed tariffs are discussed, approved and published by the Regulatory Board. Before the establishment of ERA the applied prices were very low and did not allow energy companies to recover their cost.

Though increase of energy tariffs is quite a sensible social issue, there is general understanding in MMRE and ERA of the necessity to gradually remove subsidies fro electricity and heat to ensure financial sustainability of licensed energy operator.

By 2010 tariffs were increase 5 times and the intention is by 2013 reach the cost recovering price for electricity of 8 US cents/kWh and later to remove cross-subsidies between industry and residential tariffs.

Energy Efficiency Funding

So far major sources of financing for energy efficiency activities are provided by international financial and donor organisation. The Government is providing is some funds to co-finance projects and to provide some efficient equipment to end-users (ger insulation, solar panels). A Green Credit Guarantee Fund, which has been established by the Dutch government to support energy efficiency in industrial sector and is has obtained 800 000 USD loan from the Mongolian Government. However, as of July 2010 the fund is illiquid with al its means being committed to a number of small and medium enterprises.

Mongolian has developed institutional framework for financing projects through the Clean Development Mechanism of the Kyoto Protocol. A pipeline of eligible projects is created and as of July 2010, 10 energy efficiency and renewable energy projects are registered by the DNA.

RECOMMENDATIONS

The following recommendations are offered to promote energy efficiency in Mongolia.

General Recommendations

- The Government, in devising its medium and long term energy planning, should lay out the various supply and demand side options to fill the looming demand gap. Least cost options should be chosen among supply (new electricity generation and heat supply) and energy efficiency (conversion, transmission and end use efficiency). The Government should use and expand ongoing surveys of energy losses and end use;
- Energy efficiency work should focus on those sectors holding the largest potential: energy efficiency in buildings (heating system, building envelope, and lighting), district heating and reducing electricity production, transmission and distribution losses.

EE Policies, Legislation and Programmes

- The Government should finalise the Energy Conservation Law according to the announced timetable. Promulgating the Energy Conservation Law should send a strong signal to energy stakeholders and the wider public about the crucial importance of energy efficiency. The Government should reinforce cooperation with all relevant Governmental institutions and other stakeholders in drafting the Energy Conservation Law;
- Upon the adoption of the Energy Conservation Law the Government should ensure further the development of secondary legislation and regulations in different sectors, in close cooperation with relevant actors;
- The Government should undertake strong efforts to ensure implementation and enforcement of legislation and regulations, through continued training, ensuring sufficient human and financial resources for the inspectorate and enhancing its sanctioning power. This pertains particularly to energy efficiency and environmentally related legislation such as building and vehicle emissions regulations and Environmental Impact Assessment.

Institutional Framework

- The Government should allocate sufficient human and financial resources within the Ministry for Mineral Resources and Energy for overall energy efficiency policy. This should include appointing a high level decision maker for energy efficiency policy, who should have sufficient authority and resources;
- The Government should ensure that the Energy Authority is given the adequate human and financial resources to implement energy efficiency policy;
- One of the assignments for the high level decision maker should be to organise a knowledge base by compiling information regarding energy efficiency

projects (including donor financed projects), including lessons learned. This can assist the Government in developing a strategy and prioritising future donor financing of energy efficiency projects;

- Another assignment of the high level decision maker should be to clearly define the responsibilities and roles for different ministries and other stakeholders regarding energy efficiency;
- Cooperation between the Ministry for Mineral Resources and Energy and other relevant Governmental institutions should be enhanced. Cooperation with other actors such as NGOs, donor organisations, and private actors should also be improved, perhaps institutionalised in some way.

Energy Market and Pricing

- The Government should continue the planned efforts in energy pricing reform (eventual cost covering level of prices and removal of cross subsidies);
- The Government should continue to support the liberalisation of the energy market, at the same time as ensuring private energy investment.

Energy Efficiency Financing

- The Government should continue efforts to provide end-users with energy efficient equipment and solutions including stoves, solar panels, ger insulation, using instruments such as subsidies and micro credits;
- The Government should continue its efforts in attracting Clean Development Mechanism (CDM) financing for energy efficiency projects;
- The Government should explore the possibility of allocating financial resources which are freed as a consequence of end-user subsidy removal to funding of energy efficiency projects;
- The Government should consider consolidating the Green Credit Guarantee Fund and other similar funds in order to create revolving credit liquidity;
- The Government should examine possibilities of introducing tax incentives for energy efficiency projects.

Specific Energy Efficiency Programmes and Measures

Buildings

- The Government should put strong emphasis on implementation and enforcement of adopted building regulations. The Government should demonstrate an exemplary role in public buildings and in its own construction of new apartments;

- The Government should introduce individual heat metering in modern apartments where this is technically possible and in future buildings.

District Heating

- The Government should continue current efforts in decreasing energy loss in the district heating system.

Electricity

- The Government should continue current efforts for increased energy efficiency in the electricity sector;
- The Government should ensure that best available energy efficient technologies are used for new coal power plants.

Industry

- The Government should promote the use of energy audits and energy management in enterprises.

Information, Training and Awareness Raising

- The Government should promote energy efficiency awareness raising and training for Government officials and the wider public at local, regional and national level.

Renewable Energy

- The Government should pay particular attention to the implementation of provisions of the Renewable Energy Law when advancing the currently planned projects;
- Rural electrification efforts should be continued based on the positive results already achieved from some international donor projects like the 100,000 solar Ger project;
- The Government should continue their support to renewable energy generation solutions.

ANNEX 1: GENERAL ECONOMICS AND ENERGY DATA

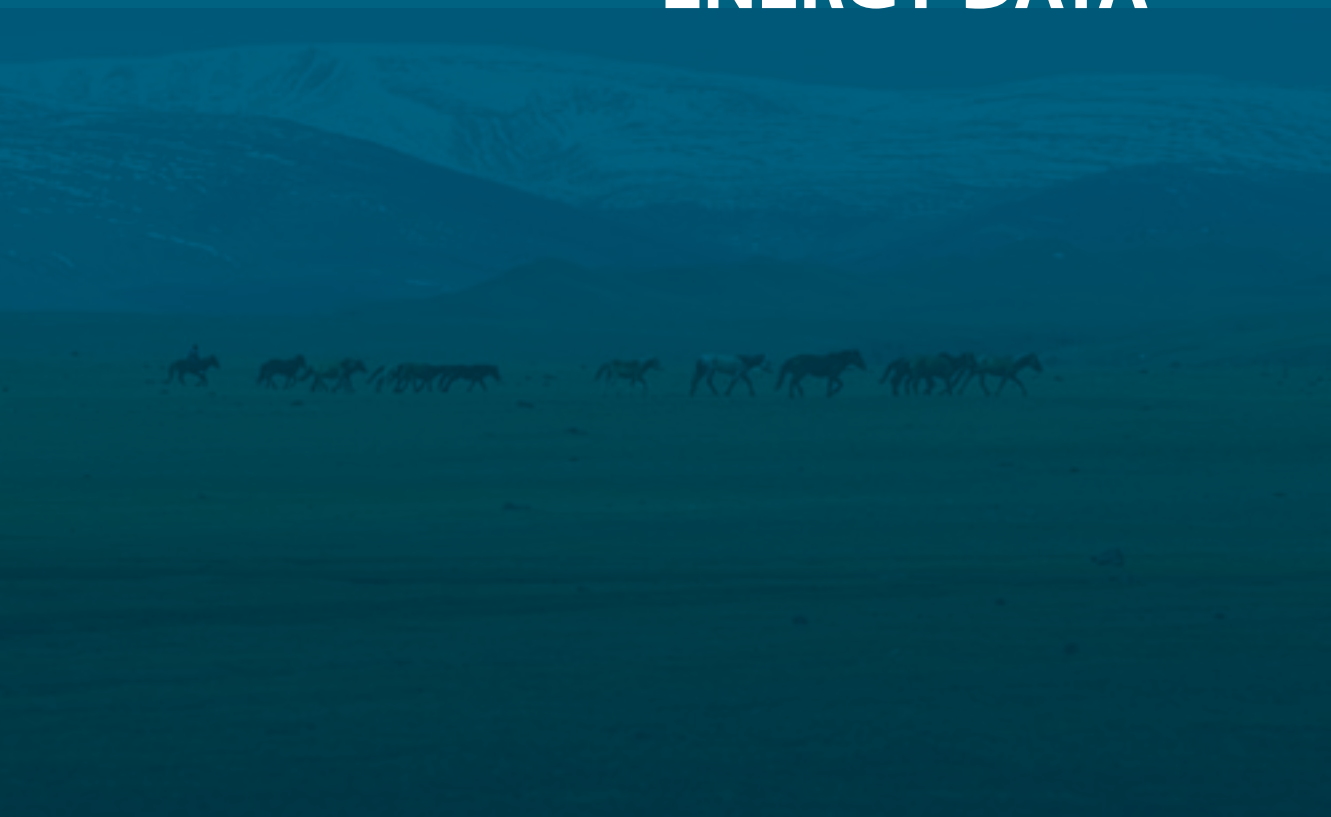


Table 22: Energy Balance (ktoe)

Indicators	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Primary Energy Production	2 749	2 256	1 916	1 903	2 052	2 104	2 527	2 752	3 130	3 552	3 890
Net imports	703	478	473	470	490	379	40	-161	-203	-395	-684
TPES	3 416	2 704	2 364	2 363	2 517	2 434	2 503	2 595	2 909	3 093	3 152
TFC	2 971	1 910	1 507	1 602	1 682	1 683	1 779	1 852	2 130	2 209	2 312

Source: IEA Statistics, Electronic Version, 2010

Table 23: Total Primary Energy Supply Structure (ktoe)

Products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	2 489	2 228	1 817	1 809	1 930	1 802	1 817	1 918	2 155	2 186	2 170
Crude, NGL and feedstocks	0	0	0	0	0	0	0	0	6	5	17
Petroleum products	823	352	434	439	474	514	568	560	626	782	845
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0	0	0	0	0
Hydro	0	0	0	0	0	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0	0	0
Solar/wind/other	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	85	92	100	100	100	103	103	103	103	103	103
Electricity	20	33	13	15	13	14	14	14	19	17	16
Total Primary Energy Supply	3 416	2 704	2 364	2 363	2 517	2434	2 503	2 595	2 909	3 093	3 152

Source: IEA Statistics, Electronic Version, 2010

Table 24: Total Final Energy Consumption (ktoe)

Products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	1 002	675	286	322	305	295	276	329	520	451	465
Petroleum products	720	307	401	402	442	478	528	523	586	729	789
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0	0	0
Electricity	0	0	0	0	0	0	0	0	0	0	0
Heat	53	54	55	55	55	56	56	56	56	56	56
Total Final Consumption	244	168	169	173	180	195	210	227	241	256	278

Source: IEA Statistics, Electronic Version, 2010

Table 25: Basic Energy Related Indicators

Indicators	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Population (mln)	2.11	2.28	2.40	2.42	2.45	2.48	2.52	2.55	2.59	2.61	2.63
GDP (USD 2000 bln)	1.10	0.95	1.09	1.12	1.17	1.26	1.39	1.49	1.62	1.78	1.94
GDP (USD 2000 bln PPP)	4.27	3.70	4.23	4.35	4.56	4.88	5.39	5.78	6.28	6.92	7.54
Primary Energy Intensity (TPES/GDP) (toe per USD 2000 thousand)	3.11	2.84	2.17	2.11	2.14	1.94	1.80	1.74	1.80	1.73	1.62
Primary Energy Intensity (TPES/GDP PPP) (toe per USD 2000 thousand PPP)	0.80	0.73	0.56	0.54	0.55	0.50	0.46	0.45	0.46	0.45	0.42
TPES/Population (toe per capita)	1.62	1.19	0.99	0.98	1.03	0.98	1.00	1.02	1.13	1.19	1.20
Electricity Consumption/ GDP (kWh per USD 2000)	3.07	2.67	2.37	2.37	2.34	2.30	2.21	2.18	2.12	2.01	2.00
Electricity Consumption/ Population (kWh per capita)	1 603	1 119	1 076	1 095	1 121	1163	1 222	1 275	1 326	1 376	1 478
Energy related CO_2 Emissions – from fuel combustion (Mt)	12.66	10.05	8.81	8.8	9.4	8.99	9.22	9.61	10.72	11.33	n.a.

Source: IEA Statistics, Electronic Version, 2010

Table 26: Electricity Generation (GWh)

Products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	3 207	2 554	2 913	2 979	3 090	3 111	3 278	3408	3 535	3 683	3 985
Petroleum products	264	113	87	98	88	99	112	104	114	150	160
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0	0	0	0	0
Hydro	0	0	0	0	0	0	0	0	0	0	0
Solar/wind/other	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0	0	0
Total electricity generation	3 471	2 667	3 000	3 077	3 178	3 210	3 390	3 512	3 649	3 833	4 145

Source: IEA Statistics, Electronic Version, 2010

Table 27: Heat Production (TJ)

Products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	36 185	27 940	28 527	27 279	28 552	29 625	32 212	32 580	32 786	32 178	32 347
Petroleum products	1 266	663	301	342	201	241	221	100	80	161	141
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0	0	0	0	0
Hydro	0	0	0	0	0	0	0	0	0	0	0
Solar/wind/other	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0	0	0
Total heat production	37 451	28 603	28 828	27 621	28 753	29 866	32 433	32 680	32 866	32 339	32 488

Source: IEA Statistics, Electronic Version, 2010

ANNEX 2: SELECTED END-USE DATA TABLES

Table 28: Total Final Energy Consumption, by Sector (ktoe)

Sectors	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Residential	609	364	411	455	501	510	538	522	562	578	599
Industry Sector	1 152	836	472	510	535	544	547	584	737	758	807
Commercial and Public Services	164	142	144	101	104	123	160	198	229	168	192
Transport Sector	522	274	328	316	350	347	393	393	439	532	538
Agriculture/Forestry	134	43	25	25	27	31	38	43	39	43	50
Non-energy use	21	1	2	3	6	3	2	2	2	3	3
Non-specific (other)	368	251	126	192	159	125	102	110	123	127	123
Total Final Consumption	2 971	1 910	1 507	1 602	1 682	1 683	1 779	1 852	2 130	2 209	2 312

Source: IEA Statistics, Electronic Version, 2010

Table 29: Final Energy Consumption of the Residential Sector (ktoe)

Energy products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	194	42	62	71	130	141	142	116	117	129	140
Electricity	41	48	44	46	47	51	56	61	69	72	76
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Heat	338	236	265	299	284	278	300	305	335	337	343
Petroleum products	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	36	38	39	39	39	40	40	40	40	40	40
Total Residential Sector	609	364	411	455	501	510	538	522	562	578	599

Source: IEA Statistics, Electronic Version, 2010

Table 30: Final Energy Consumption of the Services Sector (ktoe)

Energy products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Electricity	0	0	0	0	0	0	0	0	0	0	0
Heat	164	111	66	56	84	103	147	137	157	140	132
Oil products	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
Coal and coal products	1	31	78	44	20	19	13	61	72	28	60
Combustible renewables and waste	0	0	0	0	0	0	0	0	0	0	0
Total Services Sector	163	142	144	101	104	123	160	198	229	168	192

Source: IEA Statistics, Electronic Version, 2010

Table 31: Final Energy Consumption of the Industry Sector (ktoe)

Energy products	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal and coal products	544	445	86	77	79	79	65	72	224	187	188
Petroleum products	201	62	89	95	105	119	142	149	171	214	237
Natural gas	0	0	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0	0	0
Electricity	155	95	102	104	108	117	125	135	140	150	165
Heat	253	234	195	234	243	229	215	228	202	207	217
Total Industry Sector	1 152	836	472	510	535	544	547	584	737	758	807

Source: IEA Statistics, Electronic Version, 2010

Table 32: Energy Consumption of the Industry Sector, by Sub-Sector (ktoe)

Subsectors	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Iron and steel	0	0	0	0	0	0	0	0	0	0	0
Chemical and petrochemical	0	0	0	0	0	0	0	0	0	0	0
Non-metallic minerals	0	0	0	0	0	0	0	0	0	0	0
Non-ferrous metals	0	0	0	0	0	0	0	0	0	0	0
Food and tobacco	0	0	0	0	0	0	0	0	0	0	0
Mining and quarrying	94	29	41	44	50	56	66	69	80	100	111
Machinery	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0
Textile and leather	0	0	0	0	0	0	0	0	0	0	0
Paper, pulp and printing	0	0	0	0	0	0	0	0	0	0	0
Non-specified/other	1 058	807	430	465	486	488	481	515	657	657	696

Source: IEA Statistics, Electronic Version, 2010

ANNEX 3: ENERGY PRICES IN MONGOLIA

Note: the exchange rate used in this Annex 3 is as of august 2010: 1 MNT = 0.0008 USD.[4]

Electricity Retail Tariffs in the Central Energy System

Table 33: Electricity Retail Tariffs for Entities and Industrial Consumers

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With one tariff meter	79.80	0.064
With three tariff meter:		
- Day time (06-17 h)	79.80	0.064
- Evening (17-22 h)	133.90	0.107
- Night (22-06 h)	46.00	0.037
Trolley company in Ulaanbaatar	49.20	0.039

Source: Energy Regulatory Authority, www.era.energy.mn

Table 34: Electricity Retail Tariffs for Lighting of Public Streets and Squares in Ulaanbaatar and Aimag Centres

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
Day time (06-19 h)	79.80	0.064
Night time (19-06 h)	40.00	0.032

Source: Energy Regulatory Authority, www.era.energy.mn

Table 35: Electricity Retail Tariffs for Lighting for Condominium Owner Associations (Public Space and Stairs of Multi-Family Panel Blocks)

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
Day time (06-21 h)	79.80	0.064
Night time (21-06 h)	40.00	0.032

Source: Energy Regulatory Authority, www.era.energy.mn

Table 36: Electricity Retail Tariffs for Residential Consumers with Meters

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With one tariff meter		
- Apartment	79.80	0.064
- Ger district	77.00	0.062
With two tariff meter		
- Day time (06-21 h)	79.80	0.064
- Night (21-06 h)	40.00	0.032

Source: Energy Regulatory Authority, www.era.energy.mn

4 See http://www.exchangerates.org.uk/MNT-USD-exchange-rate-history.html.

Table 37: Electricity Retail Tariffs for Residential Consumers in Apartments in Ulaanbaatar

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With monthly consumption up to 150 kWh	70.00	0.056
With monthly consumption from 151 kWh to 250 kWh	75.00	0.060
With monthly consumption above 251 kWh	79.80	0.064

Source: Energy Regulatory Authority, www.era.energy.mn

Table 38: Electricity Retail Tariffs for Residential Consumers in Ger Districts in Ulaanbaatar

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With monthly consumption up to 150 kWh	67.00	0.054
With monthly consumption from 151 kWh to 250 kWh	72.00	0.058
With monthly consumption above 251 kWh	77.00	0.062

Source: Energy Regulatory Authority, www.era.energy.mn

Table 39: Electricity Retail Tariffs for Residential Consumers in Apartments in Other Cities and Soums

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With monthly consumption up to 150 kWh	70.00	0.056
With monthly consumption from 151 kWh to 250 kWh	75.00	0.060
With monthly consumption above 251 kWh	79.80	0.064

Source: Energy Regulatory Authority, www.era.energy.mn

Table 40: Electricity Retail Tariffs for Residential Consumers in Ger Districts in Other Cities and Soums

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
With monthly consumption up to 150 kWh	67.00	0.054
With monthly consumption from 151 kWh to 250 kWh	72.00	0.058
With monthly consumption above 251 kWh	77.00	0.062

Source: Energy Regulatory Authority, www.era.energy.mn

Table 41: Electricity Retail Tariffs for Low-Income Residential Consumers

Type	Tariff (without VAT), MNT/kWh	Tariff (without VAT), USD/kWh
Ulaanbaatar city (up to 100 kWh)	39.00	0.031
Ulaanbaatar city (above 101 kWh)	58.00	0.46
Darkhan city, Erdenet city (up to 75 kWh)	39.00	0.031
Darkhan city, Erdenet city (above 76 kWh)	58.00	0.46
Other aimags and soums (up to 50 kWh)	39.00	0.031
Other aimags and soums (above 51 kWh)	58.00	0.46

Source: Energy Regulatory Authority, www.era.energy.mn

Heat Retail Tariffs in Ulaanbaatar

Table 42: Ulaanbaatar Heat Retail Tariffs for Entities and Industrial Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating (without meter)	MNT/m^3	323	USD/m^3	0.26
Heating for basement and ground floor of buildings (without meter)	MNT/m^2	304	USD /m^2	0.24
Heating (by meter)	MNT/Gcal	20 886	USD /Gcal	16.70
Heated air	MNT/Gcal	9 493	USD /Gcal	7.59
Hot water	MNT/person	3 646	USD /person	2.91
Technological hot water	MNT/Gcal	9 493	USD /Gcal	7.59
Student residences	MNT/m^2	304	USD /m^2	0.24
Heating for apartment of foreigners	MNT/m^2	458	USD /m^2	0.37

Source: Energy Regulatory Authority, www.era.energy.mn

Table 43: Ulaanbaatar Heat Retail Tariffs for Residential Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating for apartment	MNT/m^2	304	USD/m^3	0.24
Heating (by meter)	MNT/Gcal	7 035	USD /Gcal	5.63
Hot water in heating season	MNT/person	1145	USD /person	0.92
Hot water in non-heating season	MNT/person	1 718	USD /person	1.37
Hot water (by meter)	MNT/Gcal	8 771	USD /Gcal	7.02

Source: Energy Regulatory Authority, www.era.energy.mn

Heat Retail Tariffs in Darkhan Uul Province

Table 44: Darkhan Uul Heat Retail Tariffs for Entities and Industrial Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating (without meter)	MNT/m^3	298	USD/m^3	0.24
Heating for basement and ground floor of buildings (without meter)	MNT/m^2	283	USD /m^2	0.23
Heating (by meter)	MNT/Gcal	16 600	USD /Gcal	13.28
Heated air	MNT/Gcal	8 196	USD /Gcal	6.56
Hot water for entities	MNT/month	2 805	USD /month	2.24
	MNT/t	933	USD/t	0.75
	MNT/Gcal	6 114	USD/Gcal	4.89
Technological hot water	MNT/Gcal	8 196	USD /Gcal	6.56
Heating for budget organisations	MNT/m^3	298	USD/m^3	0.24
Steam 0.8-1.3 MPa	MNT/Gcal	16 270	USD /Gcal	13.02
Steam 2.0 MPa	MNT/Gcal	16 780	USD /Gcal	13.42
Student residences	MNT/m^2	304	USD /m^2	0.24

Source: Energy Regulatory Authority, www.era.energy.mn

Table 45: Darkhan Uul Heat Retail Tariffs for Residential Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating for apartment	MNT/m^2	304	USD/m^3	0.24
Heating (by meter)	MNT/Gcal	7 035	USD /Gcal	5.63
Hot water (open system)	MNT/month	1 718	USD /month	1.37
Hot water (loop system)	MNT/month	1 145	USD /month	0.92

Source: Energy Regulatory Authority, www.era.energy.mn

Heat Retail Tariffs in Orkhon Province

Table 46: Orkhon Heat Retail Tariffs for Entities and Industrial Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating (without meter)	MNT/m^3	345	USD/m^3	0.28
Heating for basement and ground floor of buildings (without meter)	MNT/m^2	283	USD /m^2	0.23
Heating (by meter)	MNT/Gcal	22 556	USD /Gcal	18.04
Heated air	MNT/Gcal	7 795	USD /Gcal	6.24
Hot water	MNT/ Gcal	4 052	USD /Gcal	3.24
Heating for budget organisations	MNT/m^3	312	USD /m^2	0.25
Heating for apartment of foreigners	MNT/m^2	396	USD /m^2	0.32
Technological steam	MNT/Gcal	18 860	USD/Gcal	15.09

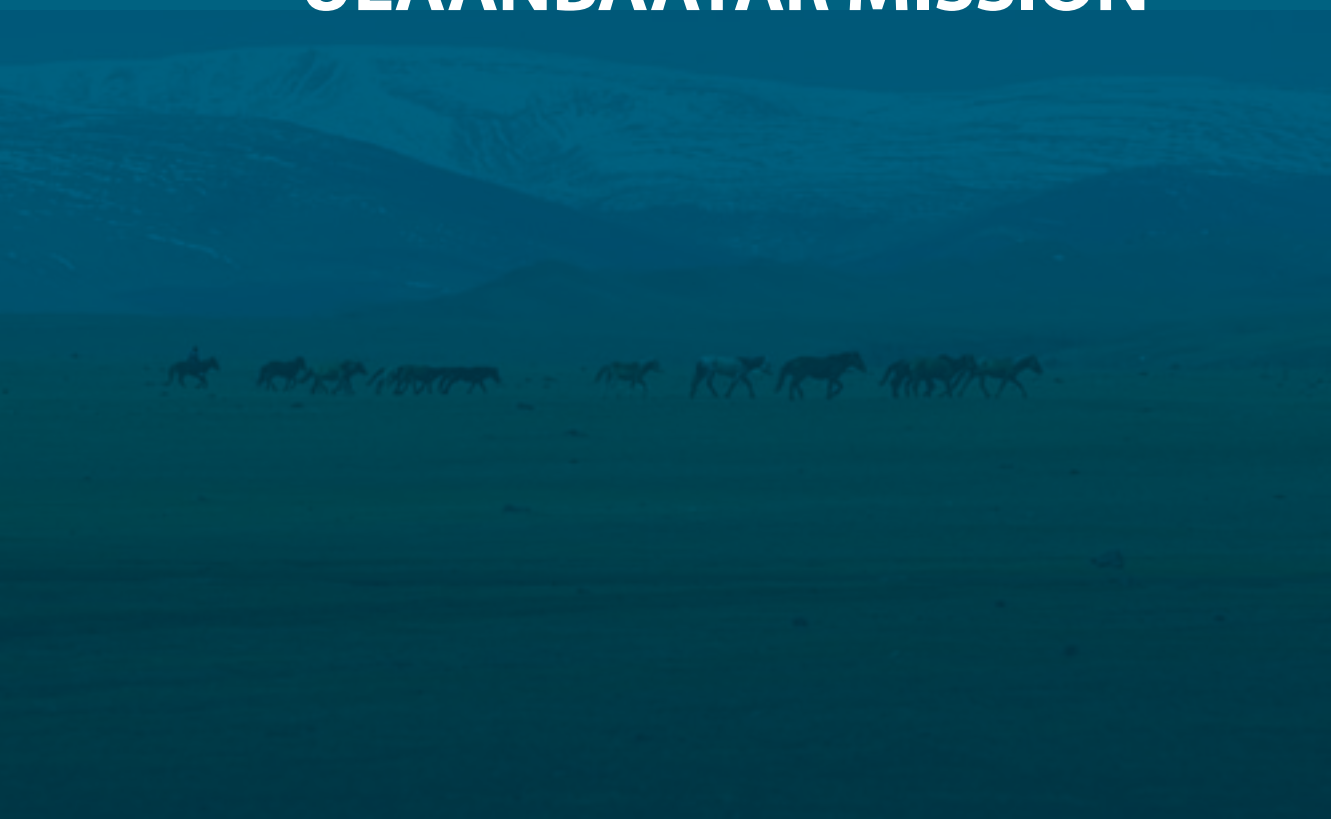
Source: Energy Regulatory Authority, www.era.energy.mn

Table 47: Orkhon Heat Retail Tariffs for Residential Consumers

Type	Unit	Tariff (without VAT)	Unit	Tariff (without VAT)
Heating for apartment	MNT/m^2	304	USD/m^3	0.24
Hot water in heating season	MNT/person	1145	USD /person	0.92
Hot water in non-heating season	MNT/person	1 718	USD /person	1.37

Source: Energy Regulatory Authority, www.era.energy.mn

ANNEX 4: ORGANISATIONS CONTACTED DURING THE ULAANBAATAR MISSION



1. Ministry of Mineral Resources and Energy
2. Ministry of Roads, Transportation, Construction and Urban Development
3. Ministry for Nature, Environment and Tourism
4. Ministry of Finance
5. Ministry of Food, Agriculture and Light Industry
6. Government Implementing Agency Energy Authority
7. Energy Regulatory Authority
8. Ulaanbaatar City Mayor's Office
9. UNDP Building Energy Efficiency Project
10. Mongolian National Chamber of Commerce and Industry
11. GTZ office – Mongolia
12. Hasu Megawatt LLC
13. MonEnergy Consult Ltd.
14. MCS International Ltd.

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ANNEX 6:
LIST OF ABBREVIATIONS

ADB	Asian Development Bank
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CES	Central Energy System
CHP	Combined Heat and Power
ECT	Energy Charter Treaty
DNA	CDM National Bureau
EA	Energy Authority
EBRD	European Bank for Reconstruction and Development
ERA	Energy Regulatory Authority
EU	European Union
FDI	Foreign Direct Investments
GDP	Gross Domestic Product
GHG	Green House Gas
IEA	International Energy Agency
JICA	Japan International Cooperation Agency
MAP 21	Mongolian Action Programme for the 21st Century
MEA	Mongolian Energy Association
MMRE	Ministry for Mineral Resources and Energy
MNCCI	Mongolian National Chamber of Commerce and Industry
MNET	Ministry for Nature, Environment and Tourism
MNT	Mongolian Tugrik
MRTCUD	Ministry of Roads, Transport, Construction and Urban Development
NAPCC	National Action Programme for Climate Conservation
NREC	National Renewable Energy Centre
PPP	Purchase Power Parity
PEEREA	Protocol on Energy Efficiency and Related Environmental Aspects
SBB	Straw-Bale Building

SBM	Single Buyer Model
SIDA	Swedish International Development Cooperation Agency
TFC	Total Final Consumption
TPES	Total Primary Energy Supply
TPP	Thermal Power Plants
UBDHN	Ulaanbaatar District Heating Company
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WB	World Bank
WEC	World Energy Council
WES	Western Energy System

ANNEX 7:
PHOTO ALBUM

Meeting at the Mongolian Energy Authority

Meeting at the Mongolian Ministry for Nature, Environment and Tourism

Meeting at the Mongolian National Chamber of Commerce and Industry

Meeting at the Mongolian Ministry for Mineral Resources and Energy

Statue of Genghis Khan, Building of the State Great Khural

In Front of the Building of the State Great Khural, Preparation for the Naadam Festival 2010

Preparation for the Naadam Festival 2010

The Naadam Festival 2010