energy sectors shall be designed in consistent with environmental and green development principles. The government should establish an energy research institute under the Ministry of Energy.

Cooperation between the Ministry of Energy and otherrelevant Governmental institutions should be enhanced. Cooperation withother actors such as NGOs, donor organisations, and private actors should alsobe improved

1.2 The Action Plan for Large Scale Hydropower Plant

1.2.1 Description of the technology

Hydropower plants capture the energy released by water falling through a turbine and convert this into mechanical power, which drives generators to produce electricity. About 20% of globally supplied electricity is generated by hydropower and in some countries it provides more than 50% of electricity supply.

Hydropower can achieve significant GHG emission reductions as it, depending on the energy mix of the country concerned, could replace fossil based technologies for electricity production

Hydropower is a fully commercial, and well-established mature technology, although there is scope for further improvement in efficiency and costs and, in particular, for developing more cost-effective technologies for small-capacity and low-head applications. Hydropower can provide a very flexible source of renewable energy, capable of delivering base load power, meeting peak demand, or being used as a storage system. Hydro's quick-start capability helps to cope with fluctuations in supply or demand. Production can be put at risk, however, when drought limits the supply of water within a catchment area, and annual hydro production in many markets varies seasonally and from year to year, depending on rainfall levels.

The three main types of hydro schemes are storage, run-of-river and pumped storage. In storage schemes, a dam impounds water in a reservoir that feeds the turbine and generator. Run-of-river schemes use the natural flow of a river and may employ a weir to enhance flow continuity. Either of these types can involve diversion, where water is channelled from a lake, river or reservoir to a remote powerhouse containing the turbine and generator. Pumped storage schemes involve two reservoirs. At times of low demand and usually low electricity prices (often at night); electricity is used to pump water from the lower to an upper basin. Then the ward stored in the upper basin is used for electricity generation in times of high electricity prices or electricity shortage.

GHG emissions are expected to be reduced by 1.458.000 tCO_2eq/year from the construction of 300 MW Hydropower plant in Mongolia.

Large scale Hydropower plants will give following economic, environmental, and social benefits:

- Improved operational conditions of the Central Energy system;
- Reduced electricity imports;
- Improved energy regime of the Central Grid during peak load;
- Introduction of the technology has the potential to reduce coal consumption;
- Reduced air pollution: the technology does not emit any local air pollutants, such as NO_X, CO or particulate matter, thereby helping to improve air quality.

1.2.2 Target for technology transfer and diffusion

The National renewable energy program approved by parliament in 2005 indicates: "Gradually implement goal of increasing the share of renewable energy in the total energy production and reaching 3-5 percent in the national energy by the year 2010, 20-25 percent share by 2020". But the target for 2010 has not been achieved. As of 2011, the share of renewable energy in total electricity production is 1.11%. In the future, the electricity generation will increase gradually and reach 7800 million kWh in 2020. In order to reach the 20% target, the electricity generation from renewable energy sources should reach 1950 million kWh (Table61).

Table 61: National overall target for the share of electricity production from renewable sources in 2010 and 2020 according to the National Renewable energy program

No.	*Target for Renewable Sources*		*Share in total Electricity Production*
1	Target of electricity from renewable sources in total electricity production in 2010		3-5 %
2	Share of electricity production from renewable sources in total electricity production in 2011.		1.11%
	From this	Hydro	*1.1%*
		Wind and Solar	*0.01%*
3	Target of electricity from renewable sources in total electricity production in 2020		25%
4	Expected total electricitydemand in 2020 (GWh)		7800.0
5	Expected amount of electricity from renewable sources corresponding to 2020 target (GWh)		1950.0

According to the government policy, the Shuren Hydropower Plant (300 MW), the Egiin Hydropower Plant (220 MW) and the Orkhon Hydropower Plant (100 MW) will be constructed before 2020. The electricity supply from hydropower plant will be 1372 GWh, which will be 17.5% of total expected electricity demand in the table above.

The target for technology transfer and diffusion of large scale hydropower plants is to construct large scale hydropower plants with total capacity 620 MW in 2020, in order to implement the National Renewable Energy Program by annually generating 1372 GWh of electricity from large scale hydropower plants.

A short summary of hydropower projects that are under consideration is shown in Table 62.

Table 62: Short summary of hydropower projects that are under consideration

Project name	Project situation	Installed capacity, MW	Annual electricity generation, GWh	Estimated capital cost, million USD	Capital cost per MW USD/kW
Up to 2020					
Egiin Hydropower Plant	The Feasibility Study of the project was carried out in 1992 and final design and tender documents have been prepared.	220.0	412.0	313.6	1425.5
Shuren Hydropower Plant	The pre-feasibility study has been carried out by the Energy Authority in 2011	300.0	800.0	450.0	1500.0
Orkhon Hydropower Plant	The Feasibility study of the Orkhon hydropower project has been carried out by prepared by the Japanese Chubu Electric Power Inc. and the Japanese External Trade Organization (JETRO), Japan.	100.0	160.0	219.0	2190.0
Up to 2030					
Chargait Hydropower Plant	The feasibility study of the Chargait Hydropower Project in Mongolia was carried out with support from the European Commission under the Framework Contract AMS/451 - Lot 4 by ESB International Dublin in joint venture with Fechner, Stuttgart in 2004-2005.	15.0	68.0	57.5	3833.0
Erdeneburen Hydropower Plant	The feasibility study of the Erdeneburen Hydropower project has been prepared by the MCS International, Kyushu Electric Power Co., West Japan Engineering Consultants, Inc. Industrial Decisions, Inc. in 2007-2008	64.2	242.7	286.0	4454.8

1.2.3 Barriers to the technology's diffusion

Short description of the identified barriers and overall enabling framework for meeting the specified targets for large scale HPP projects is shown in Table 63.

Table 63: Barriers to the technology's diffusion

Key barriers identified		Enabling measures
Category	**Barriers**	
Economic and financial	Inappropriate financial incentives	- Introduce feed-in tariff for medium and large scale HPPs; - Reduce subsidy for conventional energy; - Finance from Development Bank
	High cost of capital	Introduce public-private partnership for implementation of the hydropower plant projects. The Concession Law allows the State Property Committee to implement projects that are listed within the articles of the State Property Concession. The large-scale hydropower plant project should be included in this list of concessions which is approved by the Mongolia Government. The Government should check out the possibility to fund the project through Development Bank. The Government should issue regulation exempt the import duty on machinery, and goods and materials for large hydropower plants.
	High transaction cost	The government should build capacity for hydro power development projects by establishing an energy research institution under the Ministry of Energy. There is need to train skilled local experts who could develop project development study, including Feasibility Studies.
	Lack of adequate access to financial resources	The government needs to levy environmental pollution fees and to reduce or stop subsidies for conventional energy, in order to encourage renewable energy sources especially large-scale hydropower plants. The government needs to increase the low tariff for electricity consumption. The Government should develop capital market in Mongolia to raise capital for large scale projects such as hydropower plants.
Policy, legal and regulatory	Policy intermittency and uncertainty	The government needs to have long term political commitment. Need clear government policies with no political risks for investors. The government should formulate a new National Renewable Energy Program.
	Ineffective enforcement	The government should enhance the enforcement and implementation of laws, national programs and regulations. The government should establish a renewable energy fund according to the Renewable Energy Law which was adopted in 2007. The government should have strong control and commitments to clarify reasons of ineffective enforcement and implementation and take actions to address this.
	Highly controlled energy sector Measure	In order to improve market competition and remove utility monopoly in the energy sector, the government should continue to support the liberalization of the energy market, at the same time as ensuring private energy investment.

Market	Underdeveloped competition	The Government should continue to support the liberalisation of the energy market, at the same time improving conditions for private investment in the energy sector
Network	Incumbent networks are favored by legislation	The main assignment for the high level decision makers should be to organizeaknowledge base by compiling information regarding large-scale hydropower plant projects, including lessons learned. Thiscan assist the government in developing a strategy and prioritising of hydropower plant projects
	Weak connectivity between actors favoring the new technology	The high level decision maker should clearly define the responsibilities and roles for different ministries and other stakeholders regarding selection and implementation of large-scale hydropower plant projects. Cooperation between the Ministry for Energy and other relevant governmental institutions should be enhanced. Cooperation with other actors such as NGOs, donor organisations, and private actors shouldbe improved. Introducing suitable knowledge, skills and management would influence the government's involvement while benefiting society with efficient, environmentally technologies such as large-scale hydropower plants.

1.2.4 Proposed action plans for Large scale HPP

Proposed action plans for large scale HPP are provided in Table 64.

Table 64: Proposed action plans for large scale HPP

Measures	Actions	Why the actions need	Responsible organization	Time frame	Expected budget, 1000USD	How can be fund
Economic and financial measures						
Introduce feed-in tariff for medium and large scale HPPs	Amend the Renewable Energy Law: add in Chapter 4 Article11 (Renewable energy tariffs and prices) feed-in tariffs for medium and large scale HPPs	The RE law includes feed-in tariff for HPP with up to 5000 kW only.	Ministry of energy, Government, Parliament	1 year	No need	-
Reduce subsidy for conventional energy	Increase the tariffs of electricity and heating every year and reach its cost	In 2011, 13 companies received 2.2 million USD subsidies from the state budget and 1.6 millions USD of them went to rural plants and companies.	Energy Regulatory Committee	1-3 years	No need	-
Introduction of PPP model for implementation of HPP projects	In accordance with the law on concessions, implement the biggest HPP project, using public and private partnership (PPP) mechanism of the sector (e.g. Egiin HPP)	Although since 1992, research works have been done in order to implement a project of large-scale HPP and projects have been developed,so far none has been implemented.	Government, Ministry of Energy	(5-10) years	313600 (Egiin HPP)	Private investment
To get financial source for investment of large HPPs from the Development Bank of Mongolia.	To be approved by the Parliament the construction of large scale HPP and include in list of projects to be financed by Development Bank of Mongolia	According to the Development Bank Law, the Development Bank shall provide loans to finance large scale development projects and programs approved by the Parliament	Government, Ministry of energy	(5-10) years	450000 (Shuren HPP) 219000 (Orkhon HPP)	Development Bank of Mongolia

Exemption of import duty of machinery, and goods and materials for HPPs.	To enact a policy on exemption of import duty of machinery, and goods and materials for HPPs.	In order to decrease the initial investment of large-scale HPP, import tax exemption or softening should be applied	Government, Ministry of Energy	(5-10) years	No need	-
Establish energy research institute under the Ministry of Energy	To do research work on energy sector development					
Prepare skilled local experts who could develop project development study including Feasibility Studies	Strengthen national capacities ensuring available specialists trained from national and foreign universities and train highly qualified technicians and engineers in developed countries	Due to the lack of specialists who will implement a project of large-scale HPP project, the national specialists should be educated and trained in developed countries	The Government, Ministry of Education, culture and sports, Ministry of Energy	5-10 years	20000	State budget
Need to have environmental fees and to reduce or stop subsidies for conventional energy	Take measures to enforce law on imposing penalty for polluting air for power plants that use solid fuel	Although the environmentand soil are heavily polluted by power plants, Heat Only Boilers (HOB) no penalty is levied on the polluters. Even though there is a law on penalty for air pollution, the enforcement of this law is not satisfactory.	The Government, Ministry of Environment and Green Development	1-2 years	-	-

To increase the low tariff for electricity paid by consumers and industries. Develop capital market in Mongolia to raise capital for large scale projects such as HPP	Gradually increase the tariffs of electricity and heating every year, to enable the suppliers cover their costs	Low electricity tariff is a main obstacle against implementing a project of large-scale HPP	Energy Regulatory Committee	1-3 years	No need	
Policy, legal and regulatory						
Long term political commitment.	Design and adopt long-term policy documents to guide energy sector development up to 2030	There are two major documents: central energy system and national program of renewable energy. However these two have very weak consistency and no strong background for the development. Based on Updating Master Plan of energy sector, ADB-funded project, these documents shall be designed and adopted by the Parliament and the Government.	Ministry of Energy is in charge with relevant ministries and agencies.	1 year	100.0	State budget

Clear government policies with no political risks for investors.	During the election period, issue a decree of the Parliament to develop the Government manifesto by synchronizing it with long-term objectives of developing the energy sector until 2030	The Government is obliged to implement long-term policies that were adopted by the Government and the Parliament. Any large-scale HPP project has not been implemented for last 20 years. Egiin River HPP, which has been the sensation ever since 1993, has not been constructed. This implies that there is no long-term, consolidated policy on hand and reveals negative impacts of not implementing the policy written on the paper.	The Government and Ministry of Energy	1 year	No need	-
Newly formulate National renewable energy program.	The national program of renewable energy should be rephrased and make it the inseparable part of the policy of developing the energy sector until 2030	Need to renew the national program of renewable energy 8 years have elapsed since the document was approved. Moreover,it should be coherent with long-term policy of energy sector	The Government and Ministry of Energy	1-2 year	10	State budget

Establish a renewable energy fund according to the Renewable energy law which was adopted in 2007	Establish the foundation of renewable energy	It is stated in the Law on Renewable Energy, which was approved by January 2007, the Law on Special Foundation of the Government shall regulate the establishment of the renewable energyfoundation and its expenditure, and performance reporting. The Law on special foundation of the Government includes regulation of legal framework of establishing renewable energy foundation. However, the Ministry of Energy, who is in charge of this matter, is not performing.	Ministry of Energy	1 year	10	State budget
Strong control and commitments to clarify reasons of non-performance and enforce the implementationof laws and programs.	It should be applied that every year, the result of programs to be implemented in the energy sector should be made available to the public, and accountability mechanism should be applied if the planned works are not completed.	The public understands that there is no penalty for public servants who is irresponsible and don't implement law, regulations, programs and plans of the energy sector.	The Government and Ministry of Energy	1 year	100	State budget

Support the liberalization of the energy market and private energy investment.	Implement policy to support private sector investment in energy sector	There is good practice for implementation of 50 MW WP by private sector investment	Ministry of Energy	1 year		
Network						
High level decision makers should be to organizeaknowledge base	Establish and operate a professional but informal council that will solicit high-profile decision makers about policy and strategy to implement large-scale HPP project	High-profile decision makers in the energy sector are elected politically. Thus, most of them are unfamiliar with energy sector. Therefore, having a council that helps those decision makers is crucial.	Ministry of Energy	1 year	10.0	State budget
Clearly definethe responsibilities and roles for different ministries and other stakeholdersregarding selection and implementation of large-scale HPP projects.	The Government should issue a decree to define the duties and responsibilities of stakeholders that implements large-scale HPP project	In order to implement a large-scale HPP project, many stakeholders such as many professional ministries, agencies, private companies, NGOs and international organizations should take part in.	The Government and Ministry of Energy	1-2 year	-	-