



12 MW MAIKHAN HYDROPOWER PROJECT

BRIEF INTRODUCTION

The specialists of Usny Erchim Co., Ltd. Consulting Engineers had been prepared Feasibility Study of the 21 MW Maikhandolgoi Hydropower Plant (HPP) by own financial resource in between 1994 and 1995 to supply electricity for Western Energy System (WES) which located at the Tsengel and Ulaanhus soum of Bayn-Ulgii province of Mongolia.

Between 2000 and 2008 the consumption and market of electric energy was decreased and cost of civil engineering work and equipment was increased, therefore the Feasibility Study of the 12 MW Maikhan HPP had been reformed and prepared in English language in 2008 and introduced to the International organizations for investment.

The water resources of the Maikhan HPP is Artsat river, is initial tributary of Harganat river, which is large tributary of Hovd river which has source of Western part of Tsengelkhairkhan mountain with elevation of 3800-3900 m long term annual average discharge of water catchment area is 1.67 m³/s and it will be diverted to the Harnuur lake and will be used to produce electricity.

The depth of Harnuur lake is 50 m and 130 million m³ water or 10 m thick upper water will be used for the active storage for HPP during winter period and the used water will be reserved during the summer time. This project is accepted to the <<Water>> National Programme of Mongolia which using of glacier and snow water to construct and operate HPP at the Hovd river.

The Makhan HPP will produce electricity by using a head drop of 418 m as differences between Harnuur lake level and Hoton river and 3.5 MW capacity of electricity will be produced by 1 m³/s water and 6 MW by 1.8 m³/s water which has been shown that significantly small amount of water can be used to cover electric energy demand of WES which to compare 78.4 million kWh as average 8950 kW capacity used to electric energy in 2010. The HPP will have a possibility of annual firm energy of 36 million kWh and secondary energy of 21 million kWh and total of 57 million kWh.

Makhan HPP, 12 MW will be constructed to work with collaboration of Durgen HPP, 12 MW in the WES and aim of providing a cheap electric energy (0.04 US\$/kWh) will increase development of social and economic situation and decrease air pollution of three aimags Western Region of Mongolia.

Two pelton turbines and generator equipment of Makhan HPP, will be imported from foreign company and installed, tested and commissioned by manufacturing company and other construction facilities are normal structures to construct, therefore, Mongolian construction organizations can construct it within two years. We are planning to find financial resource and construct HPP.

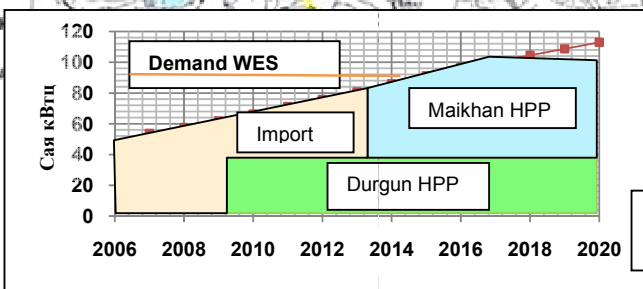
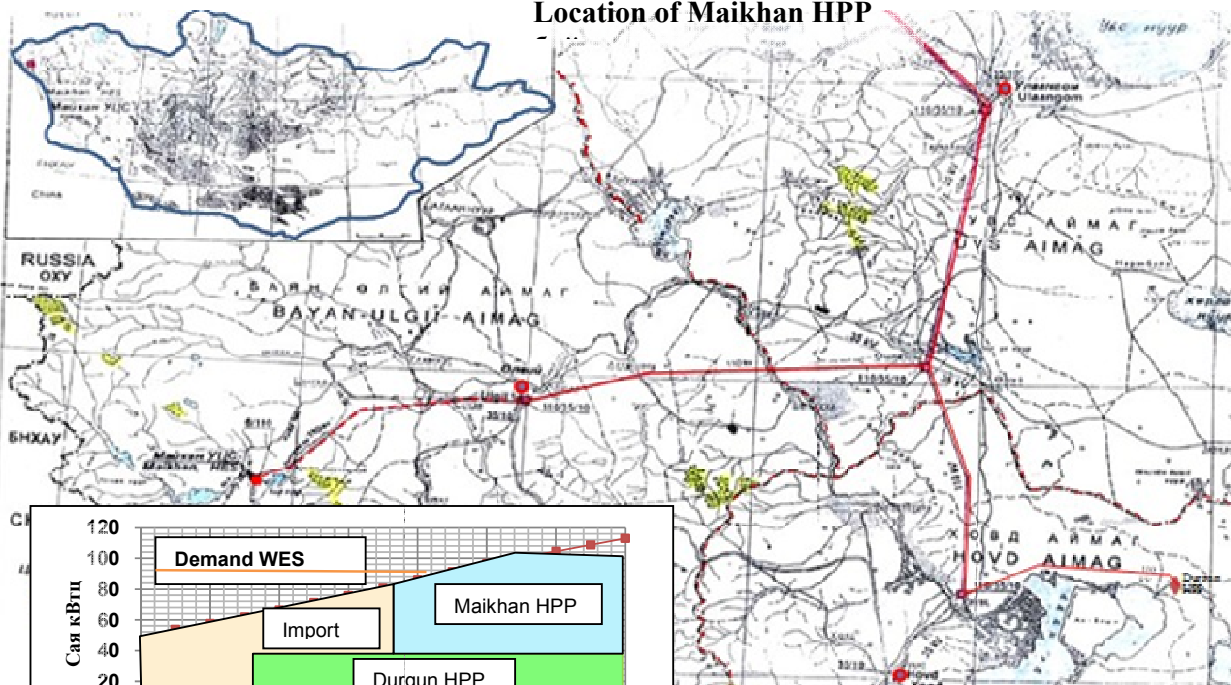
During the construction period about 50 workers will be hired and during the operation period of HPP will work 20-25 specialists and service workers permanently.

9.8 million US\$ will require to invest for construction of Maikhan HPP, 12 MW. We have been invested of 0.6 million US\$ including for investigation and design of Feasibility Study for 3 times, detailed environmental impact assessment, PDD of CDM, land renting right, determination of stability regime connecting of the HPP to the WES and other confirming documents from Ministries. Currently we are preparing of Detailed design document of the HPP.

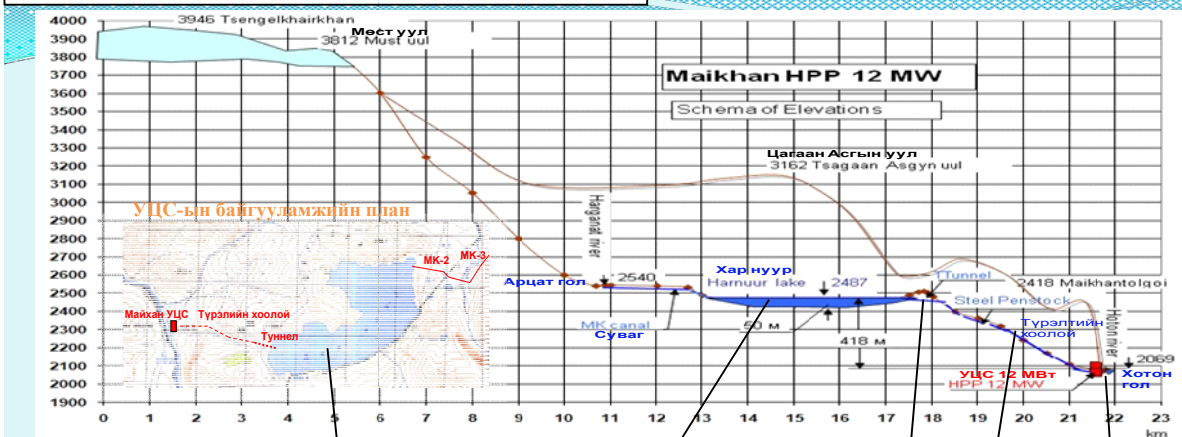
In February 2, 2012 Feasibility Study of Maikhan HPP has been confirmed by the Research and Technological Council of Energy and Fuel of Ministry Mineral Resources and Energy and decided to include the HPP to the Program on Integrated Power Energy System of Mongolia for construction.

Our purpose is to contract a Concession agreement in accordance with Concession Law of Mongolia article 4.1.3. BOO -Build-Own-Operate and will have a right of owner, operate and charge of the obligation and get Special permission for generation and selling of electric energy in accordance with Energy Law of Mongolia.

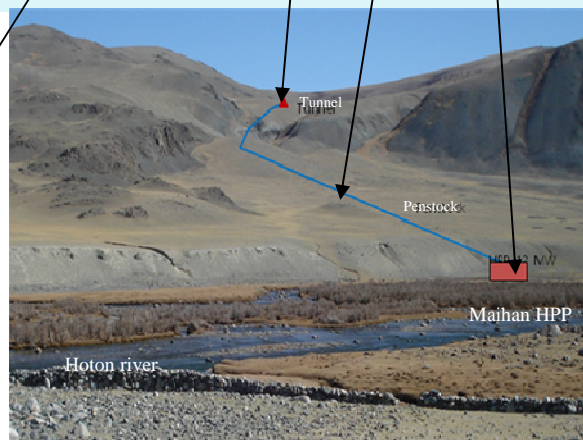
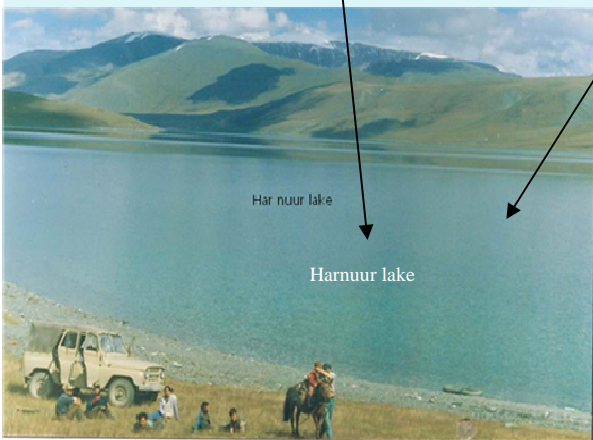
Location of Maikhan HPP



Graph to supply electricity by Durgun and Maikhan HPP and demand of the WES



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Structures and equipment of Maikhan HPP

Main particular features of Maikhan HPP is exploit a head drop of 418 m between Harnuur lake level (2487 m a.s.l.) and Hoton river (2069 m a.s.l.) and to generate an electric energy.

Reservoir of the Maikhan HPP will use natural Harnuur lake which have water area of 13.2 km², maximum depth of 50 m, volume of 360 million m³. 130 million m³ water or 10 m thick upper water of the Harnuur lake will be used for the active storage for HPP.

For the first stage capacity of 12 MW, HPP will use water of Artsat river, is initial tributary of Harganat river, and glaciers water from mountain with elevation of 3700-3800 m and water will be collected by 3 km long canals and diverted by 1.9 km canals to the Harnuur lake and total discharge will be 1.67 m³/s.

Water intake is located below 10 m from water level of Harnuur lake and water will be conveyed via 500 m tunnel and steel penstock with diameter of 1.2 m is constructed 3.5 km long distance to the Powerhouse and connected to 2 pelton turbines in the Powerhouse (24x12x8 m).

2 pelton turbines with diameter of 1.25 m will be connected to 2 generators of 6.3 MW capacity and generate electricity and used water will be discharged via tailrace canal to the Hoton river.

The HPP will have a possibility of annual firm energy of 36 million kWh and secondary energy of 21 million kWh and total of 57 million kWh.

A generator of 6.3 MW capacity will produce electric energy of 6000 V and a transformer will increase 110 kV and 97 km long electric transmission line will be connected to the WES of Ulgii 110/35/10 kV substation.

Electric transmission line of 110 kV from the HPP to Ulgii substation of 97 km distance should be constructed by the Government as similar to the 1560 km air line of WES.

Economic efficiency of Maikhan HPP

In 2010 the WES had been imported from Russia 55.2 million kWh electric energy and Durgen HPP was produced electric energy of 23.2 million kWh and total consumption was 78.4 million kWh and demand of electric energy increased by 5.57% from 2009. If the Durgen HPP produce of 38 million kWh which planned in the project, annual import electric energy of WES from Russia will be 55-65 million kWh and payment will be 3-4 million US\$.

The Maikhan HPP of 12 MW capacity will produce 36-57 million kWh energy annually. If annual average energy production of 50 million kWh sell cost of 0.04 US\$/kWh for WES, annual income will be 2.0 million US\$ and minus of the maintenance and operation cost of 0.435 million US\$ the profit will be 1.565 million US\$. It has possibility to return of 9.8 million US\$ investment in 6-7 years. If we include a possibility of emission reduction from UNFCCC, returning period will 4-5 years.

Economic internal rate return (EIRR) with cost energy production of 0.04 US\$/kWh is 15 %.

Socio-economic benefit of the Maikhan HPP of 12 MW capacity:

- The Maikhan HPP is strategically important and leading, innovation project of Mongolia
- A low cost electric energy from importer, the WES of Mongolia will save annual 1-2 million US\$.
- The WES will have more reliable energy supply source from Russia in North direction, from Durgen HPP in the East direction and from Maikhan HPP in the West direction and will decrease of energy lose which was transported 300 km distance and system efficiency will increase.
- WES will stop to import energy from foreign and will possible provide electric energy demand own resources.
- Any resettlement will not necessary during the construction and operation of Maikhan HPP because big buildings, a dam, a water reservoir will not be built. Using small amount of water is shown as environmental friendly project.
- Maikhan HPP will be adjusted according to the water consumption using automation control and can produce 12-14 MW electricity during the peak period.

- Sustainable economic and social development of urban area and industry and reducing poverty in far rural area with indigenous people (Tuba, Kazakh) Western part of Mongolia which 38.7 % population is classified as poor in 2010.
- Decreasing of migration people from Bayan-Ulgii aimag to Kazakhstan Republic (last 10 years was migrated about 60000 kazakh people).
- Decreasing the loss of electric energy of transmission line from Russian border to Ulgii city and cover peak energy of WES with Maikhan HPP by small amount of water discharge.
- Employment opportunities in construction period from local people about 50 persons and in period operation of 20-26 personal workers.
- Location in the uninhabited rural area the HPP with stall settlement will be sustainable benefits for development tourism in the beautiful lakes and glaciers mountains of the Tavan Bogd National Park.
- Without in territory coal and forest resources of the Bayan-Ulgii aimag will use electric energy for winter heating of the settlement and economy of transport from other aimags of coal and wood and decrease air pollution will be good benefit for population.
- The HPP will annual Reduction of Greenhouse gases of 36000-45000 tCO₂ and decreasing of air pollution of urban area
- This project has similarity as to discovery new mineral resources and to find natural location water and hydro energy resources for the production of low cost hydro electric energy during all the year and reliable supply electric energy and Maikhan HPP will be first example of this kind of project and in future there will be possibility to construct many similar hydro power projects.

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2012-04-23

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