

## **The Status and Challenges of Water infrastructure Development in Mongolia**

### **A. Status of water infrastructure**

#### **1. Brief description of the history of the development of water infrastructure**

Mongolia is a proud country with a rich history and a cultural legacy. Its rich heritage is marked with customary practices on water that would do the modern day environmentalists proud. The Great Rulings (*Ikh Zasag*) of the legendary General Chinggis Khan, formed the common law for tribal Mongolia since the 13<sup>th</sup> century. It imposed a stringent compliance regime for water use. Mongolian tradition forbade the pollution of water. It was believed that *naga* (the snake lord) resided in the pure waters of springs and oases. Hence, milk, dairy products, meat or any kind of waste could never be allowed to touch the water. It was forbidden to wash in running streams. Water is carried a distance from the river where washing can take place so that residual water would be filtered by the soil before it seeps back into the river. Given this tradition where surface water was not polluted by humans or animals, and the resultant good quality of surface water earned the country the tag of 'Blue Mongolia' (Basandorj & Davaa, 2006, p. 22). However, modern day urbanisation, industrialisation and particularly rapid expansion of mining activities have even made the blue waters muddy in the taps of Ulaanbaatar city. The drinking water in the city is reflective of the pressure on water resources and the quality of water throughout Mongolia.

The Mongolian Government (MG) is serious about addressing its water concerns for it realises that water is the lifeline of the country. The MG has undertaken some reforms to help restore the image of Blue Mongolia. It is also serious about meeting its Millennium Development Goal (MDG) targets related to water and sanitation. With the assistance of international agencies the MG had made significant investments to meet the goals related to urban water supply and sanitation.

Mongolia is located in the north of the central Asian plateau between 41° 35' - 52° 06' of northern latitude and 87° 47' - 119° 57' of eastern longitude and about 80 percent of the territory is at an altitude of more than 1,000 m a.s.l. It is a land-locked territory between Russia and China and has a total area of 1 566 500 km<sup>2</sup>. The country has severe climatic conditions with long, cold winters and short, hot summer. The average annual precipitation is 251 mm, ranging from 400 mm in the north to less than 100 mm in the southern Gobi region.

It is the 17<sup>th</sup> largest country in the world, and the least densely populated. In 2006, the population of Mongolia was estimated at 2.585 million. The annual population growth rate is 1.2. Mongolia is sparsely populated with an average density of about 2 inhabitants per square kilometre. Approximately 43 percent of the population (1.1 million) resides in rural areas. This high urban population is further skewed for nearly 38 percent (994,300) of the population lives in Ulaanbaatar city alone.

Mongolia is a landlocked country, divided into the three large watersheds. The country's water resource is mostly dependent on river water of trans-boundary inflow. Considering the low population density, Mongolia has comparatively abundant surface and ground water resources.

It is estimated that about 20 percent of Mongolia's water consumption is provided from surface water resources and the rest from ground water. The different sectoral usage of water are assessed as 18.1 percent for drinking and domestic use, 39.3 percent for industry, 24 percent for animal husbandry, 17.4 percent for irrigation and 1.2 percent for other purposes.

#### **2. Current status of major water infrastructure facilities.**

- **Irrigation development strategy**

The Ministry of Food, Agriculture and Industry (MFAI) has overall responsibility for formulating irrigation development policy, through the Pasture and Crop Irrigation Department, with responsibilities extending into rural water supplies and as well as irrigated crop production.

With Mongolian agricultural traditions being based on livestock, the possibility existed that the paralysis of state farming companies and the decline of formal irrigation infrastructure in recent years might lead to the dissipation of enthusiasm for irrigation.

Irrigation has potentially a small but crucial role to play in meeting Mongolia's food needs, at least in the short to medium term. Irrigation is both essential and economically viable for vegetable production and also economically viable for early potatoes and certain berry crops. No other irrigated crops have been identified as viable within the current market economy.

The expenditure of Government or borrowed funds on irrigation should therefore be limited to horticultural crops in the short term. As the demands of the free market are increasingly felt, irrigation of most other crops is anticipated to decline.

### **Water demand - present use**

According to scientists analysis, in terms of the volume of water resources per person and the volume of water that is used for agriculture and industrial purposes, Mongolia ranks very low (2.5-5 times less) compare to the other countries in the world.

Even though, by the year of 2000, water consumption in Mongolian is about 500 million m<sup>3</sup> and water consumption is decreased by 1.5 times compare with situation in 1990, there are no monitoring system on the volume of water consumption, estimation on total volume of used water by the water sources and water users, lack of databases of water users and researches and studies. As a result of that, the above estimation on the total water consumption of the country has been elaborated based on the data that were published in the "Monthly Bulletin of Statistic of Mongolia" and other research works.

- **Drinking and domestic water supply**

The water use of city dwellers in ger district and of agriculture and industry in Mongolia is ranking lower than world average. By the year of 2004, 30.8 % of Mongolian population was provided from the central water supply system, remaining 69.2% of them were provided from the un-centralized water supply system including 24.8 % of them from water transportation service, 35.7 % of them from water distribution units and wells, 9.1 % of them from natural springs, creeks and rivers. But this estimation is changing in past 3 years due to urbanization and over 10,000 settlement apartments had been established.

As an outcome of the actual water consumption surveys conducted through the country, it has been revealed that the daily water consumption of the settlements in comfortable apartments in the cities and bigger settlements reaches up to 230-350 liters, while the ger / *traditional nomadic house* area residents of the capital city and most of province and sum centers as well as the rural herders daily use is 5-10 liters water in average. /Table1 /For the country, the capital Ulaanbaatar and Darkhan, Erdenet and Choibalsan, the bigger cities or settlements, are considered duly with maximal water consumptions.

Table1 . Total drinking water consumption in Mongolia (2005)

No	The water sources for the drinking water supply	The number of settlements (thousand. people)	Average amount of drinking water consumption (l/day)	Total water consumption (thousand m <sup>3</sup> /year)	Involved areas
1	Central system	781.5	230	65.61	Apartments in central area

2	Water delivery unit	630.4	10	2.30	Ger districts in UB city, central of provinces and sub provinces
3	Water transportation service /track, pack animal/	917.3	9	3.01	Ger districts herders and local people
4	Rivers, creeks, springs and ice, snow water	233.2	5	0.43	Local people and herders
5	Total	2562.4		71.35	

- **Livestock water use**

Pasture livestock breeding is an important economic sector in terms of employment, export revenues, production of GDP. By 2005, livestock breeding made up to 84.9% of agricultural production. In Mongolia, ground water, surface water, snow and glacier water are used for livestock water supply. By 2005, there were 30.4 million head of livestock. But by 2006, the head of livestock had been increased up to 34.9 million and total water consumption of livestock became 80.0 million cubic meters per day.

#### **Industrial water supply**

In 1991-1993, industrial water use is 99.5-115.7 million m<sup>3</sup> annually: 53.2% was used for the mining sector, 32.6% for the manufacture industrial sector, 14.2% for the construction industrial sector. In 1995 108.4 million m<sup>3</sup> water was used for industry and office supply, of which 55% was used for mining industries, 33% is for heating and

energy industries and 12% is for construction industries. From the total volume of water used for industries, about 9.4% of it, which equals to 10.2 million m<sup>3</sup>, was recycled and reused.

By 2006, the annual power plants water use in Ulaanbaatar, Darkhan and Erdenet cities was 27.6 million m<sup>3</sup> and the annual mining industries water use was 93.8 million m<sup>3</sup>.

Other manufacturing industry like cashmere washing, carpet, spin tread, felt, felt boots, peltry, buff exploitation, bread production, construction industry, meat-dairy production, flour production industry's water use were about 18.0 million m<sup>3</sup> and within the country, annual water use were approximately 140.0/157.2 million m<sup>3</sup>. The national annual water use in increased by 29% compare with water volume that used 1995.

#### Total industrial water use (in year2006)

Sectors that use water	Power plant	Mining industry	Exploitation industry	Total annual water use (million m <sup>3</sup> /year)
Total water use (million m <sup>3</sup> /year)	27.6	93.8	18.6/35.8	140.0/157.2

- **Hydro powers and dams**

In 1994, the *Institute of Water Policy* of Mongolia estimated gross theoretical potential energy is 56,200 MW or 6400 MW capacity for river run-off that is more than 1 m<sup>3</sup>/s. The technical possibility to use is 20 to 60% of this estimation.

Six hydro power plants were established with 3428 kW capacity, but they can only be used for warm season and thus their utilization status is very low. By the year 2005, above HPPs produced about 3.9 million kW energy and it covers about 0.1% of the total energy. About 80 million m<sup>3</sup> water is used for producing the total energy amount.

- **Green area structure water use**

A certain volume of water is used for city's green area, but it is difficult to estimate the volume of water that is used for it. Six district service companies are irrigating the green area in Ulaanbaatar. Green area irrigation is done from April 1 to August 1, while one last irrigation activity is done before winter ('charge irrigation'), usually in October. According to the intangible information, annually 0.15 million m<sup>3</sup> water is used for the green area irrigation of Ulaanbatar, Darkhan, Erdenet and other central towns. There is no irrigation and watering around the main road and the district's green area.

Under the "Green wall" national program / by 2005-2006/, 500,000 trees were planted in about 1000 ha area and about 0.12 million m<sup>3</sup> water was used to water them.

Overall water use

The table below shows the total water use for all sectors (above mentioned) in national wide. But this estimation is based on a survey and the amounts are calculated averagely. During the project main phase, we will estimate the volume of water use by each sector by doing a specific study on national water use.

Table2 Total water use of Mongolia (by 2005)

No	Sectors that use water	Total water use /million, m <sup>3</sup> /	
1.	Drinking water use	71.35	
2.	Agricultural	Livestock	71.00
		Crop irrigation	52.28
3.	Industrial	Exploitation industry	35.8
		Extracting mining industry	93.8
		Energy production, Power plants	27.6
		Hydro Power Plant	80.0
4.	Green area	0.27	
Total:		432.1	

### 3. Overall management of WI

Water sector legislation: Although the Water law, Water Use Fees Law and some 20 other legislative regulations have been passed, in fact most of them are not being strictly enforced and therefore they need further updating.

Institutional responsibilities related to water have characteristically been very fluid in Mongolia. Annexure I lists a brief history of the changing responsibilities and the current position. In recent times, till 1987, the Ministry of Water was implementing water sector policy in its entirety. However, since 1990s, various line ministries have been given responsibilities with regard to water. Water conservation is the responsibility of the Water section under the Agency for Water and Forest Resource, within the Ministry Environment and Tourism, water use and licensing are the responsibility of the Ministry of Food, Agriculture and Ligth Industry, Ministry of Road, Transfortation, Construction and Urban Development, and others, depending on the sector – agriculture, pasture land water supply, urban drinking water or industry and mining. The Ministry of Health (MoH) is responsible for water quality, ecological and environmental sanitation and hygiene. Water related research and monitoring functions are dealt by the Mongolian Academy

of Science, and the National Institute of Meteorology and Hydrology, Agency for Meteorology, Hydrology and the Environment Monitoring.

#### **4. Most important 3 constraints in the current efforts on water infrastructure development**

In recent years, water consumption has been increasing in Mongolia, due to a rise in the urban population and socio economic development. It is suggested that the climate change is also leading to water scarcity. Economic activities have resulted in increased pollution levels, and decrease in ground and surface water resources. This is expected to rise in future and has been a major concern for the Ministry of Environment and Tourism (MET). A recent water census conducted by MET revealed that between 1997 and 2002 Mongolia's water resources have decreased rapidly. The surface water census examined 5,565 rivers and streams, 374 spas, 4193 ponds. Of these nearly 15 percent – as many as 683 rivers, 1484 ponds and springs, and 760 lakes have dried up. Further, the water quality in as many as 29 rivers had degraded due to mining and industrial activities.

Water sector not so developed within the Mongolia, most important issues improvement legal and intuitional capacity, planning and management water sources and development water economy and pricing.

#### **5. Need to improvement WI in Mongolia**

Water is development. Most of the water supply infrastructure of Mongolia was constructed during the 1970's and 80's, at a time when the economics of operation, maintenance and expansion of public utilities was of little concern. Many water systems that were constructed to support agriculture and other small-scale economic activities are in disrepair and there is no feasible way to rebuild and operate these systems without subsidies.

The South and Southeastern Gobi Regions are also a focus of serious interest in the development of mining prospects that could provide much needed economic boost for the region and the country if they are developed correctly.

These projects will need large amounts of water, and there is concern that increasing extraction rates from the non-renewable underground sources may cause irreversible environmental damage.

**Project Description.** The objective of the Herlen-Gobi Project is to divert water from the Herlen River and supply it to the Southeastern Gobi regions by means of a pipeline network. This would require that a dam and intake structure be constructed at Togos Ovo, which is approximately 125 km southeast of Ulaanbaatar. Then pipelines, pump stations, and supporting facilities would be constructed to bring water south.

**Basic Description of the Water Supply System.** There are two main parts of the system; the Dam, Reservoir and Water Intake Structure for water collection and storage, and the Pipeline, Pump Station, and Water Treatment system for transmission and distribution of water to customers.

The objective of the “Orhon-Gobi” Project is to divert water from the Orhon River and supply it to the South Gobi regions through Bulgan, Tuv and Dundgovi by means of a pipeline network. This would require that a dam and intake structure be constructed, at location approximately 300 km West of Ulaanbaatar and 30 km Southwest of Bulgan city. Then pipelines, pump stations, and supporting facilities would be constructed to bring water as far South as Tavan Tolgoi. The pipelines would supply water to users along the way and by three branches to Mandalgobi, Dalanzadgad, and Oyu Tolgoi.

The dam would also be constructed with a hydro-power generating station of 30-40mW capacity that would serve the Northern regions of Mongolia.

The Herlen–Govi and Orhon-Gobi Projects was developed NGO side and will address multiple needs for Mongolia in a way that is sustainable in a market economy and sensitive to the environment.

## **B. Challenging issues for eco efficient WI**

National water program was adopted 1999 by the Government. The purpose of this program is to render support in socio-economic sustainable development by providing the customers with good quality sufficient water, revitalizing the water resources, and preventing of water resources from deterioration and pollution.

This program has 3 phases: Phase 1 up to 2000, Phase 2 from 2001 to 2005 and Phase 3: 2006 – 2010.

In 2006 government of Mongolia adapted water program named “Renovation –WaterXXI”, which more focusing building of big water reservoirs and dams for multipurpose water sources in Mongolia.

In the Mongolia, surface water is believed to be among those to be adversely affected by climate change. River basins are critical to the economic development and environmental protection and therefore key to the pursuit of sustainable development. Two third of the country’s total land area lies within watersheds.

In Mongolia an air temperature has increased by 2.1<sup>0</sup>C between 1940 and 2007 with clear warming in winter of 3.6<sup>0</sup>C.

Initial results of impact and vulnerability assessment for water resources in the country suggest that changes in temperature and precipitation will result in a –29.3% to 15.3% change in runoff depending on the GCM used (Batimaa 2006). According the results, climate change has become *a new sector of water consumption* because climate change is projected to decrease the water resources of a country. This is particularly true, if human activities are responsible for climate change. There is widespread evidence that this is the case (IPCC, 2007).

**Table 1. Projected river runoff changes**

	A2	B2

	2020	2050	2080	2020	2050	2080
Internal Drainage Basin						
HadCM3	-1.4	9.1	-8.6	7.2	9.6	-0.3
ECHAM4	15.3	10.9	10.1	16.2	6.2	-2.8
CSIRO-Mk2b	-1.3	-0.6	-5.1	0.8	-1.7	-7.1
Arctic Ocean Basin						
HadCM3	13.9	-5.4	12.6	-0.5	-2.6	-19.2
ECHAM4	1.4	-7.3	26.9	1.4	-3.2	-17.5
CSIRO-Mk2b	-6.4	13.2	24.7	-9.1	14.6	-17.9
Pacific Ocean Basin						
HadCM3	23.5	20.9	27.5	-19.1	23.6	-29.1
ECHAM4	-9.8	18.3	24.7	-4.2	18.8	-26.1
CSIRO-Mk2b	17.5	22.9	35.6	-20.5	24.2	-29.3

Climate change and related water stress are having, and will in future continue to have, impacts on ecosystem and economy in Mongolia. The agricultural land, wetland and forests is under a variety of pressure, much of it anthropogenic, which is magnified by climate change stress. The impacts of water scarcity are likely to include the degradation of natural environments, ecosystem, changes in soil quality and structure and desertification.

#### C. Priority of regional cooperation for development of eco efficient WI

The National Water Committee (NWC) was established in the year 2000 with a mandate to coordinate and monitor the implementation of the National Water Program (NWP) of the Government. This Program includes issues related to water resource management, water quality, water uses, conservation and pollution of water. The NWP drew up a three phase implementation program (Phase I till year 2000, Phase II till year 2005, and Phase III till year

2010). The action plan for the second phase was developed with the support of UN-ESCAP and adopted by the MG in October 2002. Since then UNESCO and UN-ESCAP has been assisting the Mongolian government in developing policies, such as on water pricing.

Implementation ongoing projects;

1. Integrated Water Resources Management in Central Asia: Model region Mongolia (MoMo) in Kharaa River basin funded by Germany since 2006
2. Strengthening Integrated Water Resources Management in Mongolia funded by Dutch Government since June 2008
3. Establishment National Geo-Information Centre for Natural Resources Management Project funded by Dutch Government since June 2005 /GIS based water data base/

Mongolia as part of NEA, in 1998 was adopted "Environmental program in North East Asia /NEA/ in Ulaanbaatar. Within the implementation this regional program Mongolia reporting every year to Senior Official Meeting for NEA-n countries.

D. Recommendations: Eco efficient in water infrastructure will play a central role in terms defining the overall objectives of less develop country as Mongolia and rich mineral resources, what less developed water infrastructure.

- improve organizational, managerial and legislative issues in water sector of Mongolia
- strengthen strategic planning and management of water resources at the national and local levels
- develop and improve conditions of integrated watershed management at the national and sub-regional levels
- Manage water sources and construct big dams and multipurpose reservoirs
- promote water education and provide public participation

#### References:

1. Asian Development Bank, 1997, Provincial Towns Basic Urban Services Project,
2. Basandorj, D. & G. Davaa, 2006, *Mongolian National Case Study – Reference to Tuul River Basin*, National Committee for IHP, Mongolia, Ulaanbaatar.
3. Batsukh, N., D. Dorjsuren & G. Batsaikhan, 2008, *Water Resources, Use and Conservation in Mongolia: First National Report*, National Water Committee, Ministry of Nature and Environment, Government of the Kingdom of the Netherlands, Ulaanbaatar.
4. Mongolian Government, 2001, *Medium Term Development Strategy for Regions, 2001-10*, Ulaanbaatar.