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Mongolian – German ECOCITY

1. Present Situation

Situation: Plot situated in 9th khoroo of Khan-Uul district, on the southern bank of Tuul river, on West from Songolon the road, North from the new-planned Buyant-Ukhaa district.

Today there are no buildings or ger areas on this plot. The distinctive feature of the plot is its relief that is difficult to develop. There are many deep-sloped areas, erosion (ravines) on the territory of the plot.

Until today the original sight of the territory has not changed yet, but each year new families are expanding on these lands. Simultaneously the quantity of waste and other harmful influence of human activity are increasing.



Figure 1: View of Plot in Khan-Uul District, Nisekh.

2. Plot Data

Total Area is 72.5 ha. About 24% of it are lands difficult to develop (high erosion, slopes), and other parts separated between them with ravines. Generally, the plot has height difference from 1260 to 1315m.

According to the geological survey, there are 3 types of soil on this area. These are: proluvial loam, aluviy-deluviy gravel with clay and rock.

Soil water situates deeper than 6.5m. Though in the given territory there are no rivers or streams, there is a washing away of the surface soil by seasonal streams of rain water.

In winter time the depth of frost is 3.8m on gravel soil. The plot situates in 7-ball zone by Richter scale.



Figure 2: Planning area for Mongolian-German ECOCITY

3. Planning Data

Energy- and cost –efficient new construction in Khan-Uul District, Nisekh

Total area reserved for GTZ:	72, 5 ha
Area planned up to now:	57 ha
Housing units:	2200
Estimated inhabitants:	10.000
Density: 175 persons/ha	
Green area per person:	
Public	35 m ²
Private	20 m ²
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Total	55 m ²

4. Urban planning concept

Parameters considered with regard to urban planning:

- Urban planning adjusted to existing sloppy topography
- ECOCITY integrated into the surrounding environment
- City of short ways
- Attractive neighborhood with mixed functions, socio-economically mixed inhabitants and private & social infrastructure
- Neighborhoods clustered into three centers (construction phases) creating lively atmosphere
- Hierarchy of roads
- Roads within neighborhoods with speed breakers
- South orientation of buildings
- A “green” city
- Introduction of ecologically friendly methods for erosion ditches changing them into green areas and including green belt of the district, protecting the area from floods.
- Row houses and apartment buildings edging the streets all designed to be energy- and cost-efficient and highly-ecological.
- Ground floor of apartment buildings will dispose of shops, service centers, coffee shops, restaurants, etc.
- There will be commercial centers, schools, polyclinique, pharmacies, kindergartens, playgrounds for children, administrative facilities, police stations, etc.
- Religious worshipping place (OVOO) will be maintained
- Street lighting and street furniture will be available
- Dwellers will be owners & lessees
- Garages (temperature of 5 Degree Celsius in winter) for car parking will be available
- Decentralized heating and waste water system.



Figure 3: The urban planning concept combines energy efficiency and beautiful neighborhood-design.

Because of the sloppy area and the big quantity of erosion ditches roughly 2200 households can be accommodated in the area. This amounts to roughly 10.000 persons.

Housing units (row houses/2 stories) vary between 124.28 m² brut (96.78 m² net) and 155.04 m² brut (110.97 m² net).

There are 8 different row housing types, however, on the basis of a modular system (basically two types).

Five different apartment buildings have been designed up to now:

The apartment sizes vary between 52.62 m² net and 123.10 m² net (“maisonette” /two stories).

The apartment buildings have up to six stories. They will also be heated by solar energy and dispose of grey- and black water recycling.

Although the area is rather windy these days, the microclimate will change considerably once construction has started and plants are growing. Greeneries strongly influence on the microclimate producing more humidity, storing rain water channeling it back to the source and reducing strong winds and desertification.

Surface drainage and erosion control will be dealt with by gabions, natural stone walls and natural stone pavement.

The small technique rooms (4.66 m² brut, 2.87 m² net) in each backyard of the individual row houses will dispose of water- and electrical meters.

However, water consumption will have to be calculated differently, as the amount of consumed drinking water does not comply with the amount of waste water.

5. Basic infrastructure/utilities

a) Heating energy

With 2800 hours of sunshine in Mongolia per annum (in comparison: Germany has 900 hours of sunshine per annum), heating energy will be produced by solar collectors.

The ECOCITY will be a low energy township with a heat energy consumption of maximum 50 kwh/m²/a.

For heating energy a decentralized concept will be applied based on solar energy with solar collectors to provide warm water and heating through a floor heating system.



Figure 4: The planning considers the optimal use of solar power (even in wintertime)

The technology will be imported from Germany with the objective of producing the collectors and the water puffers in Mongolia after due course.

Each housing unit of the row houses will dispose of a small technique room (4.66 m² brut, 2.87 m² net) in the backyard enabling the individual house owners to regulate their heating temperature according to their individual demand for the different rooms. In the individual technique rooms there is a buffer storage (2000 l) filled with glycol and water (closed system) for the heating system as well as a water tank (50 l) for hot water to be heated by a tube coming from the buffer storage.

In order to be on the safe side in case of peak cold winter days without sunshine, an electrical heating bar is available in the buffer storage switching on automatically if need arises. This “security” of additional electrical heating might be abandoned if the pilot shows that additional electrical heating is not required at all.

Moreover, underneath the technique rooms, there are three pipes (potable water, grey water, black water) with inspection manholes.

The pipe coming from the house contains black water, the pipe going to the house contains grey water.

b) Waste water management

As in 2012 the demand for drinking water will exceed the drinking water reserves available in Ulaanbaatar (JICA Master Plan for Ulaanbaatar), waste water management will be implemented through a system of grey- and black water recycling in order to economize on the consumption of precious drinking water.

The purification system is based on membrane technology- the most modern technology for waste water recycling available- providing the highest possible purification degree.

Up to 45% of the water can be hence saved through recycling it and using it for flushing toilets, washing machines, the greeneries, gardens and the erosion ditches as green corridors.

The technology will be imported from Germany, staff from USUG will be trained in order to operate, handle repair and maintenance of the system.

The membranes have to be cleaned every one to two years and exchanged every four to six years.

At the end of two rows of houses (80 housing units), there is a bigger technique house (95.78 m² brut), where the black water is collected and purified/transformed into grey water and pumped back to the housing units.

An electrical meter in each big technique house will measure the amount of electricity consumed.

This amount will have to be borne by the community connected waste water wise to the technique house.

c) Water supply

Water supply for the first construction phase with roughly 80 housing units will be provided by USUG, thereafter wells will have to be dug on the plot, water quality will be analyzed and respective piping systems installed.

In the individual technique rooms of the row houses a water tank (50 l) for hot water to be heated by a tube coming from the buffer storage will be installed.

d) Electricity

Electricity will be provided through the central grid.

6. Construction method

It is planned to apply modern construction technologies under strict supervision of the Mongolian Authorities and GTZ in order to guarantee high quality construction.

GTZ will work together closely with selected contractors providing training-on-the-job (“hands-on approach”) to the construction laborers, foremen and their companies to improve their skills and create technical & managerial capacities within Mongolian contractors to continue with the application of the new technologies.

Moreover, Mongolian engineers and architects will be trained in supervision work to make the approach sustainable.

The technologies to be applied are listed below:

- Girder slab system
- FINNJOIST
- Thermal insulation composite system
- Solar heating system with floor heating
- Grey- and black water recycling system on the basis of membrane technology
- Gabions, natural stone walls & natural stone pavement.

The walls will be built with gas concrete.

They will dispose of thermal insulation (Styrofoam) of 24 cm with primer, mesh and mineral plaster on top.

The foundations & garages are also thermally insulated from the outside with XPS (25 cm).

The roof will be insulated from inside with Styrofoam or rock wool (40 cm).

7. Construction phases

The first construction phase will consist of 80 housing units. The following construction phases can go in parallel and can be speeded up, as the learning curve as well as prefabrication of building material parts will be well advanced.

In roughly five years, the total area of 72, 5 ha can be completed according to the urban planning presented.

8. Costs

The development of the whole area requires an investment of roughly USD 500 million.

Phase 1 with 36 row houses, 42 apartments and 10 shops would amount to roughly USD 12 million.

Phase 2 with 266 row houses, 295 apartments and 105 shops would amount to roughly USD 70 million.

9. Implementation

Implementation will be done in phases to maintain construction quality and allow possible adjustments where ever required.

It is intended to find investors to take over the different neighborhoods and develop them according to the plans elaborated by GTZ and under GTZ supervision.

A pilot to be implemented immediately, however, will encourage investors to engage. The pilot will allow testing the technologies during the next winter season (08/09), draw conclusions and make adjustments if required.

In order to guarantee adequate operation, maintenance & repair of the whole compound, a managing organization (or several managing companies) has to be found or the investor(s) takes over this task himself.

Staff has to be employed and trained to maintain the walkways, the greeneries, garages, apartments, organize garbage collection & technicians in case of technical problems, etc.

Rules & regulations will have to be developed and implemented in order to guarantee a clean, safe, neat & green neighborhood & environment.

10. Tariff system

The whole tariff system for water, waste water & electricity will have to be developed on a new base of parameters.

It should also be considered, whether the tariffs are only formulated on the basis of consumption or whether a promotion scheme to encourage dwellers to go for ecological devices should be introduced.

11. Target-groups

The target groups for the Mongolian-German ECOCITY for dwelling are Mongolian middle and lower income groups in need of housing.

As a recent study of JICA has shown, there is an existing housing shortage of 200.000 housing/apartment units in Ulaanbaatar.

The capacity of the contractors however reaches a maximum capacity of 6-7000 apartments per year with a rather bad quality and high prices.

The average m2 price for construction amounts to USD 1000 these days and prices are rising further.

By 2030 Ulaanbaatar is estimated to accommodate more than 2 million inhabitants.

The Mongolian 40.000 housing unit programs is planning for new satellite Cities and upgrading of the Ger areas to produce more humane & decent living space. 36.000 housing units are intended to be constructed in Ulaanbaatar up to 2010.

The Mongolian-German ECOCITY is to be seen in this context:

A sustainable and replicable model based on renewable energies, energy-efficiency and modern sanitation technologies to protect the environment and the existing natural resources creating a livelier city with better living conditions in a healthy and attractive environment.

12. Public Private Partnership

The Mongolian-German ECOCITY follows the principles of Public Private Partnership, i.e. the governmental and municipal authorities join hands with the private sector to implement a new model of urban planning and implementation in order to reach higher quality, new standards and a new style of fruitful cooperation using the strengths of both the public and the private sector for successful cooperation.

This model – if run successfully - could be promising for further township developments in the near future in Ulaanbaatar and other urban centers of Mongolia.

13. Philosophy

The ECOCITY with the envisaged introduction of new technologies and management structures follows the slogan:

“Seeing is believing”.

