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Conference Version

MONGOLIA

Enhancing Policies and Practices for *Ger* Area Development in Ulaanbaatar

Takuya Kamata
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Brett Sedgewick

THE WORLD BANK

Cities Alliance
Cities Without Slums

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The manuscript for this conference edition disseminates the findings of work in progress to encourage the exchange of ideas about development issues. It is not for citation.

Cover photo by Michael Foley, former World Bank staff and now a consultant and a freelance photographer.

Forewords

Ulaanbaatar city strives to become a well-developed capital city with vibrant economy, the city with advanced land policy, management, improved housing conditions, the city with healthy and safe environment, developed social life, legal framework, the city with responsive and efficient public administration, which enables broad participation of community, private sector in civic services; and an attractive tourist destination in Asia.

As of today more than 60 percent of UB population still lives in peri-urban informal settlements, *ger* areas, which lack modern infrastructure services, such as piped water, sanitation, proper roads, public transportation etc. And coverage of social infrastructure (health clinics, schools, kindergartens) also needs to be improved. Unplanned growth of *ger* areas and unprecedented pace of urbanization brings many challenges, such as unemployment, traffic congestion, air pollution and negative environmental impacts.

The recently updated UB City Master Plan suggested the concept of compact city, which envisions densely populated downtown area with well developed public transportation system and improved accessibility of *ger* areas. Also the UB Master Plan revealed enormous financing needs to realize envisioned plans and ideas.

I have pleasure to endorse the findings of the report "Mongolia – Enhancing Policies and Practices for *Ger* Area Development in Ulaanbaatar", which has been developed by the World Bank team based on extensive discussions and dialogue with the UB Governor's office and our agencies and stakeholders. I truly believe that options for *ger* area development in UB outlined in the report will serve as guiding directions for our work with the *ger* area residents, local communities, external partners, donors and other stakeholders.

Sincerely,

BAT Ch.
General Manager
Governor's Office
Capital City of Ulaanbaatar

The rapid expansion of Ulaanbaatar, the capital city of Mongolia, is one of the country's most critical development issues. Its population has increased by some 70 percent in the last twenty years and now accounts 40 percent of the total population. The total administrative area of the city is now 30 times larger than the original built-up areas. Most of the expansion took place in the *ger* areas: low-income areas where basic infrastructure services are poor or non-existent.

The government has developed policy directions—in its recent national and local development strategies and master plans—to better manage expansion of the *ger* areas. However, its practices have been mixed. The *ger* areas continue to expand today, improvements on urban services are slow, and the local government's capacity to respond to these challenges is still limited.

This report provides an analytical framework to assess the viability of various future development scenarios of the city. It offers costs and benefit analyses of the choices and tradeoffs relating to housing and urban services. Policy makers and citizens of the city will be able to see the implications of the policy choices they make today. The report will serve as a vital instrument for broad public policy consultations, which are an integral part of the urban development policy dialogue between Mongolia and the World Bank.

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This report was developed with the collaboration and assistance of the Government of Mongolia, and the Municipality of Ulaanbaatar, and the many representatives from the utility companies that operate in UB. The unique on-the-ground details contained in the report would not have been possible were it not for the many *khoroo*, *kheseg* and community leaders, as well as residents, who volunteered their time to meet repeatedly with the task team. These governors agreed early on to help and continued to provide support throughout the process. The project management unit of the IDA-funded Second Ulaanbaatar Urban Service Improvement Project provided valuable support in facilitating these meetings and providing sectoral data. Members of the donor and NGO community, from the ADB to local nonprofits, were willing to inform and guide the process

Existing reports provided key data and background information for the report. Of key interest were the various reports surrounding the Study On City Master Plan and Urban Development Program of Ulaanbaatar City (2008); the draft *Air Quality and Health Impact Baseline Study*; *Heating in Poor, Peri-urban Ger Areas of Ulaanbaatar* (2009); *Consolidating the Gains, Managing Booms and Busts, and Moving to Better Service Delivery* (2009); *Rethinking the Delivery of Infrastructure Services in*

Mongolia (2007); *Capacity Building in Energy Planning* (2002); *Southern Mongolia Infrastructure Strategy* (2009); *A Review of the Mongolian Primary Mortgage Market* (2007); *Mongolia Urban Development And Housing Sector Strategy* (2005); *Hygiene and Sanitation Situation Report For Ger Areas, Mongolia* (2006); *Mongolia: Exploring Options for Management Contracting-out in Water Supply and Sanitation Services for Ger areas in Ulaanbaatar* (2008); *Assessment of the Child Money Program and Properties of Its Targeting Methodology* (2006).

Currency, Acronyms and Definitions

CURRENCY EQUIVALENTS
(Exchange Rate Effective January 2009)

Currency Unit	=	Tugrik (Tg or MNT)
US$1.0	=	Tg1400
Tg1	=	US$0.000714

ACRONYMS AND DEFINITIONS

ADB	Asian Development Bank
Aimag	Province
ALAGaC	Administration of Land Affairs, Geodesy and Cartography
CHP	Combined heat and power
CMP	Child Money Program
CSC	Customer Service Center
Düüreg	District-level administrative division, UB
ERA	Energy Regulatory Authority
ESP	Energy Sector Project
GDP	Gross Domestic Product
Ger	Portable felt dwelling structure, also known as a *yurt*
***Ger* area**	Ulaanbaatar exurbs, containing both *gers* and detached houses
GoM	Government of Mongolia
Hashaa	Land plot
HH	Household
HIES	Household Socioeconomic Survey
HOB	Heat Only Boiler
IMF	International Monetary Fund
ITS	indoor transformer stations

Kheseg	Microdistrict-level administrative division, UB
Khoroo	Subdistrict-level administrative division, UB
MDG	Millennium Development Goals
MoH	Ministry of Health
MUB	Municipality of Ulaanbaatar
NGO	Non-governmental organization
NSO	National Statistics Office
O&M	Operation & Maintenance
OTS	outdoor transformer stations
PHC	Primary Health Care
PIAFF	Public-Private Infrastructure Advisory Facility
Sum	County-level administrative division, outside UB
Tg	*Tugrik*, currency of Mongolia
Tuk	Waste collection/transportation company
UB	Ulaanbaatar, Mongolia
UBEDN	Ulaanbaatar Electricity Distribution Network Company
USIP2	Second Ulaanbaatar Services Improvement Project
USUG	Water Supply and Sewage Authority Co. of Ulaanbaatar City
VAT	Value Added Tax
WHO	World Health Organization
WWTP	Wastewater treatment plant
XLPE	Rubber insulated aerial conductors
State Great *Hural*	Parliament of Mongolia

Summary

The sustainable development of *ger* areas in Ulaanbaatar (UB), the capital city of Mongolia, is one of the critical development issues facing the country. The transition to a market economy and a series of severe winters (called *zud*) have resulted in the large-scale migration of low-income families into the *ger* areas of UB. The city represents 39 percent of the nation's population and generates more than 60 percent of Mongolia's gross domestic product (GDP).

This migration pattern has led to an unprecedented expansion of the *ger* areas. The traditional built-up areas of the city center comprise some 130 km^2 but the total administrative area of UB, including *ger* areas, is now estimated at around 4,700 km^2. The population of the *ger* areas is now estimated to make up about 60 percent of the total population of UB. The city's population has grown from some 600,000 in 1989 to more than 1 million in 2007 and is expected to reach 1.3 million in 2015.

Basic services are very limited or even non-existent in *ger* areas. Nearly 85 percent of *ger* residents use wood or coal-burning stoves for heating, in contrast to apartment buildings, which are connected to the central heating system. *Ger* residents must purchase water at public water kiosks, while apartment residents enjoy reliable supplies of piped-in drinking and hot water. The low density of *ger* areas, coupled with the extremely cold climate, makes the provision of these basic public services very costly. Poor urban services have also led to environment degradation, including the pollution of air and soil, which poses such health risks as respiratory diseases and hepatitis.

Clearer policy directions, such as the "Compact City" concept of the UB Master Plan 2030, have emerged in recent years to control spatial expansion and promote high-density development for the *ger* areas. However, the government's practices have been inconsistent. These practices are, in part, a result of limited awareness and understanding by the general public, as well as by policy makers, of the public costs of their actions on land management. Also, many supporting mechanisms, including land valuation and taxation, have not yet been properly developed.

This economic sector work by the World Bank aims to help policy makers and citizens of UB better understand the consequences of their practices. The report provides information for use in public consultation with stakeholders, which constitutes the core of the policy dialogue exercise.

The intent of this report is to clarify the costs and benefits of different development paths. These paths include (i) conversion of *ger* areas into apartment building complexes; (ii) gradual improvement of urban services for existing *ger* areas; and (iii) further expansion of *ger* areas at the fringe of the city.

Three *ger* areas were chosen for review as proxies of these paths. A *khoroo* (subdistrict) in Naran *Ger* represents the first path (the "City Center" *ger*); another *khoroo* in the Bayankhoshuu *Ger* represents the second (the "Mid-tier" *ger*); and a third *khoroo* in Sharhad *Ger* (the "Fringe" *ger*) is the proxy for the last. Cost analyses—as well as some benefit analyses where possible and appropriate—were made for housing and land, water supply, municipal roads and public transport, heating, electricity, solid waste management, and other social services such as health and education.

Housing and Land: Private ownership of land and houses is generally high. In older and established *ger* areas, nearly 99 percent of families own their own dwellings and land. The ownership rate is lower (around 80 percent) in newer fringe *ger* areas where many new immigrants rent their land or houses. Private ownership of land is around 60 percent for apartments and 92 percent for single-family housing.

The size of *hashaas* (land plots) is fairly uniform at around 470 m^2–590 m^2 in all *ger* areas because residents occupy as much land as laws allow. The average house is slightly larger in the City Center *Ger* at 77 m^2, compared to 55 m^2 in the Mid-tier and Fringe *gers*. Apartments on average are 37 m^2, smaller than houses. In the City Center (Naran) and Fringe (Sharhad) *Ger* areas, almost one-half of households still live in *gers*, while in the Mid-tier (Bayankhoshuu) *ger area*, 70 percent live in detached houses.

Apartments are the most valuable assets for households in the city, with market prices on average Tg43.4 million–Tg60.2 million ($31,000–$43,000). Houses in central *ger* areas are significantly more valuable, at an average of Tg29.4 million ($21,000) than houses in the Mid-tier and Fringe *Gers*, which cost an average of around Tg18.9 million ($13,500) and Tg17.5 million ($12,500), respectively. The value of *gers* is much lower than either apartments or houses: Tg1,820,000 ($1,300) in central areas, and Tg980,000 ($700) in fringe *ger* areas.

The mortgage market is still emerging in Mongolia, with only 10 percent of house owners using mortgage loans. Fewer than 20 percent of apartment residents use mortgages. A majority of residents in the three *ger* areas will not be able to afford to live in any of the apartment buildings that the government proposes to build. Given this affordability issue, alternatives such as low-cost housing and/or low-income public rental housing should further be examined.

Residents in established *ger* areas are not only more likely to own their homes than residents of apartments, they are somewhat more likely to be satisfied with their homes. In a survey, almost 90 percent of residents in the Mid-tier *Ger* said they are either "very satisfied" or "moderately satisfied" with their living condition, compared to 70 percent of City Center *Ger* residents and 80 percent of apartment residents. However, half of residents in the Fringe *Ger* said they are "very dissatisfied" with their housing, compared to only 6 percent or 7 percent of residents in other *ger* areas. The likely reason is that Fringe *Ger* residents are new to UB, and urban services there are the poorest among all *ger* areas. In terms of the type of apartment developments, most residents would prefer to live in small groups of low-rise apartment buildings rather than in large high-rise apartment complexes.

Water Supply and Sewerage: Residents in all *ger* areas receive their water through some 500 public water kiosks. Most *ger* residents say they are relatively content with the current system of water

distribution, in contrast to their views of other services and infrastructure such as solid waste collection, local pathways and drainage. Affordability of water purchased at kiosks is not a major issue, either, because the cost is low and residents consume an average of only10 liters per day per person. Unit costs of water supply and sewerage services are by far the lowest for residences converted to apartments, estimated at around Tg280 ($0.19) per m^3.

For *ger* areas, the existing system of public kiosks seems to be the most practical way to provide water. It would be exorbitantly expensive to connect detached houses in established *ger* areas to the central water supply systems; estimated connection costs range from Tg5.6 million–Tg16.1 million ($4,000–$11,500) per household, depending on topography, proximity to existing networks and requirements for wastewater treatment.

Development of kiosks in fringe *ger* areas should be minimized, however, because of the possibility for relocation of residents, and kiosk water supply is very expensive to develop. The pricing and subsidy of kiosk water supply is a major policy deficiency: the current kiosk tariff of Tg1,000 ($0.67) per m^3 covers only a fraction of the total unit cost of kiosk water supply. There is no space for cross-subsidization, either. Currently, water is supplied by trucks to about one-half of all kiosks; the rest are connected to networks via water pipes. Converting the truck-supplied kiosks to networked-kiosks would make sense only if a drastic increase in consumption is expected, since networked-kiosks are only marginally less costly (estimated at around Tg3,280–Tg4,260 per cubic meter, or $2.19–$2.84) than trucked-kiosks (Tg4,250–Tg4,260, or $2.83–$2.84). Limited capacity in water source and treatment, and the limited sewerage system, would be major constraints for increased demand in the future.

Municipal Roads and Public Transport: The poor condition of unplanned and unstructured earthen roads in *ger* areas is one of the most serious concerns expressed by *ger* residents. Many parts of these roads are impassable for vehicles, have drainage problems, pose traffic safety hazards and are the source of a substantial amount of dust. Also, the lack of street lights contributes to higher crime rates after dark.

Poor access to public transport places *ger* residents at a disadvantage due to their long commuting times to work and schools. Residents in fringe *ger*s tend to rely heavily on public buses because they cannot afford private vehicles. Residents of both mid-tier and fringe *ger* areas must walk long distances from public transportation drop-off points along major corridors because buses, mini-buses, and taxis cannot or will not operate on the narrow earthen roads in *ger* areas.

The cost of road improvement for a couple of km within the community to allow mini-bus operations are similar for each of the three types of *ger* areas. Typical costs are between Tg238 million and Tg322 million ($170,000–$230,000) for initial construction, between Tg1,120,000 and Tg1,750,000 ($800–$1,250) for annual maintenance, and Tg1,120,000–Tg1,960,000 ($800–$1,400) for the operation of street lights. Per capita, the capital costs would be around Tg21,600–Tg40,700 ($15.43–$29.07), while maintenance would be around Tg90–Tg465 ($0.06–$0.33) annually. Road improvement is largely a fiscal capacity issue for the Municipality of Ulaanbaatar (MUB) regardless of the characteristics or location of *ger*s. Financial sustainability of public transportation is another policy issue, because many passengers do not pay fares and the public bus companies face financial deficits.

Solid Waste Management: *Ger* residents cite solid waste management as one of the worst public services. Solid waste is collected solely by vehicles, the service is unreliable, and collections are infrequent: once each month or even once every three months. Operational efficiency also is very low, with each vehicle collecting from an average of only 100 households per day in summer and even fewer during the winter (seasonal variation of waste quantity is significant: an average per household of 1.0–0.9 kg in winter and 0.2–0.3 kg in summer).

Conversion of *gers* to apartment complexes in central *ger* areas would make solid waste collection services more efficient and cost-effective. In areas where *gers* are not converted to apartments, alternatives such as using a combination of local sanitary workers, collection stations and vehicles would be much more cost-effective than the current system. Also, waste collection is less costly in the more densely populated *ger* areas than in spread-out ones.

Capital costs for a system of collection by sanitation workers are estimated at Tg13.2 million–Tg19.6 million ($9,400–$14,000) for equipment purchases. O&M costs would be Tg16.8 million–Tg35 million ($12,000–$25,000) in the Mid-tier and Fringe *gers* respectively, depending on density and spatial characteristics. Improvements using the current vehicle collection system would be more expensive, with capital costs of Tg77 million–Tg152million ($54,000–$109,000) and O&M of Tg16.8 million–Tg59 million ($12,000–$42,000) per year. However, MUB objects to the use of sanitary workers for unknown reasons.

On a per capita basis, estimated capital costs range from as little as Tg1,654 ($1.18) for the combined approach to as much as Tg13,658 ($9.76) for improving the current system. Tariffs vary across districts, at Tg1,500–Tg3,000 ($1.07–$2.14) per month for each household, with a very low tariff collection rate of 30 percent. While operational and financial details of the *Tuk* (collection companies) are subject of further review, solid waste collection services seem to be a heavy fiscal burden on district governments. Also, MUB would need to develop another landfill soon—at an estimated cost of Tg51.8 billion ($37 million)—if current services are significantly improved.

Heating: There are four types of existing heating systems in UB: a) centralized (or district) heating system; b) small heating systems for groups of buildings (heat-only boilers or boiler houses); c) individual heating systems (water heaters); and d) household stoves. The fuel for all these heating options is indigenous coal or lignite. The use of raw coal in heat-only boilers and household stoves is considered one of the main reasons for the worsening air quality in UB. Other problems include the high cost of individual connections, low heat density, the high rate of heat loss due to the lack of insulation in *gers* and houses, the lack of heating capacity in the Ulaanbaatar district heating network, and the unplanned and temporary location of *hashaas* (land plots).

Possible options for heating improvements may include a) connecting more residences to district heating services; b) creation of small heating systems for groups of buildings; c) improving the efficiency of household stoves to reduce air pollution, and d) reducing the use of raw coal for heat-only boilers and individual stoves and using cleaner fuels instead.

The cost of connecting small businesses and individual households to district heating may vary between Tg2.8 million and Tg5.6 million ($2,000–$4,000). In some cases, due to low heat density or dispersed locations, the per-unit costs could be as much as Tg11.2 million ($8,000). The connection

cost in apartment buildings may vary between Tg560,000 and Tg700,000 ($400–$500) per apartment unit. Connecting individual *gers* to the district heating system is not considered cost-effective, however. One reason is that the heat load density for individual connections in *ger* areas is about 40–50 times lower than for apartment buildings. In addition, individual connections would not be economically feasible without proper heat insulation measures. The average *ger* loses 4–5 times more heat than national insulation standards; individual houses lose twice the national standards.

Heat tariffs need to be reformed significantly because current tariffs do not cover the full costs. Pricing also is regressive, with wealthier households connected to district heating paying for their heating based on space size (rather than actual usage as measured by a meter), whereas *ger* area residents pay the market price for coal and firewood and get a fraction of the heating compared to apartment dwellers. Overall, lower-income families spend up to 40 percent of total household income on heating.

Electricity: Electricity supply in *ger* areas is subject to several major problems, including voltage drops due to capacity shortages, insufficient capacity of transformers and substations, and a small number of households without electricity. Most households in the three *ger* areas under review have electricity, except about 120 families newly migrated from rural areas. *Ger* area residents who have connections use, on average. about 100–110 kWh of electricity per month and pay about 4–5 percent of their monthly income for it, which is within the internationally recognized affordability limit. Improving service for existing consumers, such as increased capacity at nearby substations and improved metering and wiring, would cost between Tg280,000–Tg560,000 ($200–$400) per household.

The cost of new connections for households in the selected *ger* areas varies between Tg840,000–Tg1,120,000 ($600–$800) per connection depending on (among many variables) topography and distance from and available capacity of nearby transformers and substations of the Ulaanbaatar Distribution Network (UBEDN). Households that currently do not have electricity would not be able to afford new connections. Even though the Energy Regulatory Authority (ERA) has introduced lifeline tariffs for low-income households, very few households have subscribed for these tariffs because they have recently migrated to the area and have not yet registered or they have not paid their bills for electricity. The lack of proper planning and enforcement among district and municipal authorities also makes it more difficult to provide new connections.

Social Services – Education: Schools in *ger* areas lack facilities to absorb the increasing number of students. The burden on existing schools can be eased by expanding them or providing additional primary and secondary schools. Either of these actions would require not only investing in facilities but also adding teachers and other supporting infrastructure such as roads, water supplies and sanitation. The initial cost assessment suggests around Tg1.8 million ($1,300) per capita would be needed to provide school facilities on a normal single shift and the supporting infrastructure, excluding remuneration for school teachers. Given that expansion of schools is not expected in the short term, providing youth and recreational centers should be considered for prevention of juvenile delinquency. The capital cost of such centers is estimated to be around Tg175,000 ($125) per child, and Tg18,200–Tg25,200 ($13–$18) per child, per year for operation. Schools also could be made more accessible to students by improving general road conditions and increasing the frequency of the public/mini buses that many students use.

Social Services – Health: Expanding or adding primary care providers is critical in the remote *ger* areas that are served by only a limited number of hospitals. Replacing outdated equipment and ensuring deployment of enough staff would prevent the existing problem of under-utilization of the facilities: currently not many people use these facilities. The cost of building new primary health care facilities is estimated at around Tg505,400 ($361) per capita, not including salaries and other variable costs.

POLICY DIRECTIONS AND SCENARIOS

The following policy directions and scenarios have emerged as a result of the above analyses.

***Smart Growth*:** It would make economic sense to adopt "smart growth" policies as principle directions in the long run, i.e. to increase density in the center of the city where appropriate while controlling further expansion at the outskirts of the city. In general, high density development would make it easier to provide better urban services with higher efficiency and lower cost. The public also has the desire to live in high density development: low-rise apartments or collective housing with utility services. Realistically, however, the majority of *ger* areas will remain in their current conditions because achieving higher density development is very complicated, as elaborated below.

***Conversion of central gers to apartments will take time*:** Converting center *ger* areas into apartment complexes has not progressed as fast as the government had envisaged. One reason is that most *ger* area residents cannot afford the cost of apartments in the city center. The lack of mortgage finance also makes buying large assets (such as apartments) difficult for many people. A third reason is that the absence of a functioning real estate market—including proper methods for determining prices for private land transactions—has impeded the development of new housing.

***Retrofitting urban services in mid-tier gers is exorbitantly expensive*:** A majority of *ger* areas outside of the city center are older establishments. Many residents have lived there for a long time and have invested in their dwellings, a large number of which are detached houses. These residents are relatively content with their neighborhoods and would like to see improved urban services for their houses or development of low-rise, small-scale apartment complexes. These areas are not suitable for conversion to large high-rise apartment complexes—at least for the mid-term—mainly because they are not near network infrastructure, except along the major transportation corridors.

While a minimum level of urban services have reached most of these areas, upgrading services to the full-fledged level now available for apartment buildings would be exorbitantly expensive and almost impossible. The unit costs of services to individual houses are several times higher than for apartment units. Instead, improvements in housing—such as conversion to low-rise, smaller collective dwellings, which might make connection to network infrastructure feasible—could be envisaged if residents' income increases. In the meantime, gradually improving services within the affordability limit of residents and public financial resources would seem the most practical approach for the majority of *ger* areas.

***Room for relocating fringe ger residents*:** The situation in the more remote fringe areas of the city is slightly different. *Gers* in these areas are inhabited by recent migrants. Their income level is even

lower than those of city center residents or the residents of long-established *gers*. They are farther away from the economic activities of the city and have little access to health and education services. Utility services also are even worse than for residents in established *ger* areas. Therefore, residents of these fringe *gers* are very dissatisfied with living conditions and are ready to relocate, if affordable better housing is available elsewhere. But again, affordability is a very serious issue for these residents because of their economic circumstances.

IMPLICATIONS FOR PLANNING AND DEVELOPMENT

Given the situation above, seven priority areas require attention by the government:

1. *Access roads within ger areas:* The majority of the residents in *ger* areas are lower-income and are further disadvantaged by very poor access to markets, work places, education and other services. Modest improvements in the secondary access roads from major corridors to inside the *khoroos* (including basic drainage and street lighting) would give residents major benefits, including easier access by taxis or mini-buses and reduced dust, storm-water torrents and crime. Therefore, it would make sense to initiate planning for development of access roads within the *khoroos*. Community-driven initiatives on land re-plotting, if appropriate, would also make it easier to plan roads and provide access for utilities.

2. *Better heating systems to improve efficiency and reduce air pollution.* Because the development of apartment complexes is likely to take a long time and most *ger* areas will not be connected to central heating systems in the near future, short-term measures are needed to improve air quality in the city. Such measures could include better access to cleaner and more efficient stoves and fuels, as well as programs to increase the energy efficiency of houses.

3. *Solid waste management and community infrastructure*: Solid waste management is often listed by *ger* area residents as one of their most serious concerns. The current solid waste collection practices seem to be very inefficient and costly. Other community infrastructure and services, such as pathways, foot bridges and community youth centers, also would be helpful in meeting day-to-day needs of many *ger* area communities, given the lack of proper site development and the shortage of schools and extracurricular activities in *ger* areas.

4. *Research on affordable collective housing in mid-tier gers*: So far, all apartment developments have been concentrated in the center of the city and been targeted only for higher-income residents. Therefore, the development of apartments has not benefited the majority of *ger* residents. On the other hand, some residents in the older, established mid-tier *ger* areas located along major roads seem willing to consolidate their individual plots and develop low-rise collective housing; this would provide easier and less costly access to utility services. Therefore, it would make sense to begin reviewing the feasibility of affordable collective housing development along transport corridors and utility supply lines in the established mid-tier areas.

5. *Fringe gers*: Providing networked utility services in the fringe *ger* areas is very expensive. Many residents in those areas are very dissatisfied with current living conditions (including the poor quality and availability of public utility services) and might want to find better housing and economic

opportunities elsewhere. For these reasons, a major expansion of networked utilities in the fringe *ger* areas does not make much economic sense. Instead, services should be provided at the minimum humanitarian level. Since the future of these *gers* will depend, in part, on the social integration of new migrants, some lessons from social housing in Hong Kong or Singapore might help Mongolia develop clearer policies.

6. *Utility capacity expansion and reforms*: The more residents enjoy a higher standard of living, the higher the required capacity will be for utility services. However, most utility services—water supply, heating and electricity—already have reached capacity limits. As gradual progress is made on housing and utility services, capacity also can be expanded. Because estimated investment requirements are significant and utility services face considerable financial constraints, reforms of pricing and regulations of utility services will be essential prerequisites.

7. *Further research in related sectors*: The municipal budgetary resources of UB are quite limited, at around Tg30 billion–Tg60 billion ($21 million–$43 million) per year. Given the slow implementation of pricing reforms, many infrastructure services in UB already receive large implicit subsidies. Furthermore, expansion of key network infrastructure will easily require investments of Tg30 billion–Tg50 billion ($21 million–$36 million) or more. Other problems noted in this report—including inadequate housing development, the lack of mortgage financing and problems in the banking sector—create additional challenges for the housing sector. Further research on municipal finance and the banking sector, including mortgage financing, might help the government develop clearer policy directions.

1 Introduction – Background, Scope and Methods

BACKGROUND

The sustainable development of *ger* areas in Ulaanbaatar (UB), the capital city of Mongolia, is one of the critical development issues facing the country. The transition to a market economy since the 1990s and a series of severe winters, called *zud*, have resulted in the migration of many low-income families from the countryside into the *ger* areas of UB. The city grew from some 600,000 people in 1989[1] to over 1.03 million in 2007[2], representing 39 percent of the nation's population.

The city now generates more than 60 percent of Mongolia's gross domestic product (GDP) and accounts for one-half of the total investment in the country. Given the lack of employment opportunities in other major *aimag* cities, migration to UB is expected to continue. The latest forecasts indicate that the population of UB is likely to reach 1.3 million in 2015 and about 1.7 million in 2025[3].

The growth has led to an unprecedented expansion of the *ger* areas. The total administrative area of the city is now estimated at about 4,700 km^2, which is more than 35 times larger than the original center of the city (around 130 km^2). The population of the *ger* areas is now estimated to make up about 60 percent[4] of the total population of UB.

Basic services are very limited or non-existent in *ger* areas. Nearly 85 percent of *ger* residents use wood or coal-burning stoves for heating, while apartments are connected to a central heating system. *Ger* residents must travel to public kiosks as far as 500m from their homes to purchase water, which they carry back home in plastic or metal tanks. Residents of apartments, by contrast, enjoy an around-the-clock supply of piped-in drinking water and hot water. Provision of very basic public services in the *ger* areas is very costly, largely due to the low population density and the extremely cold climate of Mongolia.

The lack of basic urban services in the *ger* areas has also resulted in environmental degradation, including the pollution of air, water and other natural resources. This situation also poses serious health risks to residents, including respiratory diseases and hepatitis.

Clearer policy directions have emerged to control spatial expansion and promote high density development. The "MDG-based Comprehensive National Development Strategy," adopted by the Parliament in 2007, recommended that spatial expansion in UB should be controlled. The "2008 UB City Urban Development Master plan," which was developed with assistance from the Japanese Government, advocated a "Compact City" concept through the more efficient use of land. Implementing this guidance, technical assistance has been offered by bilateral donors for the intro-

BOX 1.1. *Ger* Areas and *Gers*

The peri-urban *ger areas* surround the built up "downtown" of Ulaanbaatar city, and are characterized by low-density scattered arrays of fenced property containing informal housing structures, a mix of *gers* and detached houses. These areas now take up about more than 90 percent of UB. Migrants typically claim open land, install a fence along the property boundaries, and build a *ger* or a detached house. As the migrants settle down and save money, they upgrade or build the more expensive detached houses on their land. In UB *ger* areas, some 61 percent live in houses and 38 percent reside in *gers*.

Traditional *gers* are nomadic felt tents with wooden lattice substructures, used by Mongolian nomads for centuries. The *ger* was an ideal living solution for nomads over many centuries because it is mobile (it can be assembled in half an hour), light-weight (one person can erect a *ger*), and portable, making it well suited for easy moving. The *gers* have limited space (on average only one room of ca. 28 m^2), and do not meet modern standards of living. Cast iron stoves provide heating and are inefficient due to poor insulation (10–15 cm of felt) and create extremely poor indoor air quality.

duction of effective zoning regulations, and the government has been taking on large-scale development of apartment residences for UB.

Although policy directions have become clearer, the Government's practices concerning the spatial development of *ger* areas have been inconsistent. The Government's early attempts to control migration to UB by imposing punitive settlement fees were struck down by the country's highest court as unconstitutional. The private land ownership laws enacted in 2002, and the subsequent land ownership registration procedures introduced in 2005, provide incentives for households to occupy as large a parcel of land as possible. During the pre-election period in 2008, the private land ownership laws were revised to expand residents' land holding entitlements by 400 percent–500 percent on average, resulting in a land-seizing frenzy around UB.

These inconsistent actions are, in part, a result of limited awareness and understanding by the general public, as well as by policy makers, of the public costs of their actions. There is high susceptibility to ad hoc behavior that places premiums on short-term private gains over long-term value-creation in public goods. Many supporting mechanisms, including land valuation and taxation, have not yet been developed to create incentives for long-term value creation.

Therefore, this economic sector work aims at helping policy makers and citizens of UB improve their understanding of the consequences of their choices of policies and practices. Specifically, it intends to clarify the cost and benefit implications of different development paths, with the goal of contributing to the eventual achievement of the "Compact City" concept. These paths include (i) conversion of *ger* areas into developments of apartment buildings; (ii) gradual improvement of urban services for existing *ger* areas, and (iii) further expansion of *ger* areas at the fringe of the city.

SCOPE AND METHODS

Since the economic sector work reflected in this report is intended to be an instrument for further public consultation and dialogue, it uses different scope and methods from those of typical sector reports of the Bank. This report provides cost benefit implications from the residents' point of view, and refers to fiscal implications for the municipal government of UB. It does not provide comprehensive sector overview of these urban services, which are readily available in many sector reports, including the 2007 Bank/PIAFF report, "Foundation for Sustainable Development: Rethinking the Delivery of Infrastructure Services in Mongolia".

This report is only the first phase of the exercise. It will be shared with stakeholders through a series of workshops and other public out-reach activities. Stakeholders include parliament members, policy makers and practitioners at the national and the municipal governments, district and *khoroo* community leaders, *ger* area residents, professional associations, academia, NGOs and donors.

Cost analyses, as well as benefit analyses where possible and appropriate, were made for land and housing, water supply, roads and public transport, heating, electricity, solid waste management, and other social services. Analyses of water supply and social services mostly relied on data from on-going donor-funded projects in *ger* areas of similar characteristics and other existing sector reviews. Quick field surveys have been carried out for roads and public transport, heating, electricity, solid waste management, and housing and land.

While on-site sanitation is one of the critical issues for *ger* residents, it is not included in this report because credible solutions have not yet been developed. Many on-going experimental programs are so costly that they are not affordable for *ger* residents. Recommendations from numerous past studies have been deemed inappropriate because of the cold climate and thus have never been adopted in a sustainable manner.

As proxies of the three paths of development—(i) apartment conversion, (ii) service improvement for existing *ger*, and (iii) further development of fringe *ger* areas—*khoroos* (sub-districts) in three *ger* areas were chosen for the analyses. In Naran *Ger*, the 11th *Khoroo*, Bayangol District (the "City Center *Ger*"), is expecting large-scale development of apartment and commercial complexes. In Bayankhoshuu *Ger*, the 8th *Khoroo*, Songino Khairkhan District (the "Mid-tier *Ger*") is chosen for the analysis of the second path. In the Sharhad *Ger*, the 9th *Khoroo* in Bayanzurkh District (the "Fringe *Ger*") is a new *ger* at the fringe of the city.

The City Center *Ger* mostly borders existing urban areas and has experienced a gradual conversion into apartment buildings. The area partially accesses the standard level of services provided to *gers*, and partially accesses more extensive services through the area's proximity to high-density areas. The Mid-tier *Ger* is bordered on all sides by other *ger* areas. Residents in the area receive the standard level of services provided to *gers*. Residents intend to stay in their plots in the long run, making gradual improvements in their housing and expecting improved urban services. In the Fringe *Ger*, residents are still claiming land. Households, especially the new arrivals, lack the standard level of services currently provided to most *ger* areas. Further description of these *khoroos* is included in the next chapter.

The *khoroo* was chosen as a unit of analysis because it is the smallest administrative division with paid employees, thus allowing for the intimate study of each area but with access to relevant and reliable data. Typically, each *khoroo* has 1,800–3,000 households with a population of 7,000–12,000. Since *khoroo*-level data is collected across the city, there is merit in scaling the costs of infrastructure service provision or estimating public benefits. In addition to location, *khoroos* were selected based on strong support for this study from *khoroo* leaders and district governors and the availability of socio-economic and service provision data from household (HH) assessments and other World Bank projects, donor projects, and NGO activities.

2 Development Context: Governmental, Socioeconomic, and Local Profile

GOVERNMENT AND ADMINISTRATIVE STRUCTURE IN *GER* AREAS

Ulaanbaatar is divided into nine districts, or *düüregs*. Six of the *düüregs* break up the central urban area of the capital city, fanning out to the *ger* areas. Each *düüreg* is divided into sub-districts, or *khoroos*, of which there are currently 132 in the city. Each *khoroo* is the further divided in micro-districts, or *khesegs*. *Ger* areas are located in all of the nine districts, usually corresponding to lower levels of administrative boundary, the *khoroos*.

The breakdown of responsibilities, from the Mayor's office to leaders of each *kheseg*, is fairly straightforward (see Table 2.1). The municipality, led by a mayor who is chosen by elected representatives, sets budget and policy, coordinates the districts, and controls city-wide activities (road maintenance, for instance). The *düüregs*, each led by an elected governor, are the smallest administrative unit with budgets available for service improvements. They are responsible for the assets in the area, infrastructure and service improvements (road construction, health clinics, and schools, for instance).

Khoroos are the primary level of government interacting with residents. To register as a resident, vote, or register a car, residents go to the local *khoroo* office. Each *khoroo* represents around 1,800–3,000

TABLE 2.1. Administrative Breakdown of Ulaanbaatar

GOVERNMENT	DIVISION	QUANTITY	APPROX. POPULATION	RESPONSIBILITY	BUDGET (MILLION TG)	REPRESENTATION, FREQUENCY OF NEW APPOINTMENT
Capital (Ulaanbaatar)	City	1	1,025,174	Budget allocation, services, maintenance	33,502	Citizen's Khural (4 years), which selects the Mayor (4 years)
Düüreg	District	9	113,908	Infrastructure, tax collection, services	754	2–4 representatives per Düüreg elected to State Great Khural (4 years), Düüreg Governor (4 years)
Khoroo	Sub-district	132	7,766	Registration, census, voting, community outreach	Salaries and office maintenance only	Citizen's Khural Representative (4 years); *Khoroo* Governor selected by community meeting (4 years)
Kheseg	Micro-district	ca. 8–13 per *Khoroo*	ca. 597–970	Registration, community outreach	Part-time stipend	Kheseg Leader

Sources: JICA master plan, local interviews

households and has a local office, often combined with a community center. *Khesegs* are the smallest administrative unit, containing no more than a few hundred households. Each has a volunteer leader who is given a small stipend and is responsible for helping with registration, outreach, health promotion, and local assistance to the unemployed and disadvantaged.

The municipal budget of UB city is quite constrained, around Tg30 billion–Tg60 billion ($21 million–$43 million) annually. Since 2003, annual city revenues have significantly exceeded expenditures, with only 84 percent of revenues going into the city budget in 2008.

SOCIOECONOMIC PROFILE OF *GER* AREAS[5]

The socio-economic differences between the *ger* areas and apartment areas are as significant as the physical differences. *Ger* area households are larger, younger, less educated, poorer, and more reliant on social services than households in apartment areas (Table 2.2).

Demographics

The average size of a *ger* area household is just above four persons, almost one person larger than in apartment areas. In line with the recent growth of *ger* areas, a high proportion of residents are migrants. Only 50 percent of *ger* area respondents were born in the district in which they are living, compared to 60 percent of apartment area respondents. Over 93 percent of those *ger* area residents who are not born in the district came from outside UB. In *ger* areas marriage is a dominant reason for migration (over 40 percent), followed by employment (19 percent), and education (14 percent).

Employment

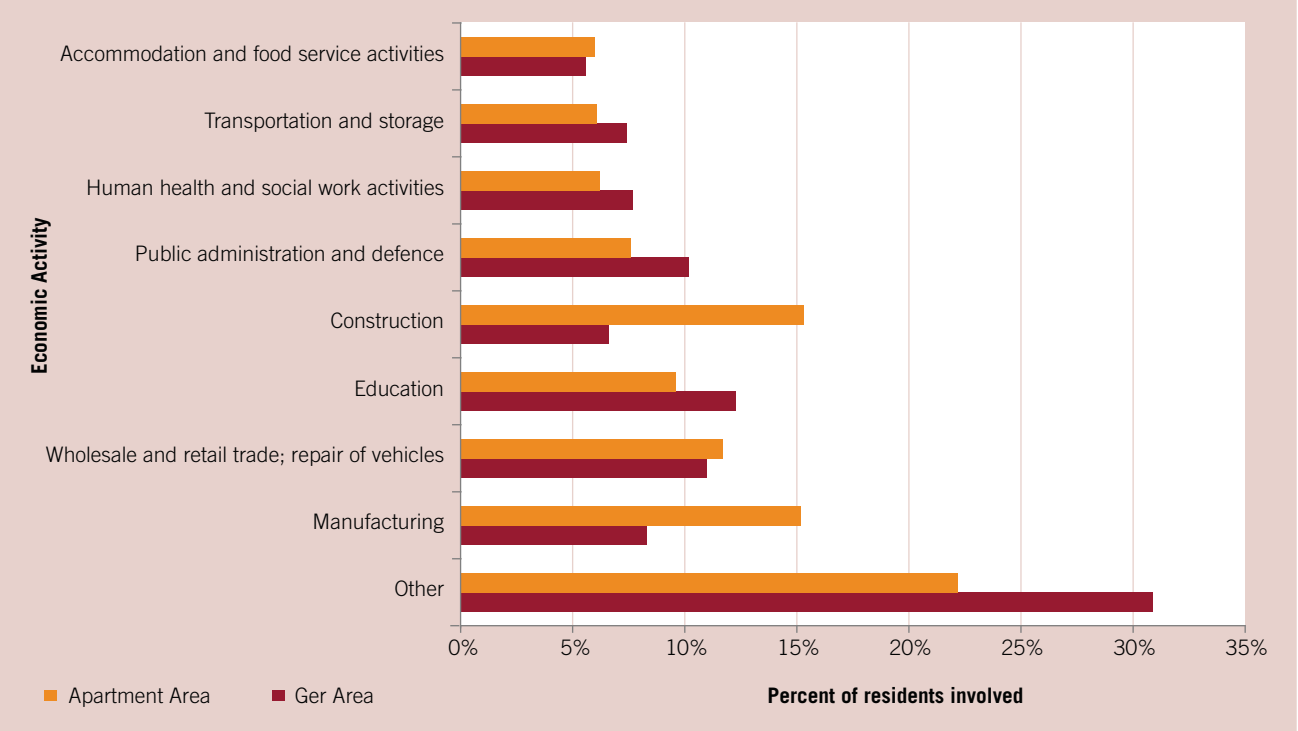
Rates of employment in *ger* areas vary according to the source of the data, but unemployment rates tend to be higher in the *ger* areas than in apartment areas or other areas outside the capital. The 2008 HIES survey reported that of working-age[6] *ger* area residents, only 51 percent had worked during the previous 12 months, compared to 56 percent in the apartment areas and the average national rate of 63.6 percent. The 2007 NSO yearbook did not disaggregate employment by the type of area, but did approximately substantiate the national employment rate, at 62.4 percent.

Economic activities in the various areas also showed a contrast. *Ger* area residents perform significantly more manual labor than do residents of apartment areas (Figure 2.1). Of those employed in *ger* areas, 30 percent are engaged in construction or manufacturing, followed by 12 percent in trade (wholesale and retail) and vehicle repair. These economic activities contrast starkly with those in the apartment areas, where the most widely-held jobs are in education (12 percent), trade and vehicle repair (11 percent), and public administration and defense (10 percent). Also, a higher share of *ger* residents

TABLE 2.2. Demographic Summary of *Ger* and Apartment Areas

	GER AREAS	APARTMENT AREAS
Male	47.1%	45.8%
Female	53.0%	54.2%
Avg. number of household members	4.2	3.4
Average Age	27.9	30.8

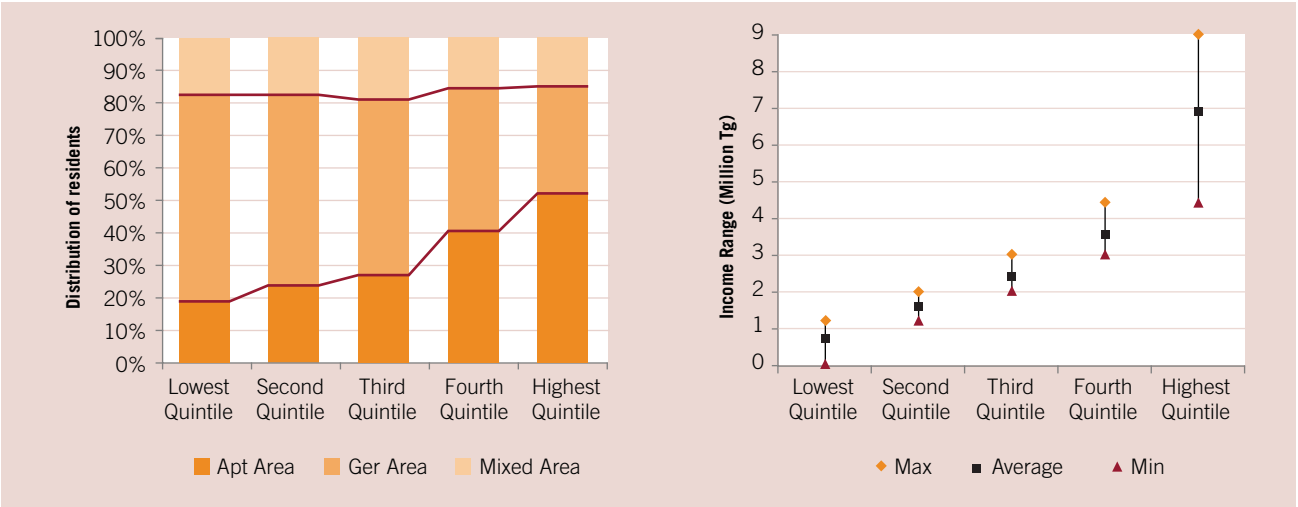
FIGURE 2.1. Economic Activity of UB Apartment and *Ger* Area Residents



are engaged in construction work (15 percent) and manufacturing (15 percent), as compared to 6 percent and 8 percent of apartment residents, respectively. These findings suggest that *ger* residents are more vulnerable to economic downturn than those in other areas.

Incomes in Ulaanbaatar also highlight the differences between the areas (Figure 2.2). *Ger* area median household income (including cash, in-kind, and bonuses) in Ulaanbaatar is Tg 2,496,897

FIGURE 2.2. Household Income Distribution, Divided by Quintile

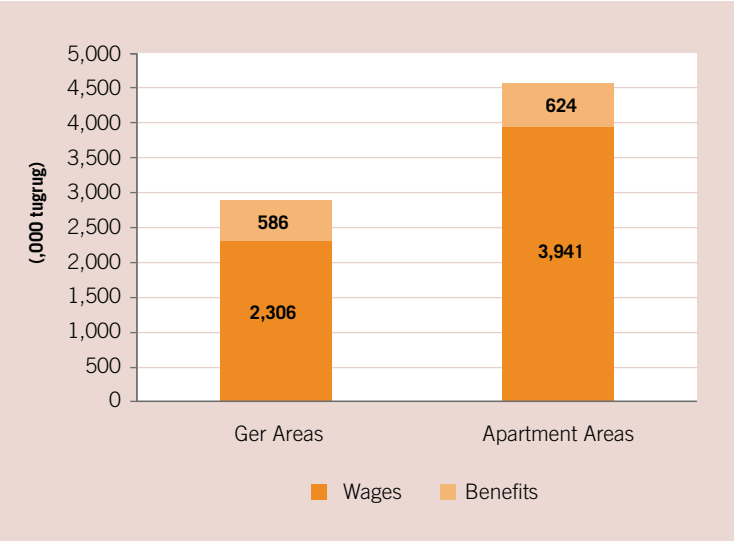


($1,665). This income is 43 percent less than for apartment area households. Similarly, income distribution within *ger* areas and city centers show that even among the highest 20 percent, average income in apartment areas is 17 percent higher than in *ger* areas.

Benefits and Allowances

Government benefits play a significant role in supplementing the incomes of UB residents, representing 20 percent of *ger* area income and 14 percent of apartment area income (Figure 2.3). These benefits are dominated by child-related payments and pensions; disability payments are also a significant contributor. With the economic crisis, however, these payments are targeted for severe reductions.

FIGURE 2.3. Average Incomes, Including Wages and Benefits



By far the most common benefit, child-related benefits dominated by the Child Money Program (CMP), are received by 73.5 percent of *ger* area households. The system is largely universal and multi-tiered, composed of: a) a Tg3,000 ($2.14) monthly payment for every child under 18; b) a Tg25,000 ($17.86) quarterly payment for every child under 18[7]; c) a new baby allowance of Tg100,000 ($71.43) per child; and d) a maternity benefit of Tg20,000 ($14.29) per month for five months during pregnancy and seven months after birth, for mothers below the Minimum Subsistence Level (Tg30,000, or $21, in UB)[8]. In total, poor families receive Tg419,333 (~$280) before the child turns seven months old, followed by Tg136,000 (~$91) per year.

State pensions also are significant, providing an average Tg1.3 million (~$930) to 30 percent of *ger* residents. Other benefits received by at least 5 percent of the population include disability payments (average Tg236,051, or ~$170, received by 7 percent of *ger* residents), and an "other benefit" that is undefined in the survey (Tg246,717, or $176, to 13 percent of *ger* residents). Several other benefits reach no more than 5 percent of residents.

Until 2007, the CMP had been a targeted, albeit inefficient, social transfer. With the universalization of the CMP, and the proliferation of other social transfer programs, these transfers quickly became a substantial part of the Mongolian budget. Three quarters of the Child Money Program comes from the Mongolia Development Fund, which is mostly financed by mining taxes. With the massive drop in commodity prices in the current economic climate, the Mongolian government is experiencing a corresponding budget shortfall. As part of a budget assistance package financed by the IMF, ADB, World Bank, Japan, and other donors, the GoM has agreed to propose a major restructuring, with the help of the ADB and World Bank, of its social transfer programs. The government will propose consolidating, reducing, and carefully targeting the transfers to the poor. The goal will be to include only the poorest families, as defined by the National Poverty Line, in the social transfer programs.

FIGURE 2.4. City Center *Ger* (Naran)

CURRENT STATUS AND DEVELOPMENT ASSUMPTIONS OF THREE *GER* AREAS

City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District (Map # IBRD36906)

Naran is one of the oldest existing *ger* areas, located immediately north of the city. Containing the national TV and Radio stations, as well as their antennas, the area is often referred to as the "TV Station *Ger*." The 11th K*horoo* was originally much larger, but as apartment buildings have been creeping northward and population has increased, clumps of apartment buildings have broken off into new *khoroos*. There are plans in the MUB to build more apartment buildings in the southern half of the *khoroo* (see Annex C). The *khoroo* climbs part of the southern slope of one of the many hills in UB, tapering off close to the top of the hill. The long eastern border is one of the main paved roads accessing the northern *ger* areas, and represents the border between Batangol and Chingeltei Districts.

In the City Center *ger*, large-scale development of apartment buildings is expected given the proximity to the city center. The current municipal plans (featured in Annex C) are for permanent structures, most of them seven to 12 stories, to fill the southern half of the *ger* area. According to the planning, by 2015 there will be 15,684 households, and the population will reach 65,800 in the development zone (which includes the 9th, 10th, and 11th *Khoroos*). Facilities will be developed, including schools for 13,160 pupils, kindergartens for 6,580 children, and health clinics with a capacity of 2,300 patients/day, as well as green areas and utilities. Water supply will be centralized, providing an estimated supply of 11,780 m^3/day. Wastewater will also be centralized, using an estimated 2,900 meters of pipes and with collection estimated at 11,780 m^3/day. Approximately 12,500 meters of transmission pipes will provide centralized heating, a load of 63.7gcal/hour. Seven substations will supply power to the district, providing capacity of an estimated 32.6MWt. Implementation, including ground engineering, roads, preparatory measures for engineering, gardening and furnishing, will cost approximately Tg26 billion ($17.3 million).

FIGURE 2.5. Mid-tier *Ger* (Bayankhoshuu)

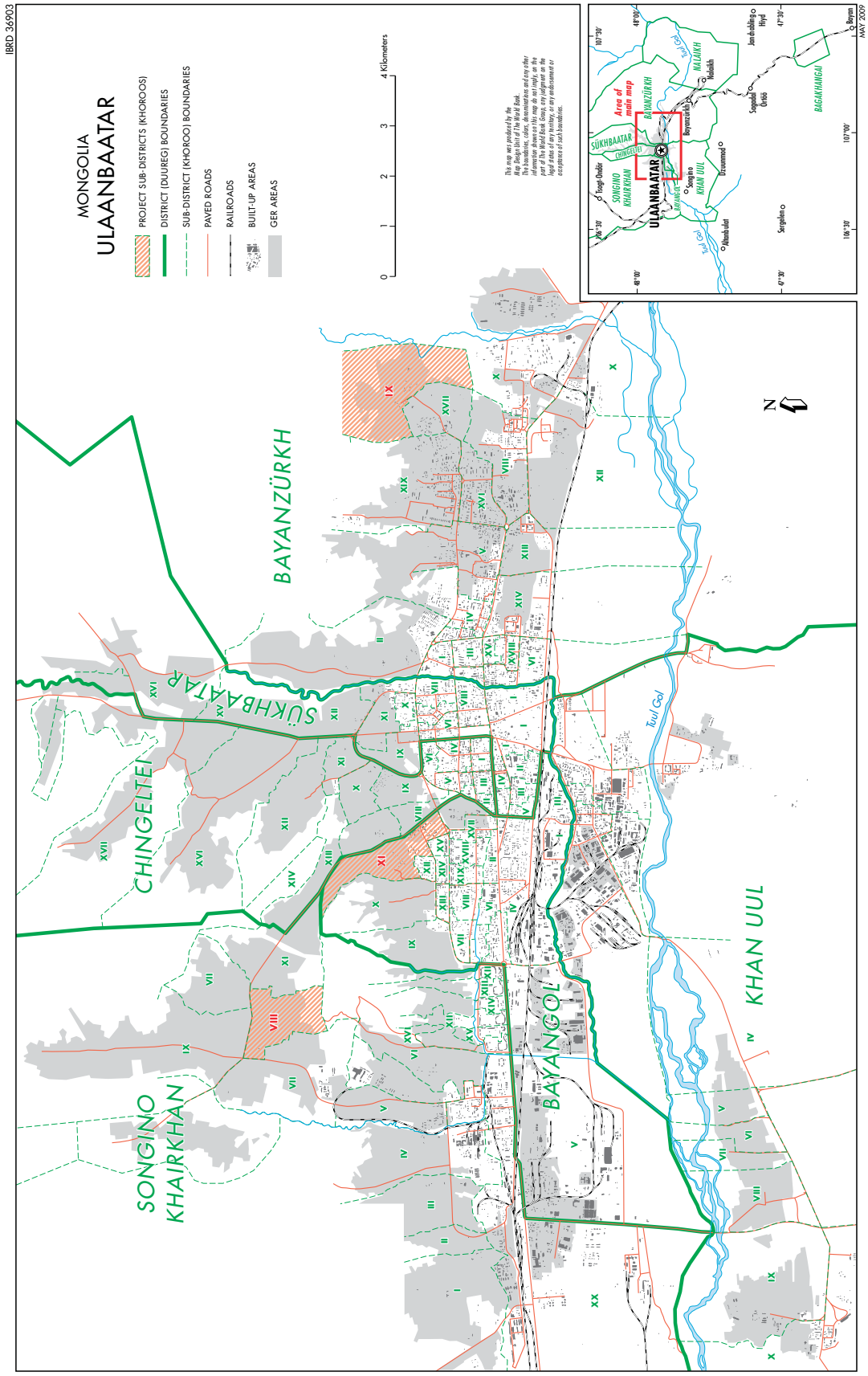
Mid-tier *Ger* (Bayankhoshuu), 8th *Khoroo*, Songino Khairkhan District (Map # IBRD36904)

The Bayankhoshuu *ger* lies a few kilometers up the road from the City Center *Ger*'s main road, on the other side of a large hill. The main road provides the k*horoo*'s northern border and is the principal source of commerce. This *khoroo* is relatively flat, with a small lake in the middle that feeds several brick-making enterprises. The lake also effectively collects the solid waste that blows around the neighborhood's streets. The mid-tier *ger* areas exemplified by Bayankhoshuu form the mostly continuous mass of the larger *ger* area. It is surrounded, for several kilometers in every direction, by other *khoroos* filled with *gers*. Household plots of land have been oriented along the main road with little planning, creating long, uninterrupted blocks sometimes over 1 km long. The community is entrenched, with residents having established themselves and their families in the area and are reluctant to leave. Some higher-income residents may wish to obtain private services, such as private water supply connections or private hot-water boilers, for their houses. Other affluent residents might want to consolidate their land plots and build small scale residential building structures for multiple family dwellings.

Fringe *Ger* (Sharhad), 9th *Khoroo*, Bayanzurkh District (Map # IBRD36905)

Along the northeast edge of UB, the relatively new Sharhad *Ger* area is still expanding, with a comparatively lower density. The *Khoroo* starts in the main UB basin, climbing the edges of foothills. The residents farthest from the center raise livestock for a living; other than this type of pastoralism, urban agriculture is largely unknown in UB. Several bus lines end at the bus terminal just over the nearest border, the only paved section of the *khoroo*. A largely self-sufficient national mental hospital is also located in the *khoroo*. The city's main used-car market is located in the neighboring *khoroo* (17th), providing jobs to many residents. Compared to the mid-tier *ger* areas, residents of the far-fringe *ger* areas are less attached to their land, having only recently arrived in the area, and are therefore more willing to move.

FIGURE 2.6. Fringe *Ger* (Sharhad)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MONGOLIA
ULAANBAATAR
PROJECT SUB-DISTRICTS (KHOROOS)
DISTRICT (DUUREG) BOUNDARIES
SUB-DISTRICT (KHOROO) BOUNDARIES
PAVED ROADS
RAILROADS
BUILT-UP AREAS
GER AREAS
0 1 2 3 4 Kilometers
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
BAYANZÜRKH
SÜKHBAATAR
CHINGELTEI
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Area of main map
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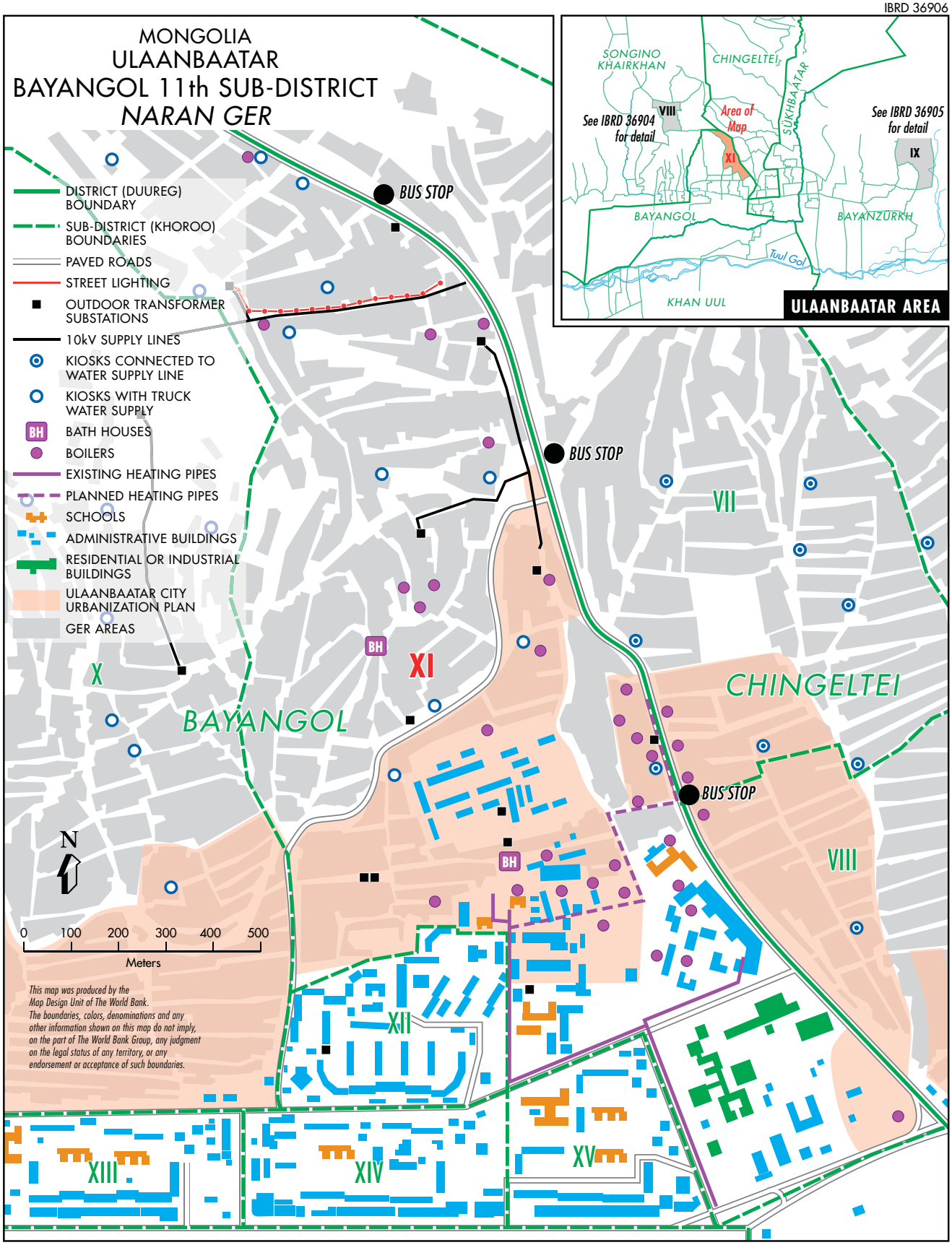

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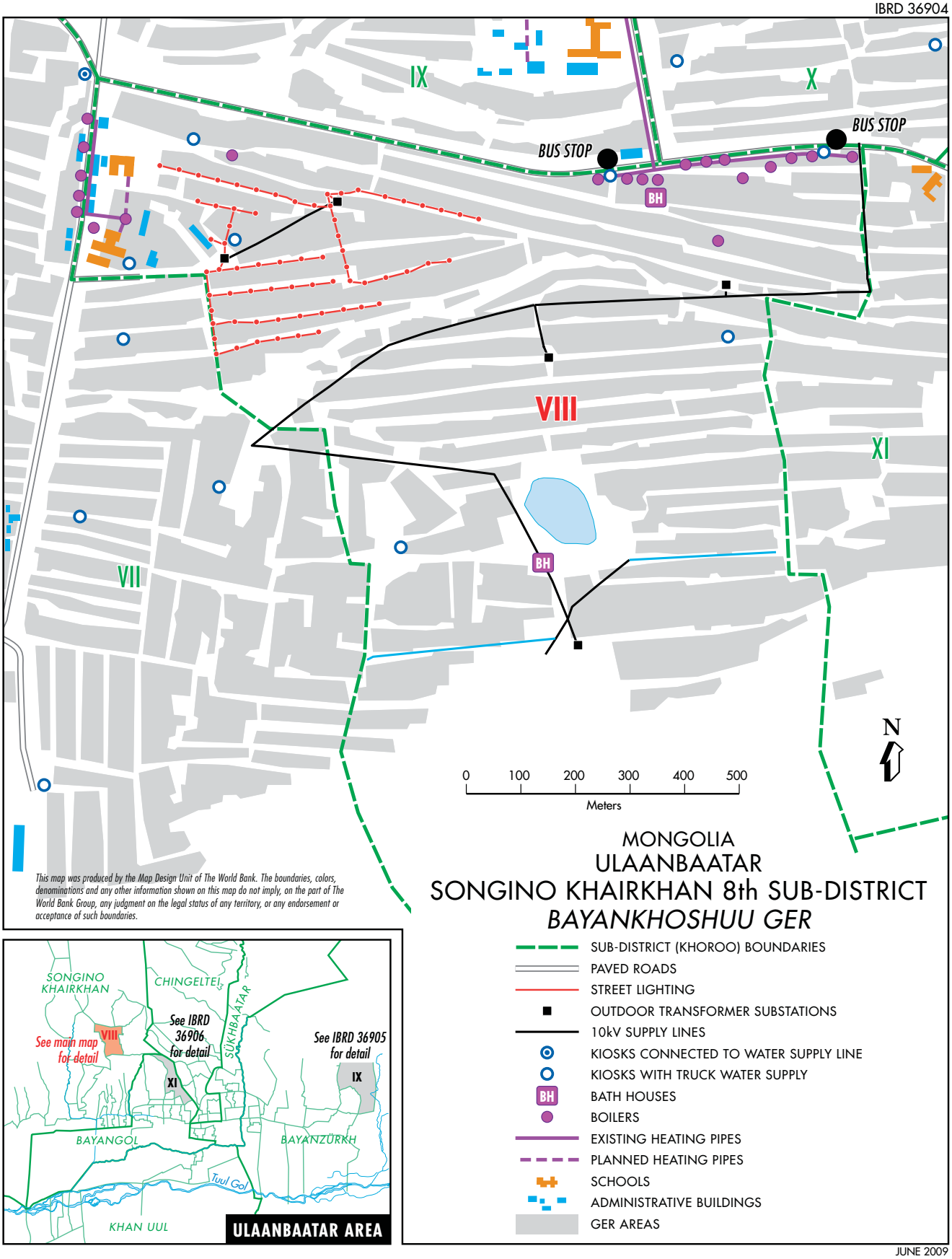

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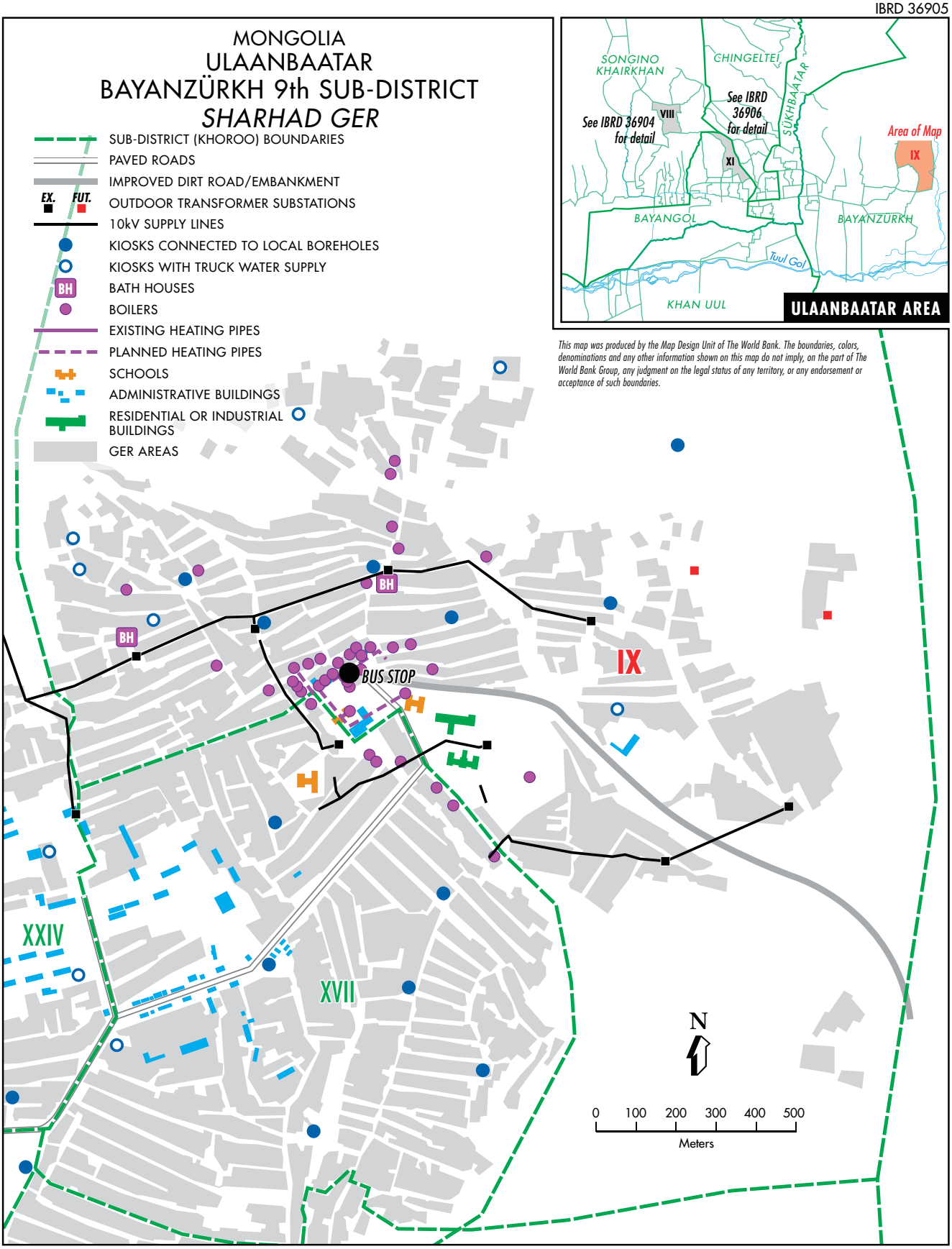

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3 Land and Housing

This Chapter is based on a survey the study team organized in three *ger* areas and a representative apartment area to assess land ownership, dwelling types, and households' preference for housing options as well as affordability issues[9]. The survey analysis intends to highlight issues related to financing and affordability for housing.

LEGAL, INSTITUTIONAL AND POLICY ASPECTS

Land ownership in Mongolia has gradually been privatized since the country's transition to a market economy. There has been a series of land laws or amendments of existing laws; the current land ownership in Mongolia is based on the 2002 "Law of Allocation of Land to Mongolian Citizens for Ownership." According to this law, the land tenure system in Mongolia is comprised of a combination of three land rights: "ownership" only for Mongolian citizens; "possession rights" for up to 60 years, with possible extension, available to Mongolian citizens and joint ventures; and "land use rights," valid up to five years with possible extension, for which foreigners are also eligible.

Land ownership is tied to the land fee system which the Government introduced in 1997 under the "Law of Mongolia on Land Fee." The law stipulates that individuals, business entities, and organizations that own, possess or use land are subject to land fees. For cities, villages and other settled places, the land fee ranges from 0.1 to 1 percent of the base land value. The land fee is determined by the Central Government taking into account certain fixed parameters, including location and land use as well as socioeconomic, geological, and environmental conditions.[10] The city of Ulaanbaatar is divided into five land valuation zones depending on location and income level and the land fee is applied uniformly to the properties in each zone.

The GoM has fully privatized ownership of land for "family needs" or residential purposes. The "Law on Allocation of Land to Mongolian Citizens for Ownership" stipulates that each household is entitled to the following for ownership: up to 700 m^2 in Ulaanbaatar; up to 3,500 m^2 in Aimag; or up to 5,000 m^2 in Sum. The associated land fee is set low: about 90 percent of the land fee up to 700 m^2 is exempt.[11] The fees are estimated on an annual basis and charged quarterly; collection is managed at the district government level.

Land management is currently done by the Administration of Land Affairs, Geodesy and Cartography (ALAGaC), under the Ministry of Construction and Urban Development. The mandate of the ALAGaC is to oversee and implement the government's land policy, to manage and update geodetic and cartographic information and databases, and to improve the cadastral system by carrying out cadastral surveys and establishing a unified database. In addition to the ALAGaC, there are Land

Departments in nine districts of Ulaanbaatar that process and manage registration. These Departments are also responsible for mediating any disputes over land ownership as well as evicting the occupants of illegal settlements.

While there have been numerous initiatives to improve land management—mostly funded by external donors—the cadastral system (surveys of land boundaries) generally suffers from a lack of administrative capacity and the limited availability of adequate databases. This is mostly caused by unsatisfactory or insufficient cadastral surveys and mapping and inadequate registration of land owners, users and possessors.

On the legal side, existing cadastral law does not include procedures for property registration. There also is no legal framework for handling disputes arising during cadastral surveys; such disputes are increasingly common in residential areas. Institutional roles and responsibilities at different levels of government are not clearly delineated, in addition to the general lack of administrative capacity, especially at the district levels that are mainly responsible for managing land registration. The National Land Information System—a comprehensive cadastral database connecting the collection of data from around the country—was planned for implementation but has experienced some delay[12].

The GoM launched the 40,000 Housing Units Program and more recently the 100,000 Housing Construction Policy. This is essentially a supply-driven housing development that focuses mainly on providing apartments and core supporting infrastructure. However, the effectiveness and viability of these programs remain questionable, as there are still critical systematic deficiencies in housing finance and affordability. In addition, there are no institutional systems to provide low-cost housing for middle- and low-income households, which comprise of about 70 percent of all households.

TABLE 3.1. Survey Respondents' Average Age (years) and Household Size (number of persons)

	AVERAGE AGE OF HH	AVERAGE HH SIZE	RESPONDENTS (%)	
			HEAD OF HH	SPOUSE
City Center *Ger* (Naran)	47.1	4.9	65.1	34.9
Mid-tier *Ger* (Bayankhoshuu)	48.8	4.3	97.7	2.3
Fringe *Ger* (Sharhad)	44.4	4.5	68.0	32.0
Apartment area	46.0	3.4	76.1	23.9

TABLE 3.2. Employment Status (% frequency)

	WAGE EMPLOYEE	TEMPORARY OR SEASONAL EMPLOYEE	SELF-EMPLOYED (BUSINESS OWNERS, ETC)	UNEMPLOYED
City Center *Ger*	27 (28.0)	0 (0.0)	39 (21.1)	44 (50.9)
Mid-tier *Ger*	14 (10.5)	6 (5.3)	22 (21.6)	68 (62.6)
Fringe *Ger*	26 (24.3)	3 (1.5)	21 (19.9)	60 (54.3)
Apartment area	43 (39.4)	10 (9.2)	33 (30.3)	23 (21.1)

TABLE 3.3. Household Assets, Liability, Monthly Income and Savings ($)

	TOTAL ASSETS					
	ILLIQUID ASSETS (PROPERTY)	LIQUID ASSETS (CASH, STOCKS, CARS)	TOTAL	TOTAL LIABILITIES	MONTHLY INCOME	MONTHLY SAVINGS
City Center *Ger*	21,920	4,381	26,196	234	223	70
Mid-tier *Ger*	13,521	935	14,454	42	154	14
Fringe *Ger*	8,958	312	9,266	46	164	5
Apartment	26,444	1,362	27,806	2,049	319	21

GENERAL HOUSEHOLD CHARACTERISTICS

For the surveyed households, the average age of residents ranges from 44.4 to 48.4, and the number of people per household ranges from 3.4 to 4.9.

About half of *ger* residents are reported to be unemployed, consistent with the findings from the HIES Survey, which showed about 59 percent of the sample in *ger* areas reported not to have worked during the previous 12 months. The percentage of unemployed is highest in the Mid-tier and Fringe *gers*: 62.6 percent and 54.3 percent, respectively, in contrast with 21.1 percent in the apartment area.

The survey result highlights income and wealth gaps between *ger* and apartment areas. Average monthly income in the Mid-tier and Fringe *gers* is only about 50 percent of apartment areas' income level. The income level in the City Center *Ger* is higher than the Mid-tier and Fringe *gers*, at $223 per month, which is about 70 percent of apartment area's income. As for assets and liabilities, there is again a stark contrast between *ger* and apartment residents. Differences are most notable between apartment areas and the Fringe *Ger*, where the total reported assets are only 30 percent of the apartment residents.

LAND AND HOUSING IN *GER* AREAS

Similar to most *ger* areas, dwelling types in the three *ger* areas consist of a combination of *gers* and detached houses, and the distribution of different dwelling types reflects the locations of the areas.

TABLE 3.4. Dwelling Types in Three *Ger* Areas (% of respondents in *ger* area)

	GER	(%)	DETACHED	(%)	APARTMENT	(%)	TOTAL HHS
City Center *Ger*	1,800	59	1,100	36	150	5	3,050
Mid-tier *Ger*	460	29	1,151	71			1,611
Fringe *Ger* (Sharhad)	1,418	58	1,015	42			2,433

Source: Statistics from district government offices

TABLE 3.5. Size of Land and Houses in Three *Ger* Areas

	LAND SIZE (m^2)	# OF WALLS	LAND SIZE (m^2)	HOUSE SIZE (m^2)	# OF ROOMS	APT SIZE (m^2)	# OF ROOMS
City Center *Ger* (Naran)	535.7	4.8	593.5	76.5	3.5	59.0	1.9
Mid-tier *Ger* (Bayankhoshuu)	589.3	4.9	546.8	55.4	2.9	—	—
Fringe *Ger* (Sharhad)	469.2	4.8	501.3	54.0	2.3	—	—
Apartment area	—	—	—	—	—	36.7	2.1

In the City Center *Ger*, a majority of people (59 percent) still live in *gers*. This is due to the fact that the area is still expanding with people settling in the hilly side of the district. In Bayankhoshuu, the Mid-tier *Ger*, more than 70 percent of households live in detached houses, consistent with the fact that this *ger* area was established a relatively long time ago. In the Fringe *Ger,* more than one-half the residences are *gers* because this is a newly-established and still-growing area.

The average size of land plots in the three areas is less than the 700 m^2 size of a *hashaa*, which individual households are entitled to by law. For *gers*, average land size ranges from 470 m^2 to 589 m^2, and the average number of walls in the three *gers* areas is more or less the same, just under five. For detached houses, plot sizes range from 501 m^2 to 593 m^2, with the average number of rooms ranging from 2.3 to 3.5. In the case of detached houses, the closer to the center of Ulaanbaatar households are located, the larger the average plot size and house.

Most households in *ger* areas own their residence and the land attached to it. In case of the Fringe *Ger*, the share of income paid as rent is higher. This could be because the residents are very low income and cannot pay an up-front land registration fee (average Tg10,000/$7.14 for migrants; Tg5,000/$3.57 for intra-city migrants) and hence residents rent *gers* temporarily. Another explanation is that people plan to stay in the fringe area for only a short period of time before moving to a different location. In addition, *ger* residents reported that they paid about Tg16,800 ($12) per year in land fees; those living in detached houses paid about Tg29,400 ($21) and apartment residents about Tg211,400 ($151).

The unit price analysis of existing detached houses and apartments shows that the price of apartments is about 2.5 to 3 times higher than of detached houses. The price of detached houses per

TABLE 3.6. Ownership Patterns for Housing and Land (% frequency)

	OWNED	RENT	OTHERS	PRIVATE	STATE-OWNED*	OTHERS-OWNED
City Center *Ger*	108(97.3)	1(2.7)	0(0.0)	109(99.1)	0(0.0)	1(0.9)
Mid-tier *Ger*	108(98.8)	2(1.2)	0(0.0)	84(87.9)	23(6.7)	2(5.4)
Fringe *Ger*	100(81.5)	10(18.5)	0(0.0)	96(75.7)	1(0.5)	12(21.4)
Apartment area	100(91.8)	7(6.4)	2(1.8)	65(59.6)	36(33.0)	8(7.4)

Note: In the case of apartment residents in the City Center Ger, about 70 percent responded that their land was state-owned (not privately owned). Following the definition of three types of land ownership, this could be either possession rights or land use rights.

TABLE 3.7. Housing Prices and Annual Operation and Maintenance Costs (Tg per m²)

LOCATION	DWELLING TYPE	ESTIMATED CURRENT PRICE	AVERAGE ANNUAL PRICE INCREASE	ANNUAL O&M COST
City Center *Ger* (Naran)	*Ger*			700
	Detached house	434,980	29.0%	7,140
	Apartment	1,076,600	15.5%	13,020
Mid-tier *Ger* (Bayankhoshuu)	*Ger*			140
	Detached house	324,940	24.2%	1,680
Fringe *Ger* (Sharhad)	*Ger*			140
	Detached house	449,960	15.7%	2,800
Apartment Area		1,226,960		10,080

Note: Operation and maintenance costs do not include utilities, only costs incurred by living in the houses.

square meter ranges from Tg324,800 to Tg449,400 ($232 to $321), while the apartment unit cost for the City Center *Ger* and apartment areas is Tg1,064,000 ($760) and Tg1,226,400 ($876), respectively. Apartments in the City Center *Ger* were completed in 2005, and apartment areas include those built during the late 1990s, early 2000s and most recently in 2009.

The average price increase for detached houses varies. The highest price increase is seen in detached houses in the City Center *Ger*. While generalizing price trends based on a small sample size is difficult, the analysis shows that the closer to the city center, the higher the price. The price increase is most evident in the City Center *Ger* area and least in the Fringe *Ger* area. As for the annual costs of operation and maintenance, *ger* residents reported that they spend Tg700–Tg2,800 ($0.5–$2.0) per m², a contrast with the cost for apartments, which ranged from Tg10,080 to Tg13,020 ($7.2 to $9.3) per m². The average price of a *ger* ranged from Tg29,400 to Tg8.5 million ($21 to $6,071) with average of Tg607,600 ($434).

Housing finance is mostly done through personal savings, and only a small percentage of housing finance is possible via loans from banks or other formal sources. In the case of detached houses, only 2 percent to 9 percent of the total price is financed through loans. The analysis shows that households in the Mid-tier *Ger* and the Fringe *Ger* had very limited access to bank loans, amounting to less

TABLE 3.8. House Financing Sources (million Tg)

		SELF-FINANCING	(%)	LOANS FROM BANKS OR OTHERS	(%)	TOTAL
City Center *Ger*	Detached houses	7.197	91.2	0.692	8.8	7.888
	Apartment	31.510	89.6	3.653	10.4	35.162
Mid-tier *Ger*	Detached houses	10.521	97.7	0.242	2.2	10.765
Fringe *Ger*	Detached houses	5.487	95.3	0.267	4.7	5.754
Apartment area		31.245	80.7	7.463	9.3	38.709

TABLE 3.9. Level of Satisfaction with Housing Conditions (% of respondents in *ger* area)

	VERY SATISFIED	MODERATELY SATISFIED	MODERATELY DISSATISFIED	VERY DISSATISFIED
City Center *Ger*	9.8	63.2	20.2	6.8
Mid-tier *Ger*	46.8	46.7	5.3	1.2
Fringe *Ger* (Sharhad)	4.4	37.3	8.3	50.0
Apartment area	32.1	53.2	9.2	5.5

than 5 percent of the total housing price. Apartment residents, however, reported that they borrowed a higher portion from banks or other creditors: 10.3 percent and 16.7 percent in the City Center *Ger* apartment and apartment areas respectively. This finding reflects the fact that mortgage lending for housing is still an evolving concept and only the well-to-do can borrow from financial institutions.

As for satisfaction with housing conditions, there seem to be diverging views among *khoroos*. Almost all residents in the Mid-tier *Ger* said they were "very satisfied" or "moderately satisfied" with their housing. In the Fringe *Ger*, however, more than one-half of survey respondents voiced a lack of satisfaction with their housing. Such a difference is probably caused by the fact that the Mid-tier *Ger* has existed for a long time and residents have had the time to improve their housing condition, while Fringe *Ger* residents are relatively newly settled and hence have not had the time and opportunity to improve their situations. In the City Center *Ger* and apartment area, a majority of residents indicated they were comfortable with their housing. As to the reasons for dissatisfaction with housing, residents in both the City Center *Ger* and the Mid-tier *Ger* ranked water supply, drainage and sanitation as the most immediate concerns. Fringe *Ger* residents ranked the size of rooms, lack of a proper kitchen and heating as reasons for dissatisfaction, in addition to water supply, drainage and sanitation.

While *ger* residents expressed a relative comfort in their housing conditions, with the exception of the Fringe *Ger* (Sharhad), survey respondents seem quite dissatisfied with the broader environment in which they live. This is most apparent in Fringe *Ger*, where more than 90 percent of respondents said they were "highly dissatisfied." In contrast, most residents in the Mid-tier *Ger* answered that they were "moderately" or "very satisfied" with their living environment. The differences between the Mid-tier *Ger* and Fringe *Ger* may be attributed to their respective characteristics as *ger* areas: the Mid-tier *Ger* has existed for many years, while the Fringe *Ger* is relatively new and still expanding. In the Mid-tier *Ger*, more than 70 percent of residents live in detached houses, indicating that the

TABLE 3.10. Level of Satisfaction with Living Environment (% of respondents in *ger* area)

	VERY SATISFIED	MODERATELY SATISFIED	MODERATELY DISSATISFIED	VERY DISSATISFIED
City Center *Ger*	6.5	26.9	23.8	42.8
Mid-tier *Ger*	36.3	38.6	22.8	2.3
Fringe *Ger*	0.0	1.9	7.8	90.3
Apartment area	17.6	27.8	15.7	38.9

population has been there for a period of time; this also can be linked to the high level of satisfaction with housing conditions.

Asked why they are dissatisfied with their living environment, Fringe *Ger* residents pointed to a range of social and public infrastructure deficiencies, including school facilities, health services, roads, public parks, garbage collection, etc. For City Center *Ger* and Mid-tier *Ger* residents, access to school and health services seem to be less of a concern but road access, limited public space, garbage collection, air pollution and crime were rated as important reasons for dissatisfaction in their living environment. In the case of apartment area residents, air pollution, limited public space, and traffic congestion were rated as the primary reasons.

Preferred Dwelling Type and Development of *Khoroo* Areas

In light of the government policy to modernize existing *ger* areas by building apartment complexes, *ger* areas in the vicinity of the city center and mid-range *ger* areas will develop apartment complexes or a combination of apartments and detached houses. Survey questionnaires included households' preference for dwelling type and development patterns in *khoroo* areas to determine how the city government's policy is in line with *ger* residents' preferences for housing and development options.

The survey analysis shows that a conversion to apartments seems to be the option most preferred among residents, especially in the City Center *Ger* and Fringe *Ger*. In the Fringe *Ger*, more than 95 percent of residents said they would like the area to be developed with apartment complexes. Since the same residents are most dissatisfied with their housing and living environment, it may be that the residents see apartments as the ultimate solution for improving their living environment and housing. In the City Center *Ger,* more than 60 percent of residents preferred an option to convert their district into an apartment area; a minority favored redevelopment with a combination of apartments and detached houses. About 13 percent of the City Center *Ger* residents responded that they would not like to see the area developed but would prefer to improve existing houses or supporting infrastructure.

Responses from the Mid-tier *Ger* were somewhat different from the other two *khoroos*. Residents in the Mid-tier *Ger* seem to want to maintain the current characteristics of *gers* with a partial

TABLE 3.11. Preferred Options for *Khoroo* Development (% frequency)

	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Build apartments in all *khoroo* areas	61.6	16.4	95.1
Redevelop the entire areas of *khoroo* with a mix of apartments and detached houses	21.4	17.5	1.0
Build apartments in some parts of *khoroo*	2.0	17.5	1.5
Develop a mix of apartments and detached houses in some *ger* areas	1.3	24.0	0
Do not redevelop the area but improve existing housing and supporting infrastructure	13.0	24.0	2.4
Keep the *khoroo* as it is	0.7	0.6	0

TABLE 3.12. Preferred Dwelling Type (% frequency)

	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
High-rise apartment buildings	14.9	6.9	37.1
Low-rise apartment buildings	69.3	79.3	0
Newly built detached houses	15.8	13.8	47.4
Others (*ger*, dormitory, etc)	0	0	15.5

Note: High-rise apartment buildings are 10 stories or more with multiple buildings in a complex; low-rise apartment are five stories or less with one or two buildings in one complex.

development of their *khoroo*, including a mix of apartments and detached houses—or keeping the *khoroo* as it is while improving existing houses and infrastructure. This is probably explained by the relatively high level of satisfaction with housing conditions and the living environment expressed by these residents.

In general, surveys found that *ger* residents seem to prefer apartment buildings over single detached houses or *gers*. As for a particular type of apartments, these residents said they would prefer low-rise rather than high-rise buildings. A large share of residents in the City Center and Mid-tier *gers* said they wished to live in apartment buildings of five stories or less, with one or two buildings grouped together in a complex. They chose this style in preference to high-rise buildings (ten stories or more) with multiple buildings grouped together. The focus group interview also suggested that many residents are interested in low-rise multi-family buildings. In the case of the Fringe *Ger*, where about 95 percent of survey respondents answered that they would like their *khoroo* to be developed into an apartment area, residents in fact said they would prefer to live in newly built detached houses. This may reflect the resident's awareness that their income level is below what is required for apartment buildings.

IMPLICATIONS OF *GER* AREA HOUSING DEVELOPMENT OPTIONS

Implications for GoM: The above survey results suggest the following implications when considering *ger* housing development options.

- Residents of most *ger* areas seem generally content with their housing. In particular, families who have lived in the area for a long period have replaced *gers* with detached houses, and they are quite comfortable with their current housing. An exception is found in the remote Fringe *ger* area, where members of households expressed a very low level of satisfaction; this reflected the characteristics of that area, which is fairly new and still expanding.
- By contrast, *ger* area residents seem generally dissatisfied with the broader environment in which they live. This is mainly due to such factors as air pollution and the lack of key infrastructure and social facilities, including roads, garbage collection, and public space.
- Many residents, especially those living close to the city center and in the remote *ger* areas, would prefer to live in apartments. However, a significant number of residents, especially in the Mid-tier *Ger* area, want to keep their existing housing but with improved living conditions and better infrastructure and services.

Ger residents seem to prefer small concentrations of low-rise, multi-family apartment buildings, as opposed to large concentrations of high-rise buildings.

TABLE 3.13. Income, Asset and Housing Price in City Center *Ger*

		AVERAGE MONTHLY INCOME (TG)	AVERAGE MONTHLY SAVINGS (TG)	TOTAL ASSETS (MILLION TG)	CURRENT HOUSING PRICE (MILLION TG)
City Center *Ger* (Naran)	*Ger*	257,600	92,400	22.69	1.91
	Detached house	376,600	93,800	53.57	28.97
	Apartment	488,600	204,400	80.62	61.23
Apartment Area	Apartment	446,600	29,400	38.93	43.11

Note: Housing price is benchmarked as average price of apartments in City Center and apartment area.

- The real estate market is still forming in Mongolia. Housing prices seem to be determined on an ad-hoc basis, though there are some consistent correlations between location and housing price, and between dwelling type and housing price.
- Housing in the *ger* areas is financed mostly through private savings. Even for residents who have steady incomes and could afford to purchase apartments, getting loans from commercial banks at an affordable rate would be a key challenge. This is because bank loans are scarce and credit and mortgage market are still evolving.
- A majority of residents in the three *ger* areas will not be able to afford any of the apartment buildings the government proposes to build. Given the affordability issue, low-cost housing and/or low-income public rental housing should further be examined as alternatives.

Implications for Households in the City Center Ger (Naran): Under the government's plan, some parts of this *khoroo* will be converted to high-density apartment complexes. An affordability analysis shows that income level, asset holding, and savings in Naran are not significantly different from residents already living in apartments[13]. If the area is converted to apartment complexes targeted for middle-income households, most of the residents in detached houses should be able to afford newly built apartments, if they wish, since they share similar socio-economic characteristics as residents of the city center. Even so, these residents would need to finance about 10 percent to 20 percent of the cost using bank loans. Thus, the lack of mature credit market could become a key constraint for them.

TABLE 3.14. Income, Asset and Housing Price in Mid-tier and Fringe *Gers*

		AVERAGE MONTHLY INCOME (TG)	AVERAGE MONTHLY SAVINGS (TG)	TOTAL ASSETS (MILLION TG)	CURRENT HOUSING PRICE (MILLION TG)
Mid-tier *Ger*	*Ger*	190,400	4,200	8.74	—
	Detached house	225,400	26,600	24.83	17.59
Fringe *Ger*	*Ger*	232,400	—	6.96	1.00
	Detached house	225,400	16,800	21.37	18.69
Apartments in City Center *Ger*		349	488,600	204,400	80.62
Apartment area		446,600	29,400	10.93	43.11

Residents living in *gers*, however, face a different story: Their income levels and asset values are only about 70 percent and 40 percent, respectively, of residents of detached houses. *Ger* residents will be less able to afford apartments. For residents living in areas scheduled to be converted, the affordability issue will not be of great importance because developers are likely to compensate them by granting them apartments in exchange for their land.

In newly built apartment areas in Naran, the financial burden of maintenance and operation for housing and other utilities will increase greatly. For detached houses, the annual cost per square meter of maintenance and operation ranges from about Tg1,400–Tg7,000 ($1–$5); maintaining a *ger* costs practically nothing. When residents move into apartments, their costs would rise to Tg9,800–Tg12,600 ($7–$9) per square meter per year.

Implications for Households in the Mid-tier and Fringe Gers: Socioeconomic conditions in these two *ger* areas are much worse than in the City Center *Ger* and apartment areas. The current market price of apartments—ranging from Tg42 million to Tg63 million ($30,000 to $45,000)—is clearly beyond the affordability range for *ger* residents whose average annual income is about Tg2.52 million ($1,800). These residents will probably have to stay in their existing houses, even if they wish to move to apartments.

In the case of the Mid-tier *Ger* (Bayankhoshuu), a majority of people responded that they are relatively content with their housing conditions and would like to see improvements in the living environment, rather than moving to new homes. Hence, maintaining the status-quo on housing does not seem much of a concern for them. Residents of the Fringe *Ger*, however, would prefer to move into apartments but, because of their poor economic condition, probably will have to make the accept the more realistic alternatives of building or improving their *gers* and detached houses.

4 Water Supply

STATUS OF CURRENT WATER SUPPLY IN *GER* AREAS

FIGURE 4.1. Water Containers Filled at a Water Kiosk

Water Kiosks: The current status of water supply and sewer services is fairly consistent across the three *khoroos* under review. No house or *ger* in any *ger* area of UB has a private connection to water distribution networks. Residents instead purchase water at kiosks. More than 550 kiosks have been developed across the *ger* areas of UB, some 460 of which are managed by USUG—the public water supply and sanitation utility company owned by the municipal government of UB[14]. The rest are contracted out to private operators. About 66 percent of the kiosks depend on tanker trucks operated by USUG for water delivery; most of the rest are connected to water distribution mains, which have been developed under the two World Bank-financed UB Service Improvement Projects. A small number of kiosks in remote areas depend on local water wells. (See Annex E for the distribution of kiosks.[15])

Access to kiosks: Kiosks have been located so that each serves about 900–1,200 people, in line with the city's benchmark of 1,000 people per kiosk. For most residents, kiosks are located within 100–500 meters. Table IV.1 summarizes the distributions of kiosks in the three *khoroos* under review, and Annex E provides information on broader *ger* areas.

Services: The selling schedule is generally 10 am–8 pm, with a mid-day lunch break. Residents report that 83 percent of kiosks provide water according to this schedule, with exceptions usually due to supply breakdowns or kiosk employees not following the schedules; 88 percent indicated that this schedule was suitable.16 Kiosks fed by tanker trucks are less reliable due to limited capacity,

TABLE 4.1. Distribution of Kiosks in Three *Ger* Areas *(Data from USUG)*

GERS/KHOROOS	PIPE-FED KIOSKS	TRUCK-FED KIOSKS	NUMBER OF RESIDENTS PER KIOSK	DISTANCE FROM KIOSK (M) FOR MOST RESIDENTS
City Center *Ger* (Naran)	9	1	1,225	500 m
Mid-tier *Ger* (Bayankhoshuu)	9	0	887	100 m
Fringe *Ger* (Sharhad)	5	5	1,113	500 m

breakdowns and traffic. While it is cumbersome for residents to transport 10–30 liters of water from kiosks to their houses a couple times a week, most of them accept the current practice. Approximately three-quarters use carts for transport, while 2 percent (mostly those living more than 600m from a kiosk) use vehicles[17]. Water transport is made difficult by the weather and the lack of infrastructure: rocky or icy surfaces, speeding traffic, trash-strewn roads, and steep inclines are the most frequently-described obstacles.[18] Even so, residents are relatively content with the water supply situation, as compared to other more pressing problems such as the lack of solid waste collection, drainage and proper sanitation facilities.

FIGURE 4.2. Young Children Load Water for Transport

Affordability: Affordability of water purchased at kiosks is not a significant issue for residents. Household expenditures for water represent less than 3 percent of *ger* residents' average income, even though that income is quite meager: around Tg657,000 ($469) per year for the lowest quintile. Residents can afford water because their consumption is extremely limited: around 5–10 liters per person per day due to inconvenient transportation. The water tariff at kiosks is Tg1,000 ($0.71) per cubic meter, or Tg1 (less than $0.01) per liter. The cost of water, type of dwelling, or household income levels do not seem to affect per capita consumption.[19] Table 4.2 below presents detailed data on water expenditures compared to income.

Utility company: The USUG is the water supply and sewerage company in charge of developing, maintaining and operating kiosks, except for about 90 kiosks that have been contracted out to private operators. For the USUG, kiosks lose money since the existing tariff of Tg1000 ($0.71) per cubic meter is well under the full unit cost of kiosk water supply operations, which is estimated at somewhere between Tg3,200–Tg4,300 ($2.29–$3.07) per cubic meter, depending on the types of water delivery (truck-fed or piped) and the complexity of construction. Providing water via kiosks is estimated to be more than ten times more expensive than the cost of central water supply to apartments (Tg280, or $0.20, per cubic meter[20]). Each kiosk incurs annual losses in the range of Tg10 million–Tg26 million (~$7,100–$18,600), depending on sales volume, which resulted in USUG annual operating losses of Tg4.1 billion ($2.9 million) in 2008[21]. The biggest portion of kiosk operating costs is for the salaries of kiosk operating personnel: estimated at 51 percent of the total unit cost of piped-kiosks and 44 percent of truck-fed kiosks[22]. For truck-fed kiosks, fuel and operating costs of tanker trucks represent more than 30 percent of the unit cost. For pipe-fed kiosks, depreciation charges (or debt service) of the distribution pipe network are 25 percent of total unit costs. More details are reviewed by specific *ger* areas below.

TABLE 4.2. Household Water Expenditure and Income

INCOME QUINTILE	HH INCOME (TG/YEAR)	HH EXPENDITURE ON KIOSK WATER (TG/PER YEAR)	PERCENT OF INCOME (HH SURVEY RESPONDENTS)
Highest	5,389,809	16,897	0.3%
4th	2,963,326	16,466	0.6%
Middle	2,075,552	14,706	0.7%
2nd	1,412,200	16,764	1.2%
Lowest	657,144	18,582	2.8%
Total	**2,496,897**	**16,701**	**0.7%**

Source: HIES 2008

Wastewater: There is no sewerage service in *ger* areas since the sewer network has not reached beyond the central apartment areas. Disposal of wastewater in *ger* areas is not a major issue for now, but it will have to be resolved in the long-run. Because of the minimal amount of water consumption in the *ger* areas and the extreme climate of the country, sewer collection would face almost unsolvable technical challenges unless the *ger* residential areas are converted to fully-served apartment dwellings. Therefore, wastewater issues are only lightly discussed in this report.

Sanitation: Most households have pit latrines, the majority of which are not ventilated. Lined latrines are used to a varying degree from *khoroo* to *khoroo*. (See Table 4.3 for a breakdown of latrine types.[23]) While various donors offer programs to improve latrines, none of these programs seem to have made any large-scale impact in *ger* areas, and some donors have withdrawn support for improved latrines. It does not appear that there is much incentive for *ger* area residents to invest in improving latrines, either. Because of the extremely cold climate of the country, existing programs have proven difficult to adopt in UB or have been very costly. However, the negative environmental impact—pollution of soils and ground water and the poor health conditions of *ger* residents—is obvious and will require more focused attention. Because of the current lack of a clear solution, the household sanitation issue is not addressed in this report.

CITY CENTER *GER* (NARAN), 11TH *KHOROO*, BAYANGOL DISTRICT

Options of service improvement

A large-scale development of apartment buildings is expected given the proximity of the *khoroo* to the city center. If apartment buildings are built, they will be connected to the water supply mains. All the apartments will have tap water, as well as hot water supply.

FIGURE 4.3. A Water Kiosk in the *Ger* Areas

Costs of water supply and wastewater service to apartment buildings

Water supply mains and sewer collectors already exist near this area, therefore the capital costs of connecting new apartment complexes to existing service will be minimal. A preliminary development plan prepared by the UB municipal government envisages development of apartment complexes for some 2,450 households, as well as commercial and community infrastructure near this area. It would cost only an estimated Tg1.855 billion ($1.325 million) to connect these apartment complexes to the existing water supply mains and wastewater collectors; installing booster pumps would cost around Tg770,000 ($550) per household.

Key assumptions are as follows: The total water consumption in these complexes would be 3,350 m^3 per day (270 liters per day per capita, which is in line with the current average consumption of apartment residents); pipeline length is 3.1 km for water supply and 3.4 km for sewer collectors; and pipe diameters are DN100–DN500 for water supply and DN250–DN400 for wastewater. The costs of pipes, fittings and water meters within the apartment buildings are not included in this estimate and will be included in the selling prices of the apartments.

The estimated unit operating cost of water supply, including maintenance, is the same as the ongoing costs of water supply for existing apartment buildings in the city, estimated at Tg280 ($0.20) per cubic meter. The water supply tariff for apartment residents is currently Tg167 ($0.12) per cubic meter, which is well below the unit cost of supply. This subsidy causes enormous financial deficits for the water utility company, USUG.

Financial and economic implications of service improvement

Consumer economic benefits: Apartment residents are known to consume large quantities of water because it is heavily subsidized and usage is not metered. The consumption at the new apartment complexes is expected to remain at around 270 liters per person per day, as currently observed in many apartments. This would represent a drastic increase over the current water consumption of current *ger* area residents, who use only about 5 to 10 liters per person per day. Therefore, while the residents of the new apartment complexes are unlikely to be the same current residents of this *khoroo*, there will be significant increase in consumer benefits.

Financial implications: The pricing of water supply for apartments will remain the most critical policy issue. If the current level of heavily subsidized tariffs continues and water consumption increases drastically, the financial performance of the already loss-making water supply operations in UB will be worsened to a calamitous level. Current financial losses of USUG from apartment residential operations are estimated at Tg41 billion ($29.3 million) for 2008.

Fiscal implications: Mainly due to significant delays in tariff adjustments for apartments, the USUG is not in a position to service debt obligations on various foreign loans, including subsidiary loans and loans from World Bank USIP1 and USIP2, and the Spanish Government. The outstanding debt obligations amount to some Tg42 billion ($30 million). Currently, the MUB is making debt repayments and interest payments on behalf of USUG, thus subsidizing the company's financial losses. If tariff increases are not enacted and water consumption increases in new apartment development, these implicit subsidies also will increase, thus having a significant negative effect on the fiscal performance of MUB.

Other implications

If additional water sources need to be developed (along with the necessary infrastructure), additional costs will be incurred, though not attributable only to conversion of houses to apartment buildings. Also, while it is difficult to quantify at this stage, the opportunity costs to the environment of tapping into precious water resources will have to be considered.

There also may be implications for the capacity of the wastewater treatment plant of USUG, since the water consumption volume in this area will significantly increase at the new apartment complexes. There is only one large-scale WWTP in UB with peak flow of 180,000 cubic meters per day, as well as a couple of small independent treatment facilities, including one near the UB international airport.

MID-TIER *GER* (BAYANKHOSHUU), 8TH *KHOROO*, SONGINO KHAIRKHAN DISTRICT

Options of service improvement:

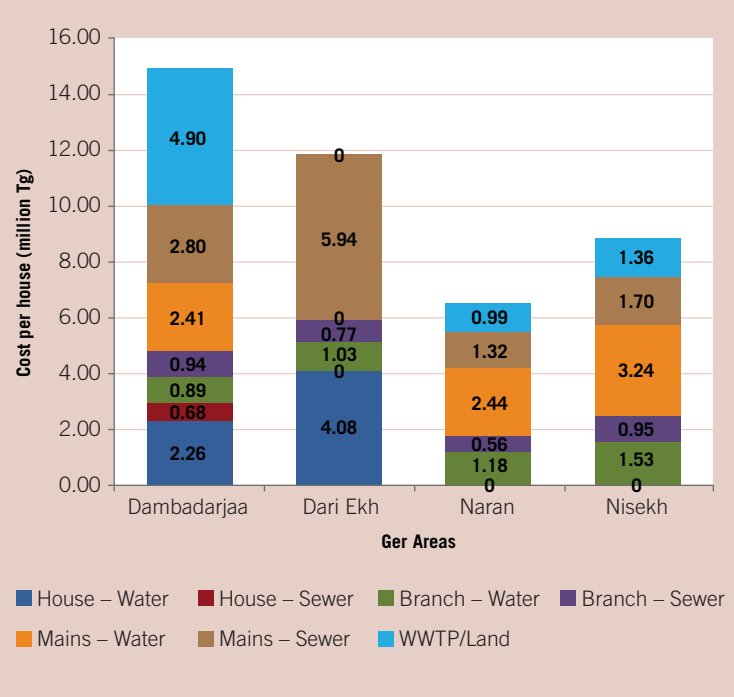
Some higher-income residents may wish to obtain private water supply connections for their houses. Other affluent residents might wish to consolidate their land plots and build small-scale residential structures for multiple family dwellings. However, insulating water pipes to protect them from freezing temperatures will be a daunting engineering challenge, and the engineering viability of private connection needs further review. So far, there have been no private water connections to any houses in UB. In addition, wastewater branches will have to be connected to the nearest sewer network. If no sewer network serves the area, other methodologies such as mini-treatment plants will have to be pursued.

Cost of service improvement:

Several engineering estimates indicate that private connection costs for houses in *ger* areas would be in the range of Tg5.6 million–Tg16.1 million ($4,000–$11,500) per household, excluding in-house materials such as sinks and faucets. The cost depends on many factors in each area, including proximity to the existing water supply networks, connectivity to sewer treatment systems and topography.

The breakdown of costs is as follows: Construction cost of branches for water distribution/sewer collection and main networks for water/sewer per household amounts to about Tg5.6 million–Tg7 million ($4,000–$5,000 per household), excluding construction costs within each private property. The additional cost of connecting to houses within their private property would be around Tg2.8 million–Tg4.2 million ($2,000–$3,000) per household. This means, typically, the total private connection cost will be around Tg8.4 million–Tg11.2 million ($6,000–$8,000). If a small wastewater facility has to be built because the wastewater main networks have not reached the area, the capital development cost of the independent small wastewater treatment plant will be an additional Tg4.2 million–Tg4.9 million ($3,000–$3,500) per household. So, the total cost in more expensive cases of private connection will be around Tg12.6 million–Tg16.1 million ($9,000–$11,500) per household. Details of the breakdown of capital cost for private connection are presented in Figure 4.4.

FIGURE 4.4. Examples of House Connection Costs



Since there is no existing water supply tariff for individual houses, tariffs for water consumption would be set at somewhere between the current apartment water tariff (currently Tg167, or $0.12, per cubic meter) and the *ger* area kiosk water tariff (currently Tg1,000, or $0.71, per cubic meter). Assuming that consumption would increase to 70–80 liters per capita per day, monthly water bills are estimated to be around Tg19,000–Tg115,000 ($13–$82) per four-person household per year.

Affordability and willingness-to-pay for house connections would be major issues, as the average annual income of even the wealthiest quintile of *ger* residents is Tg5.4 million, or $3,600. Options for consideration might include cost-sharing and public contributions to the cost of connecting each private service to the distribution/collection networks. Even if the costs are shared or subsidized at the beginning, consumers might eventually be required pay all the costs through their tariffs.

Benefits of service improvement

Consumer economic benefits: The direct benefit to consumers will be quite significant because the household consumption will definitely increase from the current level of 5–10 liters per person per day to as much as 60–70 liters per person per day—more than a ten-fold increase in some cases.

Utility company: The city-owned utility company could recover its costs if private houses are required to pay the actual cost of water delivery and ongoing operations. But if the current, heavily-subsidized apartment residential tariff is applied to private houses, the utility company will incur substantial losses.

Fiscal implication: Also, depending on who bears the cost of connecting private plots to the water distribution mains (either in the form of direct counterpart contribution at the time of construction, or through tariff collection later on), this expansion of service could put a fiscal burden on the municipality.

Other implications

In the long-run, providing piped-in water service to many more homes will require expansion of the city's sewer network and wastewater treatment capacity.

FRINGE *GER* (SHARHAD), 9TH *KHOROO*, BAYANZURKH DISTRICT

Options for service improvement

Construction of more tanker-fed kiosks with more reliable water delivery is desired for the short term. In the long-run, construction of a water main might be considered for connecting the kiosks to water supply mains, depending on the relative costs and benefits of the two options (tanker-fed kiosks or network-connected kiosks).

Cost of service improvement

The cost of building kiosks is relatively small: Tg12.6 million ($9,000) per kiosk. However, both pipe-fed kiosks and truck-served kiosks are relatively expensive to operate. This is due to the high cost of personnel required to operate both types of kiosks, the high fuel and operating costs for water tanker trucks for truck-fed kiosks, and capital construction cost of the water distribution network for the networked-kiosks. The capital costs of network construction and rehabilitation/construction of kiosks are presented in the Table 4.4.

Total unit costs for networked kiosk water supply are estimated at around Tg3,280–Tg4,260 per cubic meter, compared to the unit cost of central apartment water supply operations of (Tg280 per cubic meter). Depending on construction methods and cost calculation methods (e.g., attribution of associated central network operation costs and allocation of capital investment costs), the unit costs of piped-kiosk water supply seem to be lower or equal to the unit cost of trucked-kiosk water supply. According to the "2008 performance indicator" calculations made by USUG, the unit cost of piped-kiosk water supply was Tg3,280 ($2.34) per cubic meter (excluding USIP2-related capital costs) and the unit cost of trucked-kiosk water supply was Tg4260 ($3.04) per cubic meter. A World Bank task team has estimated that the unit cost of piped-kiosk water supply is around Tg4,250 ($3.04) per cubic meter (with fully-loaded USIP2-related capital costs) and the unit cost of trucked-kiosk water supply is around Tg4,260 ($3.04) per cubic meter.

Conversion of truck-supplied kiosks to networked-kiosks would make sense only if a drastic increase in consumption is expected, since the cost advantage for networked-kiosks is only marginally proven vis-à-vis the cost of truck-supplied kiosks However, it should be noted that either type of kiosk water supply is very costly when compared to piped-in water supply to apartments. Even with the increased tariff of Tg1000 ($0.71) per cubic meter, kiosk water supply is a huge loss-making operation for the utility company.

TABLE 4.4. Example: Capital Costs of Network/Kiosk Construction[24]

GER AREAS	CAPITAL COSTS (MILLION TG)	# OF KIOSKS
Bayankhoshuu North	Tg 6,638	36
Bayankhoshuu South	Tg 1,954	29
Chingeltei	Tg 1,712	24
Dari-Ekh	Tg 959	16
Dambadarja	Tg 2,259	26
Total	**Tg 13,524**	**131**

Benefits of service improvement

Consumer economic benefits: Converting kiosks from service by trucks to service by networked pipes will have little impact on consumption,

TABLE 4.5. Unit Cost Estimates of Kiosk Water Supply (Tg per m^3)

	TRUCKED-KIOSK	NETWORKED-KIOSK
USUG estimates	4,260	3,280
WB task team estimates	4,250	4,260

and therefore should not be seen as a direct benefit to consumers.

Financial implications: For the USUG, kiosks will remain as loss-making operations with the current level of tariff at Tg1,000 ($0.71) per cubic meter. The more kiosks are built, the bigger the losses would be. The financial loss of one kiosk for a *khoroo* is estimated at Tg19million (~$13,600) per year, and there are more than 550 kiosks in UB.

Fiscal implications: USUG will not be able to meet debt repayment obligations for the construction of water mains and kiosks as long as the current level of tariffs prevails. Therefore, MUB will have to assume the debt repayment obligations of USUG.

5 Municipal Roads and Public Transport

CURRENT STATUS OF ROADS IN CITY CENTER, MID-TIER, AND FRINGE *GERS*

The condition of road networks in the three *khoroos* reviewed in this study is largely similar. Most of the roads began as informal tracks to *hashaas* and *ger* households under development. As subsequent *hashaas* were plotted out and land taken, tracks were simply extended to reach them. There was no formal planning involved, and with time the tracks evolved in a haphazard manner to become "earthen roads." As a result, they have little connectivity or integration with the formal municipal road network.

The earthen roads in each of the *khoroos* have no predetermined alignments, are not built to any standards, lack consistent dimensions, and are completely devoid of supporting facilities, including drainage systems, sidewalks and space for parking. Street lights are evident along some of the roads, but many do not work and others are unreliable. Along any given corridor, the width of available rights-of-way ranges from about 2.5 meters to 16 meters, and the roads often have sudden and unexpected sharp turns. The roads are suitable only for smaller vehicles because larger ones are unable to negotiate the unforeseen narrow passages and tight turns. In some instances, these earthen roads end abruptly at certain geographic features, such as deep ravines or gullies, or steep hillsides.

Except during the rainy season, vehicles driving along the earthen roads create dust. When it does rain, the roads turn to mud. Because there is no proper drainage, water flows from the surrounding

FIGURE 5.1. An Earthen Road in the Mid-tier *Ger* (Bayankhoshuu)

slopes onto the roadway. This accelerates deterioration and creates a nuisance for people living in the area. During winter months, the snow and ice on steeper slopes can create treacherous driving conditions. Residents complained of having to wash clothes and shoes more than normal because of the earthen roads.

Shallow ravines are common in *ger* areas, and it is not unusual for these ravines to be used as roads during dry periods. Typically, *hashaas* are situated along both sides of a ravine with fences built to the edge. During heavy rains or prolonged wet periods, the ravines flood, cutting off a route for vehicles. The rains also bring trash and garbage onto roadways, creating health hazards.

Approximately 10 percent of the road network in the three *gers* is paved. However, most of the paved networks tend to be large arterial roads that border the *gers*. The short segments of secondary paved road that penetrate the *gers* tend to be in very poor condition and have deteriorated so much that they need to be reconstructed. Most roads have a PSR roughness[25] of between 1 and 2, which means they are passable but not in good condition. The exceptions to this are located in the City Center *Ger* (Naran), in which there is a 1.5 km stretch of paved road that bisects the *ger* area, and a short segment of Khasbaatariin Street, both of which are in good condition. Although the districts are responsible for maintaining *khoroo* roads, preventive maintenance is almost never undertaken. Table V.1 provides a snapshot of road type by length in each of the *gers* included in this study.

If one excludes the City Center *Ger*, the percentage of paved roads drops significantly to just over three percent.

CURRENT STATUS OF PUBLIC TRANSPORT

Greater Ulaanbaatar Area. The public transport system in Ulaanbaatar consists of large buses, trolley buses, minibuses and taxis. According to estimates,[26] there are more than 155 million passenger trips per year, which equates to an average of around 435,000 passenger trips daily.

Public transport services are essential for enhancing people's mobility and access to work, school and other activities. In the greater Ulaanbaatar area, passenger transport demand consists of buses (34 percent), walking (30 percent), cars (25 percent), taxis (9 percent), and other (2 percent). The most popular mode of travel to work is by bus (39 percent), while 85 percent of students walk or use the bus to get to school. The average time it takes to get to work is 32 minutes and the average distance traveled is 4.5km.

TABLE 5.1. Road Type by *Ger*

TYPE OF ROAD	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*	TOTAL
Earthen	18,461	23,241	30,611	**72,313**
Paved	6,805	1,004	807	**8,616**
Totals:	**25,266**	**24,245**	**31,418**	**80,929**
% Paved Roads	26.9	4.1	2.6	**10.6**

NOTE: The figures above are in meters unless otherwise specified.

Large buses typically seat between 40 and 50 passengers, while minibuses have seating for 12 to 15 passengers. Bus fares, which are set by the municipality, are Tg300 ($0.21) for large buses, between Tg200 ($0.14) and Tg400 ($0.29) for minibuses (depending on distance traveled), and Tg400 ($0.29) per km for taxis. However, with only around 25 percent of passengers paying the full price on large buses, the government is obliged to heavily subsidize fares. Nearly 100 percent of passengers using minibuses pay full fare.

City Center, Mid-Tier and Fringe *Khoroos*. With the exception of the Sharhad Bus Station,[27] which is on the edge of the *khoroo* boundary in the Fringe *Ger*, only minibuses and taxis provide service to the three *gers*. However, services are limited by poor road quality, an inability to access all areas during inclement weather, and drivers' unfamiliarity with the destinations within the *gers*. In each of the three *khoroos* under study, approximately 20 percent or less of households own vehicles.[28] As a result, the share of walking is high among families that do not own a vehicle, and the use of public transport is high among all households. The use of bicycles and motorbikes is not common.

Rough estimates indicate that inhabitants of the three *gers* get to work using public transport services (buses) 58 percent of the time, followed by walking (29 percent) and family vehicles (13 percent). These figures would indicate that residents rely almost twice as much on public transport (buses) to travel to work as do citizens of other districts (34 percent), and that they use private vehicles half as much (13 percent vs. 25 percent). The average travel time to work (25 minutes) is roughly the same as for residents of other districts, but the average distance traveled (8 km) is almost twice as far. Since residents rely heavily on public transport to get to work, initiatives to improve bus services to the *khoroos* should be considered.

In terms of traveling to school, 90 percent of students in the three *gers* walk the entire way or walk to catch a bus; this is in line with findings for students in other districts. However, it takes twice as long to get to school (16 minutes more) in these *gers* than in other districts, even though the distance is nearly one km less on average. Because so many students walk to school, construction of sidewalks and adequate street lighting are important priorities.

During informal interviews with 21 minibus driver/owners that currently provide services to the peripheries of the *khoroos*, all indicated that they would expand services *within* the *khoroos* if roads were widened and improved, i.e., paved.

Tables 5.2 and 5.3 provide snapshots of transport modes and travel times/distances for all districts in Ulaanbaatar and for the three *khoroos* in this study.

A casual observation of traffic counts[29] at select key intersections in each of the targeted *ger* areas reveals that in the City Center (Naran) and Mid-tier (Bayankhoshuu) *gers*, the overwhelming percentage of vehicles observed

TABLE 5.2. Transport Modes in UB

TRANSPORT DEMAND BY MODE	ULAANBAATAR	TARGETED *GER* AREAS
Bus	34%	58%
Walk	30%	29%
Family Vehicle	25%	13%

TABLE 5.3. Travel Times and Distances in UB and *Ger* Areas

TRAVEL TIMES AND DISTANCES	ULAANBAATAR	TARGETED *GER* AREAS
To work (averages)	32 mins./ 4.5 km	25 mins./ 8.0 km
To school (averages)	27 mins./ 3.3 km	43 mins./ 2.5 km

TABLE 5.4. Observed Vehicles in Targeted *Ger* Areas

DISTRICT	CARS	%	BUSES	%	TRUCKS	%
City Center *Ger*	48,391	93	933	2	2,523	5
Mid-tier *Ger*	7,335	87	130	2	976	11
Fringe *Ger*	407	26	828	52	351	22
Totals:	56,133		1,891		3,850	

were passenger cars (Table 5.4). In the Fringe *Ger* (Naran), more than half of the vehicles were buses, presumably because the Sharhad Bus Station is located in the south central edge of the *ger*.

OPTIONS AND CHALLENGES FOR SERVICE IMPROVEMENTS

Options. Road quality and safe access for pedestrians seem to be the biggest concerns for residents of the three *khoroos*. When asked what measures were most needed to improve transport in their *khoroo*, 95 percent of respondents supported the improvement of district roads and the conditions for pedestrians.[30] Because the roads are too rough for most public transport operators to provide comprehensive service, many residents must walk long distances—up to 30 minutes in some cases—to reach their homes. In doing so, they must compete with vehicles for the limited space available, and they say that after dark, the lack of street lighting contributes to crime.[31] Improving roads would also facilitate access for emergency vehicles, including ambulances and fire trucks, and the delivery of goods and other services.

Increasing the coverage and frequency of public bus services is another priority area. When residents were asked what measures would improve the current transport situation in the three *khoroos*, more than 95 percent of inhabitants wanted improvements to bus and taxi stops.[32] When asked to assess the quality of minibus services in terms of convenience of transfer to other city buses, 45 percent responded that it was "bad" or "very bad."[33]

Challenges. One of the key reasons operators do not provide service to these areas is the extremely poor condition of roads, which prevents them from entering many areas. Improving road quality would encourage public transport providers to extend their operations in the three *khoroos*, and it would appear that demand is high for public transport services in these areas. While paving roads would increase access, it would also have a dramatic impact on area development, both in terms of land use and socio-economic activity. As such, any plans to pave or build roads in the *khoroos* must be considered in light of local land use plans.

If roads are to be paved, facilities for pedestrians, including sidewalks and street lighting, must be included. It would also make sense to consider preserving the rights-of-way for possible future utility services (power, water and waste water), although this could involve considerable additional expense. However, because of the significant cost involved, the provision of water supply and sanitation services should only be considered if there are apartment blocks along a paved road's alignment. If public transport services were to be extended into the *khoroos*, space would also be needed to construct lay-bys for public transport stops.

Another difficulty to paving roads in the *khoroos* is the likelihood that land will need to be acquired from property owners. Because there was no formal planning in the location of *hashaas*, plots are of various sizes. As a result, most of the earthen roads do not have straight alignments, and, instead, meander past and around *hashaas* and natural geographic features. Complicating matters are the fences that most owners have built to enclose their *hashaas*, many of which extend into the path of the earthen roads. Depending on the alignment of the road to be paved, some inhabitants or economic activities might need to be relocated.

Maintaining the improved roads would present another challenge. The value of maintaining roads has long been recognized: Roads in good condition reduce vehicle operating costs, decrease travel times, and contribute to safe driving conditions. International good practice calls for countries to spend about 1 percent of their GDP to maintain existing roads. For Mongolia, which had an estimated GDP of around $3 billion in 2008, this would imply expenditures in the range of $30 million per year. However, only Tg4.2 billion ($3 million), or about 0.1 percent of GDP, was spent to maintain the country's network of roads in 2008. Any plan for road improvements will require a review of options for financing the cost of maintenance.

All road projects would need to be carefully reviewed and subjected to a variety of technical assessments. These would include geotechnical studies and hydrological reviews, as well as economic, financial, environmental and social analyses to ensure their viability and value for money.

Construction and Maintenance Costs

Typical Construction Costs.[34] Low traffic-volume roads and parking areas are often sealed utilizing double bituminous surface treatment (rather than hot mix paving) due to the cost savings that are possible.[35] In Ulaanbaatar, the cost to build roads using this method is about Tg28 million ($20,000) per km, and the municipality has issued a set of guidelines for using double surface treatment for *ger* area roads.[36] To drain storm water from the road surface and the base course, U-shaped roadside ditches, lined with stones in concrete, are proposed at a cost of approximately Tg70 million ($50,000) per km.[37]

The cost to build concrete sidewalks (one meter wide) is about Tg21,000 ($15) per square meter, and the cost to erect street lighting is around Tg420,000 ($300) per street light.[38] There would be an additional cost of some Tg14 million ($10,000) per km for cabling and control boxes.[39]

Typical Maintenance Costs. As a general guideline, countries should devote about 1 percent of GDP annually to maintain road assets. In Mongolia, this would equate to about Tg840,000 ($600) per km per year.[40] The average estimated amount spent to maintain and power street lighting in each of Ulaanbaatar's *khoroos* is Tg2.1 million ($1,500) per month.

City Center *Ger* (Naran): 11th *Khoroo*, Bayangol District

Roads

The *khoroo* covers some 162 hectares, has 12,245 inhabitants, and is characterized by hilly terrain. The *khoroo* has about 25.3 km of roads, 6.8 km of which are paved. The percentage of paved roads

is higher in this *ger* than the other two locations under study (27 percent compared to 4 percent and 2 percent), and the roads tend to be in better condition. However, most of the paved network runs along the eastern and southern periphery. There are also three vehicular bridges and eight foot bridges. In addition, residents have better access to public transport, due to its central location and dense concentration of inhabitants, than those in the other areas. It is, however, one of the older *ger* areas, with even less order in the placement of *hashaas* and *gers*. As such, when one leaves the paved network, the streets tend to meander more and are narrower, which creates a challenging environment for vehicular movement.

Because of the hilly nature of this *khoroo*, and due to the lack of protective measures on the steep slopes, large stones and boulders have been known to roll down the hillsides after heavy rains, diminishing road width. During winter months, it often is not possible for vehicles to utilize the undulating narrow roads that are covered with snow and ice.

An existing 1,200 meter-long flood water dam was constructed between 1982 and 1985. It is in poor condition and garbage has accumulated at the dam wall. Illegal *ger* dwellers occupy the upper end of the floodway.

The city plans to build a series of apartment complexes in the southern half of the *khoroo*. The plans should provide for sufficient parking for the residents of the apartments.

It is estimated that 5 percent to 10 percent of *khoroo* residents own private vehicles. A quick observation of traffic indicates that this *khoroo* has the most daily traffic of the three under study. At the *ger*'s busiest intersection, Tasganii Ovoo, the average daily traffic is around 52,000 vehicles per day.

The vast majority of vehicles, 93 percent, are passenger cars; buses and microbuses account for less than 2 percent of traffic. This would tend to indicate that at Tasganii Ovoo Intersection, a lot of vehicular traffic originates outside of, or passes through, the area.

Public Transport

Although numerous public transport options serve the eastern and southern peripheries along main transport corridors, no regular microbus service is offered inside the *ger*. Taxis provide only limited access, primarily along the east-west road that bisects the *khoroo*. As a result, residents must typically walk from 100 meters to 500 meters to access public transport services. Because of the hilly terrain, this can be particularly challenging during winter, when temperatures regularly drop to –30 degrees Celsius, and during spring, when the rains turn the earthen roads to mud.

Options for Service Improvement

Because of its location in central Ulaanbaatar, the City Center *Ger* has more paved roads and better access to public transport services than the other two *gers* in the study. Nonetheless, improving roads and encouraging better public transport services remain important considerations. Residents indicated that their priorities would include the following investments:

Option 1. Upgrade and pave (including drainage, sidewalks and street lighting) the 1.2 km road that runs from the "Micro Road" on the southern periphery in a northerly direction past the District Center to the "TV Bus Terminal Intersection." This road used to be well-maintained and is paved for the first 200 meters off of Micro Road. When traffic builds on the main road, drivers use this road as a bypass.

Option 2. Remove the current restrictions that prohibit microbus operators from providing scheduled services along the main paved road that bisects the *khoroo* from east ("TV bus terminal") to west ("microbus #7 terminal"). Designated areas beside a road where microbuses can pull over and not impede traffic, or bus lay-bys, should be constructed, and sidewalks should be built along the length of the road. Street lighting is already in place.

Option 3. Provide paved sidewalks from the Microbus Terminal on the south-western periphery north about 2 km to the kindergarten. This alignment is steep and passes through a high-density area. It was reported that a number of citizens walk along this route because it is too difficult for most vehicles to access.

Although it is not currently planned as an option, it is highly recommended that adequate parking be provided for the residents of the planned apartment complexes. This is because of the already high percentage of passenger cars operating in and around the *khoroo*.

Cost of Service Improvements

The estimated cost of proposed service improvements 1, 2 and 3 are outlined in Table 5.5.

Financial and Economic Implications of Service Improvement

Economic Benefits to Residents. Benefits for residents would mainly come from improved road conditions (which would make a minor contribution to lowering vehicle operating costs), and more reliable and higher frequency of bus services (which would decrease travel times for some users by reducing the walking distance to catch a microbus). The sidewalk to the kindergarten would create safer walking conditions. These improvements would result in increased access to markets, schools, health clinics, other public services, and employment—as well as improved air quality due to the reduction of dust.

Fiscal Implications. Implementing the improvements proposed in this section would have fiscal implications, primarily in the form of funding required to maintain the new assets. The improved road would require routine and periodic maintenance, which is collectively estimated to cost Tg840,000 ($600) per km per annum (or Tg1 million/$720 per annum for the proposed road improvement project). If street lighting systems are provided at 50-meter intervals along the improved road, the cost to maintain and power them is expected to be less than Tg1.1 million (~$800) per year, Tg90 ($0.06) per resident.[41]

TABLE 5.5. Estimated Costs of Proposed Service Improvements in City Center *Ger*

CITY CENTER *GER* (NARAN) PROPOSED SERVICE IMPROVEMENT	LENGTH OR QUANTITY	COST/UNIT (MILLION TG)	COMPONENT COST (MILLION TG)	PER CAPITA COST (THOUSAND TG)
1. Upgrade & Pave 1.2 km from Micro Rd to TV Bus Terminal				
1.1 Road Construction (double surface treatment per km)	1.0	28	28	2.3
1.2 Road Drainage System (per km)	1.2	70	84	6.9
1.3 Sidewalks (per km)	1.2	21	25.2	2.1
1.4 Street Lighting (1 every 50 meters)	20	0.42	22.4	1.8
1.5 Cabling for Street Lights (per km)	1.2	14	30.8	2.5
Estimated Capital Cost:			*190.4*	*15.5*
2. Remove Restrictions on Microbus Operators (East-West Rd.)				0.0
2.1 Construct Bus Lay-bys (per km, 2 each direction)	4	28	112	9.1
2.2 Sidewalks (per km)	1.0	21	21	1.7
Estimated Capital Cost:			*133*	*10.9*
3. Provide Sidewalk from Microbus Terminal to Kindergarten				0.0
3.1 Sidewalks (per km)	2.0	21	42	3.4
Estimated Capital Cost:			*42*	*3.4*
Overall Estimated Cost of Improvements:			***365.4***	***29.8***

Mid-tier *Ger* (Bayankhoshuu): 8th *Khoroo*, Songino Khairkhan District

Roads

The Mid-tier *khoroo* covers an area of nearly 99 hectares of land, is home to 7,979 inhabitants, and has predominately flat terrain. There are about 24.2 km of roads, but just 4 percent, or 1 km, is paved. All of the paved roads run along the northern, western and eastern boundaries of the *khoroo*. There are no paved roads *within* the *khoroo*. The most striking feature about the road network in this *khoroo* is the fact that there is just one north-south road (the "Gully Road") on the western side. However, this road does not provide access to the northern side of the *khoroo* as it stops some 750 meters short of the main road to the north. All other roads have east-to-west alignments, which severely limits access and vehicular movement. Fences enclosing *hashaas* abut one another, preventing north-south access, but small footpaths every one km or so do permit pedestrians to walk between some *hashaas*.

Approximately 7 percent of residents own private vehicles. Traffic counts were taken at the intersection between Zuunsalaa and Bayankhoshuu Streets (along the main road bordering the *khoroo* to the north). A rough estimate of average daily traffic along this stretch is 8,500 vehicles per day. The majority of vehicles, 86 percent, are passenger cars, with buses and microbuses accounting for about one percent.

Residents complain of heavy trucks transporting bricks between *hashaas* where no formal roads exist. The bricks come from brick factories that operate in the southern side of the *khoroo*. Trucks operate throughout the day, produce inordinate amounts of dust, and create hazardous conditions for pedestrians.

Public Transport

There are no regular microbus services provided within the *khoroo*. To travel within the *khoroo*, most residents walk or rely on taxis, when available.

Options for Service Improvement

Providing better north-south access is a priority for most residents. Improving the Gully Road would be helpful, but since it's on the western side of the *khoroo* another north-south alignment further to the east should be identified. There are no sidewalks or street lighting on the Gully Road, and during the rainy season, low elevations along the alignment tend to have standing water.

Option 1. Upgrade and pave, including drainage, sidewalks and street lighting, the existing Gully Road from Bayankhoshuu #25 to Nuur Street (about 1.4 km). Some minor changes in the alignment may be required, and if possible, the road should be extended to the northern side of the *khoroo*. It is important to note that extending the road might require the acquisition of property, which would add to the cost of the project. It is also worth noting that the overall length of the Gully Road is around 3.7 km, and that around 2.3 km of the road passes through two other *khoroos* (to the north-east and south-west). Any planned improvements to the road should be coordinated with those *khoroos*.

Cost of Service Improvement

The estimated cost to improve the Gully Road is summarized in Table 5.6.

TABLE 5.6. Estimated Costs of Proposed Service Improvements in Mid-tier *Ger*

MID-TIER *GER* (BAYANKHOSHUU) PROPOSED SERVICE IMPROVEMENT	LENGTH OR QUANTITY	COST/UNIT (MILLION TG)	COMPONENT COST (MILLION TG)	PER CAPITA COST (THOUSAND TG)
1. Upgrade & Extend Gully Road				
1.1 Road Construction (double surface treatment per km)	2.1	28	58.8	7.4
1.2 Road Drainage System (per km)	2.1	70	147	18.4
1.3 Sidewalks (per km)	2.1	21	44.1	5.5
1.4 Street Lighting (1 every 50 meters)	42	0.42	31.64	4.0
1.5 Cabling for Street Lights (per km)	2.1	14	43.4	5.4
Estimated Capital Cost:			*324.94*	*40.7*
Overall Estimated Cost of Improvements:			***324.94***	***40.7***

NOTE: If the road is not extended 750 meters to the north, the cost would be about Tg226 million/$161,400.

Financial and Economic Implication of Service Improvement

Economic Benefits to Residents. Although limited to one side of the *khoroo*, an improved Gully Road would provide a reliable north-south corridor with year-round access. This would be the biggest benefit to residents. It would speed travel times and might open the way for micro-bus services. Sidewalks and street lighting would create safer and cleaner walking conditions for pedestrians. These improvements would also result in increased access to markets, schools, health clinics, other public services, and employment; as well as an improvement in air quality due to the reduction of dust.

Fiscal Implications. Financing the costs for routine and periodic maintenance of an improved Gully Road would require about Tg1.75 million ($1,250) per year with the extension, and Tg1.2 million ($840) per annum if the extension is excluded. Maintaining and powering the street lighting system can be expected to cost less than Tg1.96 million/$1,400 annually (Tg1.26 million/$925 without the extension). Per capita, these costs would be about Tg300–465 ($0.22–0.33) per year.

Fringe *Ger* (Sharhad): 9th *Khoroo*, Bayanzurkh District

Roads

The Fringe *Ger* is the largest outlying *khoroo* both in terms of size (48 hectares) and number of inhabitants (11,130). It has the same hilly terrain as the City Center *Ger*, and is bordered on the west by the Uliastai River and on the north by the Eej Khairkan (mother mountain). Overall, there are about 31.4 km of roads, 30.6 km of which are earthen (97.5 percent). The 807 meters of paved roads that run from the *khoroo* boundary to the Sharhad Bus Station are in very poor condition.

Some 20 percent of residents own private vehicles. Traffic counts were taken of vehicles passing through the main intersection where the National Physiology Health Center is located. Based on very limited observations, the average daily volumes look to be around 1,600 vehicles per day. Buses and microbuses made up just over 50 percent of traffic, followed by passenger cars (25 percent) and trucks (25 percent). The composition of traffic at this location is different from the other *khoroos*

included in this study, where well over 90 percent of traffic consisted of passenger cars. The higher percentage of buses is likely the result of the Sharhad Bus Station.

Public Transport

The Sharhad Bus Station is situated on the extreme south-central edge of the *khoroo*, occupying nearly 650 square meters of land. It is used by large buses, minibuses and taxis. The bus station is located on a roundabout, but is not well organized and creates a bottleneck as drivers seek to enter and exit the facility. It is also located next to a school, which creates unsafe conditions for students.

There are no scheduled bus services or bus stops beyond the Sharhad Station, but some taxis do offer to take residents to some outlaying areas within the *khoroo*. However, much of the area has very rough road conditions, which limits where most taxis will go. Residents who need to use public transport must walk from their homes to the Sharhad Bus Station, or hope to catch a shared taxi that might be passing by.

Because of its distant location, residents must travel twice as far to get to and from the central business district, which results in higher travel costs for inhabitants of this *khoroo*.

Options for Service Improvement

While residents of this hilly *khoroo* would welcome improved public transport services, they expressed more interest in having better roads. A number of suggestions for improving specific roads were provided, but most of the proposed projects presented problems. In one case, the road to be improved would provide better access for *hashaas* that had been built in an illegal area. Proposed

road improvements in the core of the *khoroo* were constrained by limited space and narrow, winding alignments that would severely limit the size of vehicles that could use the road. As such, just one proposed road improvement project was considered.

Option 1. Upgrade and pave, including drainage, sidewalks and street lighting, the 1.5 km road from the Sharhad Bus Station to the top of Eej Khairkan Mountain to the north. The proposed route parallels a high density area to the west and would provide residents living on the north side of the *khoroo* better access. If conditions were improved, microbus operators might offer bus services for residents living in the area along the alignment.

A number of residents also asked that the Sharhad Bus Station be relocated to the top of Eej Khairkan Mountain because of ample open land that's available. However, doing so would require significant study to determine the benefits, if any, and potential environmental and social implications. It would also take considerable coordination with municipal agencies.

Cost of Service Improvements

The estimated cost to improve the 1.5 km road to Eej Khairkan Mountain is outlined in Table 5.7.

Economic and Financial Implications of Service Improvements

Consumer Economic Benefits. If public transport services are provided along the new route, the biggest economic benefit to residents would likely be the amount of time saved by not having to walk to and from the Sharhad Bus Station. These improvements would result in increased access to markets, schools, health clinics, other public services, and employment; as well as an improvement in air quality due to the reduction of dust.

Fiscal Implications. Funding maintenance activities would be the biggest fiscal impact. Routine and periodic maintenance for the improved road is estimated to cost Tg1.26 million ($900) per annum, while the cost to maintain and operate the street lights would be around Tg1.4 million ($1,000) per year. Per capita, these costs would be around Tg239 ($0.17) annually.

TABLE 5.7. Estimated Costs of Proposed Service Improvements in Fringe *Ger*

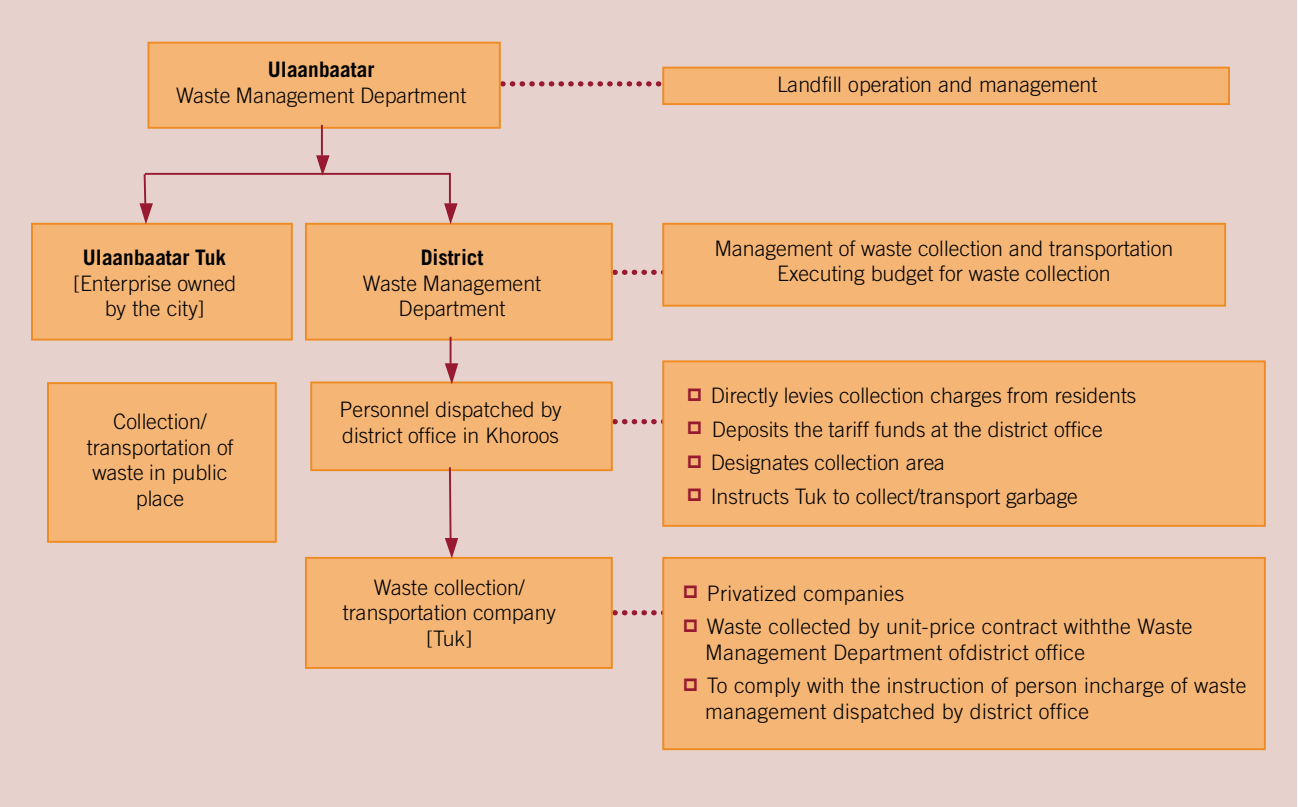
FRINGE *GER* (SHARHAD) PROPOSED SERVICE IMPROVEMENT	LENGTH OR QUANTITY	COST/UNIT (MILLION TG)	COMPONENT (MILLION TG)	PER CAPITA COST (THOUSAND TG)
1. Upgrade Road from Sharhad Bus Station to Eej Khairkan				
1.1 Road Construction (double surface treatment per km)	1.5	28.00	42.00	3.8
1.2 Road Drainage System (per km)	1.5	70.00	105.00	9.4
1.3 Sidewalks (per km)	1.5	21.00	31.50	2.8
1.4 Street Lighting (1 every 50 meters)	30	0.42	26.60	2.4
1.5 Cabling for Street Lights (per km)	1.5	14.00	35.00	3.1
Estimated Capital Cost:			*240.10*	*21.6*
Overall Estimated Cost of Improvements:			***240.10***	***21.6***

6 Solid Waste Management

OVERVIEW OF CURRENT SOLID WASTE MANAGEMENT IN *GER* AREAS

Institutional Arrangement: The bulk of responsibilities for solid waste management are decentralized to the district level, while the city government is responsible for landfill operations. Until 2007, the City Waste Management Department directly managed the collection and disposal of solid waste in Ulaanbaatar. In 2007, a new regulation on waste management was introduced to minimize the city government's involvement, while increasing the efficiency of management. Under the current institutional arrangement, each district government is responsible for collection and transportation of waste from homes, business entities and all the other locations except for public spaces. The Waste Management Department of each district collects fees (which are often decided by the City Council), manages contracting services with a privately run waste collection and

FIGURE 6.1. Institutional Arrangement and Responsibilities for Solid Waste Management in Ulaanbaatar



Source: interviews with various city officials

FIGURE 6.2. Current Waste Disposal in *Ger* Areas

OUTSIDE HOUSES	HILL OR YARD		AROUND LAKE
			

transportation company (a *Tuk*), and provides street cleaning services to citizens. The Waste Management Department of Ulaanbaatar operates waste landfills, collects and transports waste in public places via contracting-out to the state-owned enterprise, Ulaanbaatar Tuk.

Current Garbage Collection System. Because formal garbage collection is infrequent and unpredictable, residents dispose of most household garbage waste themselves—usually by dumping it outside their houses, on hills, in yards, and alongside roads and waterways. This ad hoc waste disposal poses a risk to public health and sanitation, including respiratory diseases. Open garbage disposal is also linked to environmental degradation, including the contamination of soil and underground water. In contrast, apartment areas run a relatively efficient and clean system. Separate transfer spaces are installed on the first floor of each building and waste is discharged into these spaces by trash chutes directly connected to individual apartment units.

Ger area garbage is collected by vehicles that visit each household, door-to-door, and collect fees onsite. In the City Center *Ger*, an autonomous collection system within the *khoroo* has been put in place. The *khoroo* owns collection vehicles and operates a few crews of drivers and supporting staff. District staff and vehicles go around to households to collect garbage and also levy the waste collection charge. The district government, in turn, pays a community-owned system for collection and transportation to landfill sites. In the case of the Mid-tier (Bayankhoshuu) and Fringe (Sharhad) *gers*, collection is done similarly via collection vehicles visiting each household and transferring the collected garbage to landfill sites.

The quantity of waste produced in *ger* areas varies significantly by season. The waste quantity during winter is three times that of summer: 0.9–.0 kg per person per day in winter in comparison with 0.2–0.3 kg per person per day in summer. This is because heating fuel (mostly wood and coal) is consumed in large volumes during the cold winters. Ashes are separated from general garbage and usually discharged into 200 liter iron drums or sacks. During the summer, when fuel is used only for cooking, ash is not separated. Throughout the year, recyclable materials are sorted for sale to the recyclable materials stores.

The frequency of waste collection in the *ger* areas is very low, from once a month in the case of the Mid-tier and Fringe *gers*, to once every three months in the City Center *Ger*. Low frequency of collection is attributed to a number of factors. First, the current vehicle-based system of collection at each household is not efficient given the low density of *ger* areas. Collection vehicles can cover

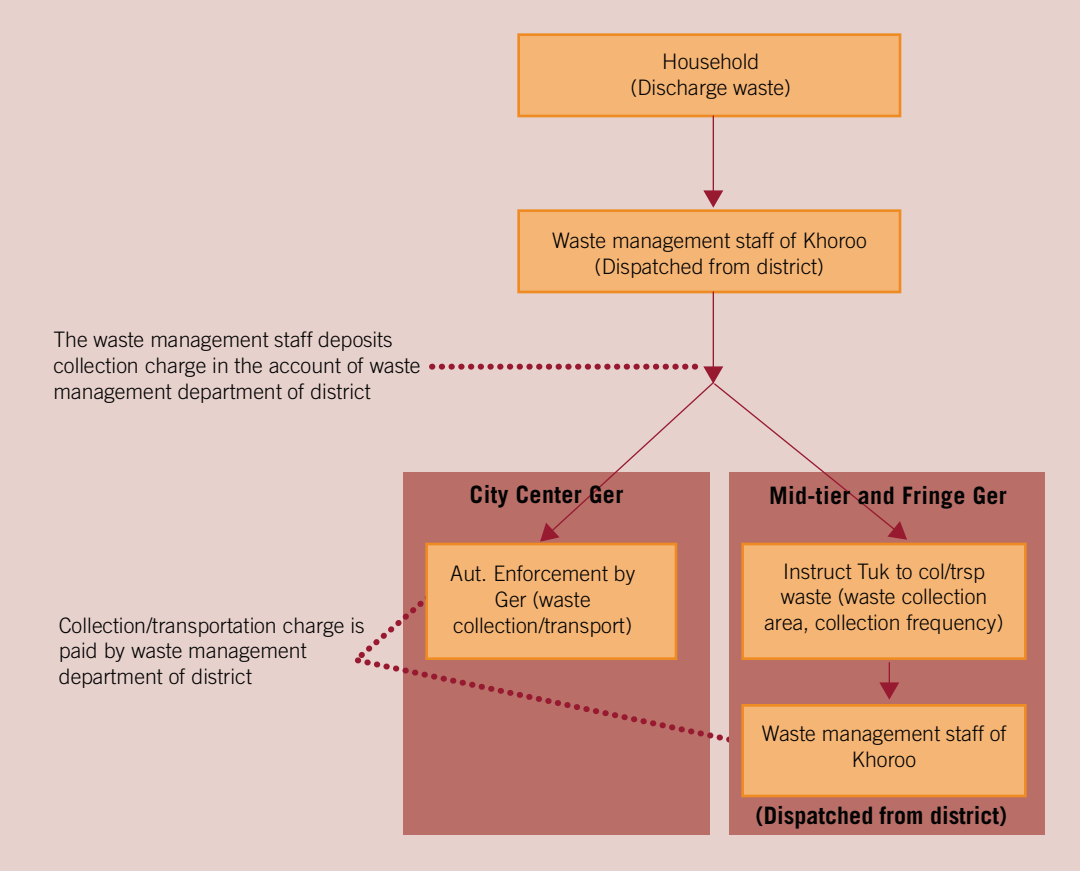


FIGURE 6.3. Solid Waste Collection in Three *Ger* Areas

only 20–30 households during summer and 15–20 households in winter per two-to-three hour trip. Collection vehicles operate on average nine hours per day, and hence each vehicle can cover fewer than 100 households per day.

A shortage of collection vehicles, equipment and workers is another problem. District governments have limited resources for equipment and vehicles, as their revenue is solely dependent on a collected tariff. According to the field survey, only one open truck, one driver and two assistant

FIGURE 6.4. Current Situation of Waste Collection in *Ger* Areas

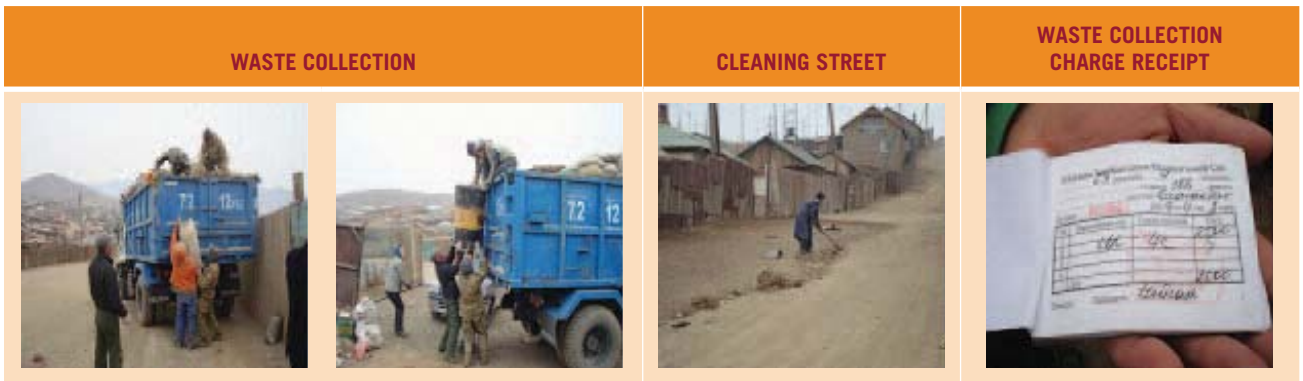


TABLE 6.1. Solid Waste Management in Three *Ger* Areas

CLASSIFICATION	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Households / Population	3,000 / 12,245	1,677 / 7,979	2,500 / 11,130
% of HH paying tariff	30%	Less than 20%	30%
Frequency of waste collection	2 times/day, 1 time /3 months per household	3 times/day, 1 time /month per household	2 times/day, 1 time /month per household
Form & number of pieces of collection equipment	1 Open Truck	1 Open Truck	1 Open Truck
Number of collectors	1 Driver, 2 Assistant workers	1 Driver, 2 Assistant workers	1 Driver, 2 Assistant workers
Wages of collector (Tg./capita.trip)	Driver : 4,500 Assistant worker : 4,000	4,000	7,000
Distance to landfill	Approx. 15km	Approx. 9km	Approx. 30km

Source: Field interviews with district officials and khoroo leaders.

workers are assigned in each *ger* area to cover 1,677 to 3,000 households (See Options for Service Improvement for detailed investment requirement). Finally, poor road conditions, or in some cases the lack of an access road to *ger* households, add to the difficulty of collection. Houses located at a distance from the main road, without proper road access or with very narrow roads, often remain un-served.

The collection schedule is random and there is no designated date and time for collection. As garbage bins are kept inside household fences, waste cannot be collected if no one is at home. The unpredictability of waste collection reinforces residents' habits of disposing domestic garbage in open dump sites nearby.

Solid Waste Tariff Structure. The waste collection tariff for households in Ulaanbaatar was set by the Municipal Council in 2006 at Tg2,500 ($1.79) per month for *ger* areas and Tg2,000 ($1.43) per month for apartment residents. However, the District can adjust the tariff level to some extent reflecting the revenue requirements and socio-economic conditions of *ger* residents. In the City Center *Ger* (Naran), the monthly tariff is Tg3,000 ($2.14); in the Fringe *Ger* (Sharhad), Tg2,500 ($1.79); and in the Mid-tier *Ger* (Bayankhoshuu), Tg1,500 ($1.07).

TABLE 6.2. Solid Waste Tariff in Three *Ger* Areas

ITEM	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Collection tariff per HH	3,000 Tg/ month	1,500 Tg/ month	2,500 Tg/ month
% of HHs paying tariff	30%	Below 20%	30~40%
Willingness of households to pay an increased collection charge for better collection	Additional payment is difficult, because the current waste collection charge is high.	Additional charges could be paid, if collection charges are differentiated for each season.	Current collection charge should be maintained.

Only about 30 percent of households actually pay a waste collection tariff. One reason obviously is the socio-economic condition of poor households. Another important factor is the lack of awareness of the need for environmental protection and public goods. The field survey indicates that *ger* residents generally think garbage

collection is the responsibility of city government, so they are not used to the notion of paying for public service. Furthermore, some residents who could afford the collection fee do not want to pay as long as they can dispose of domestic garbage elsewhere outside their houses. Residents also do not seem to have a strong confidence in the government's ability to manage waste. Some of long-term residents believe that the garbage problem is created by new migrants and are reluctant to pay the collection fee. When asked about their willingness to pay for improved collection, only the Mid-tier *Ger* residents showed a willingness to pay additional collection charges if a differential tariff level can be introduced, e.g. one that is higher during winter times when more garbage is produced.

OPTIONS FOR SERVICE IMPROVEMENT FOR SOLID WASTE MANAGEMENT

The key area for service improvement of solid waste management would be to increase efficiency in the collection system. At the moment, the frequency of collection is very low: once every month or once every three months per household. The target benchmark is to increase collection frequency to once a week per household.

City Center Ger. Since the bulk of this area will be converted to apartments, the collection system will remain vehicle-based. Similar to the current collection system in apartment areas, a transfer

FIGURE 6.5. Solid Waste Collection in Apartment Area

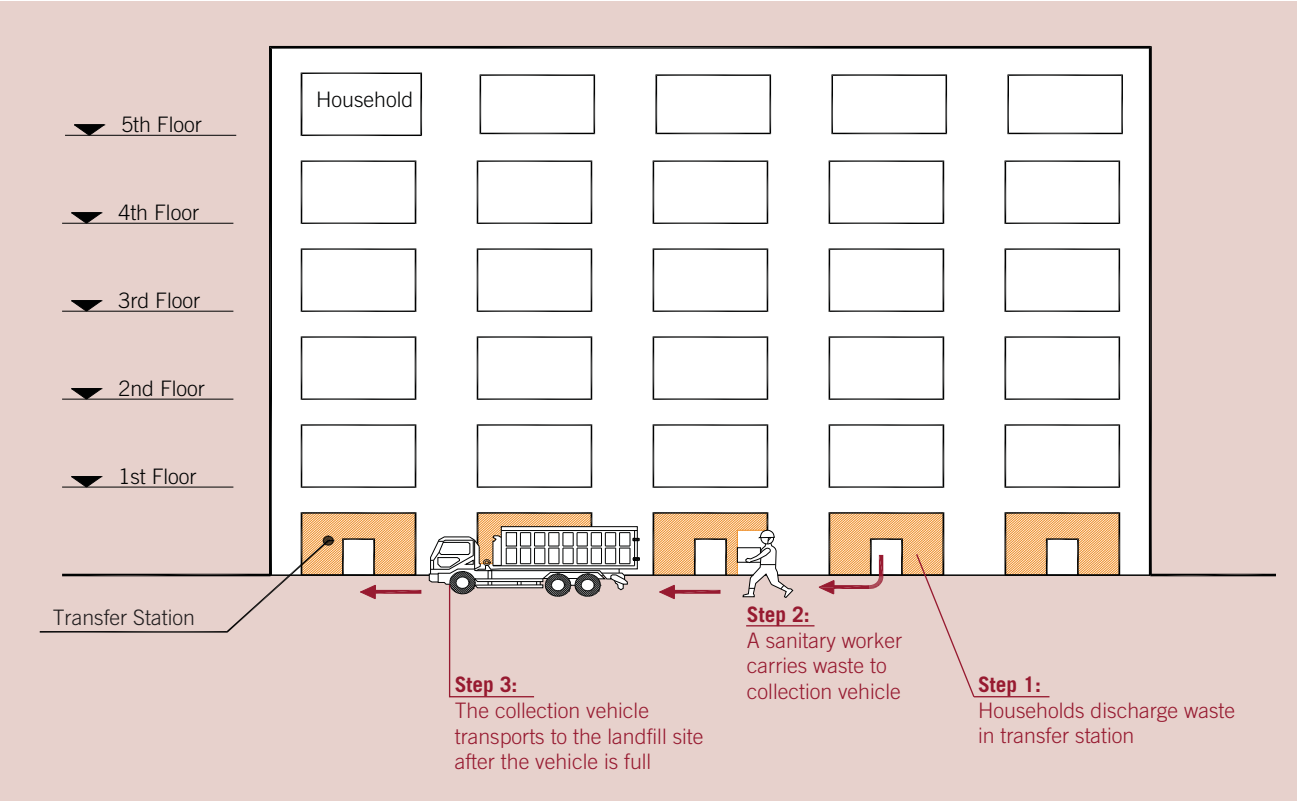


TABLE 6.3. Procurement Required for Service Improvement in the City Center *Ger* (Naran), Apartment Area

ITEM		UNIT	CITY CENTER *GER*
Baseline data	Waste generation	Ton/day	12.245
	Times of collection/ household	Times/week	1
	Round trip distance(Landfill)	km	30
Waste collection vehicle	Time spent for collection/ transportation (LD, TR, UL, RT)	min	346
		hr	5.7
	Number of collection vehicle (total)	EA	1
	Using existing vehicle	EA	1
Workers and driver	Driver	Person	1
	Assistant Worker	Person	2

station will be installed on the first floor of apartment buildings connected to individual households via a trash chute.

If the City Center *Ger* is turned into an apartment area, existing equipment and workers are enough to manage garbage collection and transportation in the area.

FIGURE 6.6. Solid Waste Collection by Sanitation Workers

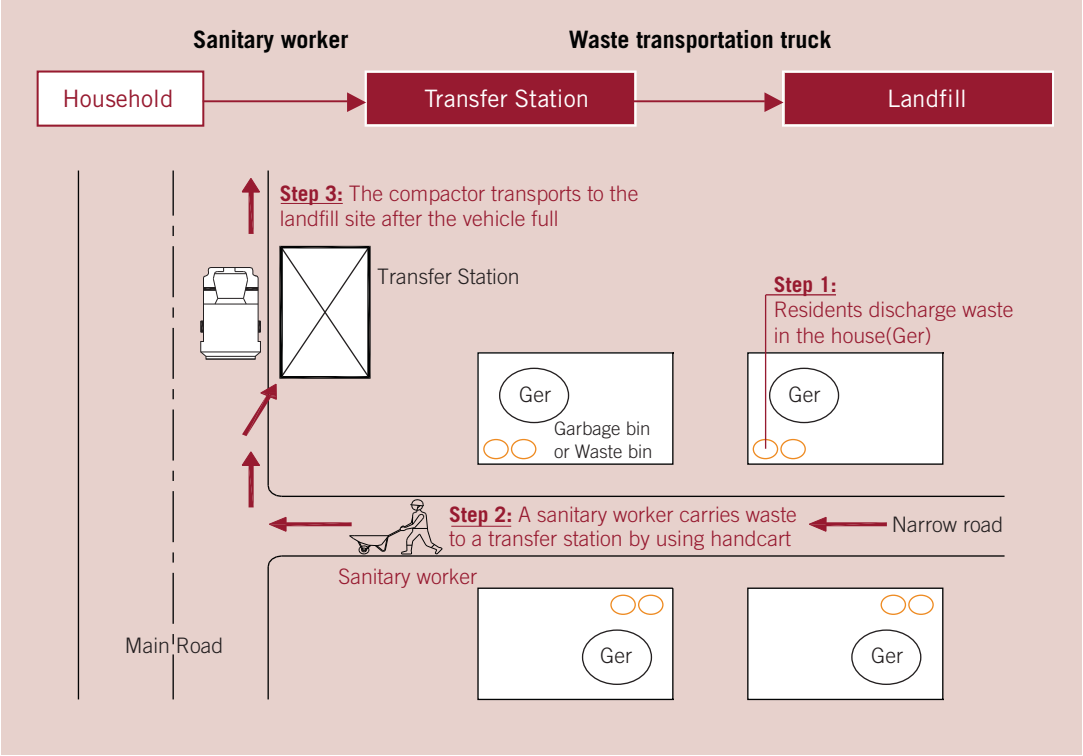


TABLE 6.4. Procurement Requirement for Service Improvement Option 1

	ITEM	UNIT	MID-TIER *GER*	FRINGE *GER*
Baseline data	Population	Population	7,979	11,130
	Number of households	Household	1,677	2,500
	Population/household	Population/ Household	4.8	4.5
	Waste generation per capita	kg/capita.d	1.0	1.0
	Waste generation	ton/day	7.979	11.130
	Times of collection/ household	Times/week	1	1
	Round trip distance(Landfill)	km	18	60
Sanitary worker	Collection efficiency of garbage bin	MH/ton	5.8125	5.8125
	Total collection time	hr	46.4	64.7
	Daily collection time	hr	8	8
	Number of Sanitary Workers	Person	6	9
	Collection households/ Sanitary Worker	household	280	278
Transfer station	Number of Hand Carts	EA	6	9
	Number of installed transfer stations	EA	2	3
Waste collection vehicle	Time spent for collection/ transportation(1 time) (LD, TR, UL, RT)	min	92	142
		hr	1.5	2.4
	Number of collection vehicles (total)	EA	1	1
	Using existing vehicle	EA	1	1
Per- for col/veh	Driver	Person	1	1
	Assistant Worker	Person	2	2

Mid-tier Ger and Fringe Ger. In these two areas, which likely will not be converted to apartment areas in the immediate future, three collection methods can be considered to improve collection frequency: collection service by sanitation workers; collection service by residents; and vehicle-based collection. Each method has a different implication for investment and operation costs, and this will be discussed in detail.

Option 1: Collection Service by Sanitation Workers. In this case, the waste discharged by each household in a *ger* is collected by a sanitary worker, who uses a handcart to transport it to a transfer station. Then, the waste is transported from the transfer station to a waste landfill in a high volume vehicle.

Under this option, the required number of sanitary workers and the amount of collection equipment are determined by taking into account collection efficiency and collection work time, etc. In the Mid-tier *Ger*, six sanitation workers, six hand carts and two installed transfer stations will be needed. In the Fringe *Ger*, nine sanitation workers, nine hand carts and three installed transfer stations would be necessary.

FIGURE 6.7. Solid Waste Collection by Residents

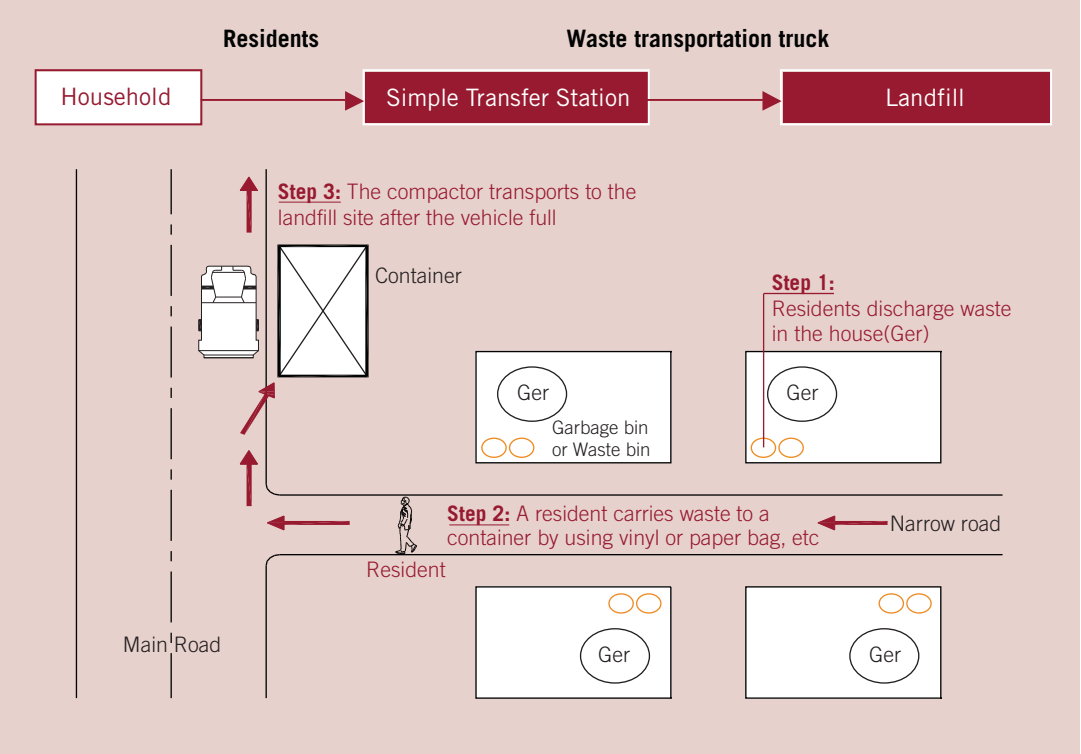


TABLE 6.5. Procurement Requirement for Service Improvement Option 2

	ITEM	UNIT	MID-TIER *GER*	FRINGE *GER*
Baseline data	Population	Population	7,979	11,130
	Number of households	Household	1,677	2,500
	Population/household	Pop/HH	4.8	4.5
	Waste generation per capita	kg/capita.d	1.0	1.0
	Waste generation	ton/day	7.979	11.130
	Times of collection/ household	Times/week	1	1
	Round trip distance (Landfill)	km	18	60
Simple transfer facilities	Average interval of installation	m	100	100
	No. of installed facilities (1EA/200household)	EA	84	125
Waste collection vehicle	Time spent for collection/ transportation (LD, TR, UL, RT)	min	382	607
		hr	6.4	10.1
	Number of collection vehicle (total)	EA	1	2
	Using existing vehicle	EA	1	1
	Aqr new vehicle	EA	—	1
Per- for col/veh	Driver	Person	1	2
	Assistant Worker	Person	2	4

Options 2: Collection Service by Residents. Under this option, the waste is collected by each household in bags. Residents will dispose of garbage bags themselves in nearby simple transfer facilities or waste containers. The waste collected in containers is then transported to a landfill by a waste transportation vehicle. It was estimated that one container is required per 20 households, with the average distance of 100 meters to transfer facilities. Based on this, it is estimated that about 84 containers will be needed in the Mid-tier *Ger* and 125 in the City Center *Ger*. In the Fringe *Ger*, additional vehicles to transport garbage will be needed.

Option 3: Vehicle-based Collection. This is the model most similar to the status quo, but would replace current collection and transportation equipment with a modern collection system. Waste is collected using the door-to-door system and then transported to the landfill. It is estimated that two collection vehicles would be needed in the Mid-tier *Ger* and three in the Fringe *Ger* (Sharhad). Additional drivers and workers would be needed to operate the new vehicles.

Each option has its own advantages and disadvantages. Collection by sanitation workers would bring the additional benefits of employment creation by utilizing laborers in *ger* areas who would otherwise remain unemployed. Collection efficiency will be higher than vehicle-based collection, as

FIGURE 6.8. Solid Waste Collection by Vehicles

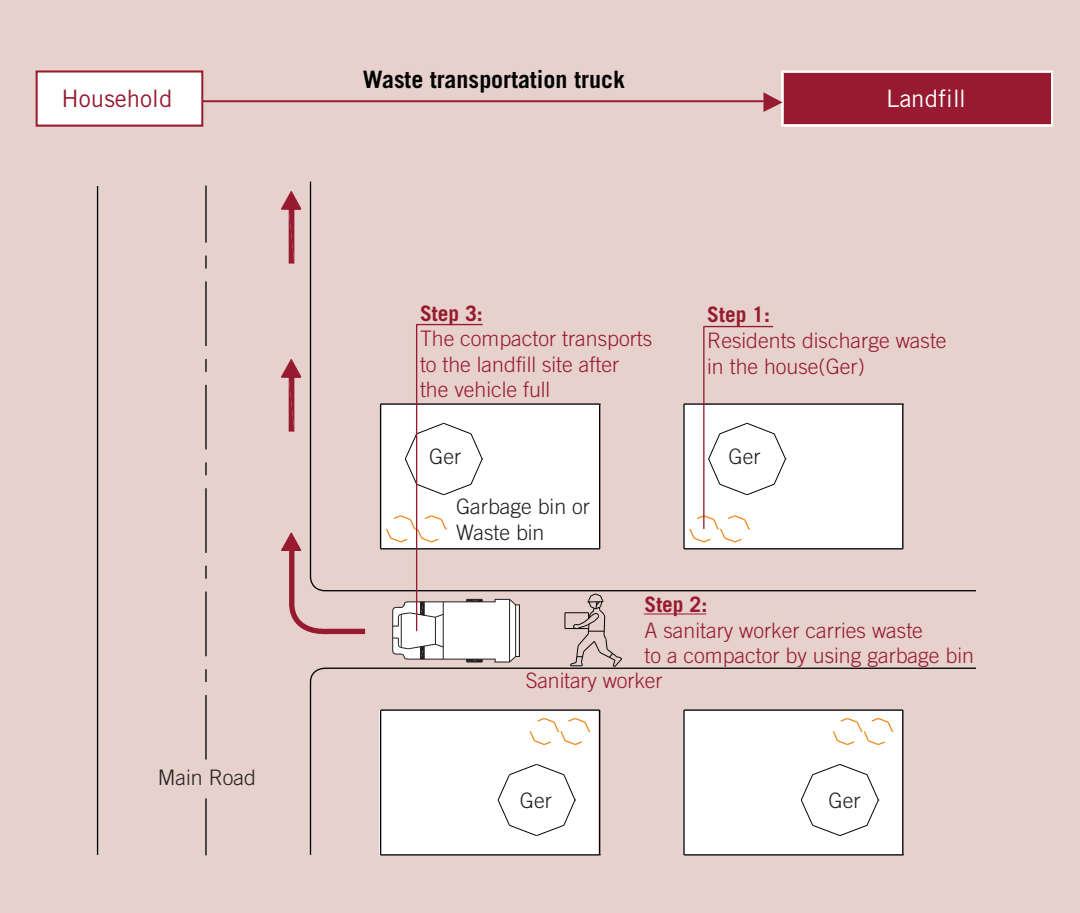


TABLE 6.6. Procurement Requirement for Service Improvement Option 3

	ITEM	UNIT	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Baseline data	Population	Population	12,245	7,979	11,130
	Number of households	Household	3,000	1,677	2,500
	Population/household	Pop/HH	4.1	4.8	4.5
	Waste generation per capita	kg/capita.d	1.0	1.0	1.0
	Waste generation	ton/day	12.245	7.979	11.130
	Times of collection/ household	Times/week	1	1	1
	Round trip distance(Landfill)	km	30	18	60
Waste collection vehicle	Time spent for collection/ transportation (LD, TR, UL, RT)	min	1,546	872	1,333
		hr	25.8	14.5	22.2
	Number of collection vehicle (total)	EA	3	2	3
	Using existing vehicle	EA	1	1	1
	Aqr new vehicle	EA	2	1	2
Per- for col/veh	Driver	Person	3	2	3
	Assistant Worker	Person	6	4	6

waste pickers would go to individual households that are difficult for vehicles to access. This is also the most economical option (See Financial and Economic Implication for details). For the second option of collection by residents using small transfer systems, considerable public education and campaigning on waste disposal would have to accompany its implementation as residents become a part of the collection system. For the option of using the existing vehicle-based collection system, interviews with government officials and residents indicate that this is the most preferred option because it is a system they are most familiar with. In all options, a new tariff system will have to be introduced to replace existing one where residents pay a fee at the time of garbage collection.

FINANCIAL AND ECONOMIC IMPLICATION FOR IMPROVED SOLID WASTE SERVICE

The three options for improving solid waste management bear different financial implications, both in terms of initial investment costs and recurring operating and maintenance costs. As for the investment cost, in case of the City Center *Ger*, which will be turned into an apartment area, existing collection vehicles and equipment are considered sufficient to cover the newly built apartment area. Hence, there should be no additional investment required.

In the Mid-tier and Fringe *gers*, however, there is a wide variation among different service options (See Annex G for detailed cost assumptions). The lowest cost investment option is collection service done by sanitation workers. The estimated investment cost for this service is about Tg13.2 million ($9,400) for the Mid-tier *ger* and Tg19.8 million ($14,000) for the Fringe *ger*. In contrast, collection by residents into small transfer systems is the most expensive option, with an esti-

TABLE 6.7. Comparison of Different Options for Service Improvement

CLASSIFICATION	ADVANTAGES	CHALLENGES
Option 1 Collection service by sanitary worker	• To create jobs by utilizing manpower in *gers*, areas with high unemployment, as sanitary workers • To solve the issue of waste stagnancy in each home by increasing collection frequency • To increase collection & transportation efficiency compared to the current collection system by direct -door- to-door collection system • To increase the collection rate of recyclable materials by operating the transfer station • Most economical program	• A new tariff system needs to be introduced replacing current one which levies tariff at the time of collection • Land should be acquired to install a transfer station • Transfer station poses the risk of fire • Local residents may complain about dust, stench and noise from the transfer station
Option 2 Collection service by residents	• To improve the awareness of residents as they are part of collection system. • To reduce waste collection & transportation cost • To reduce the amount of stagnant waste in the house, as the resident personally disposes waste to the transfer station	• A new tariff system needs to be introduced replacing current one which levies tariff at the time of collection • It is necessary to encourage resident to participate voluntarily, through publicity and education campaigns. • Land should be acquired to install a transfer station with the consent of local residents • Local residents may complain about dust, stench and noise from the transfer station
Option 3 Collection service by vehicle	• The most familiar system, which simply supplements the collection equipment of the current collection system • System most preferred by residents and public officials	• As collection interval is too long, it is required to improve the collection vehicles and collection containers • The collection rate mey remain very low • Current tariff system is not financially viable and a new tariff system needs to be adopted

mated cost of . about Tg 241 million ($172,000) and Tg 434 million ($310,000) in the two *gers*, respectively. Investment costs for vehicle-based collection in the two *gers* would be Tg75.6 million ($54,000) and Tg152 million ($108,576), respectively.

As for operation and maintenance, in the City Center *Ger*, about Tg14.56 million ($10,400) is the estimated cost per year for labor and vehicle maintenance and operation. In the Mid-tier and Fringe *gers*, collection by residents into small transfer systems would entail about one-half of the operation and maintenance cost of the two other options. Using sanitation workers would cost about Tg16.5 million ($11,800) and Tg16.5 million ($25,500) in the Mid-tier and Fringe *gers*, respectively. The most expensive option, vehicle-based collection, would require Tg16.1 million ($11,500) and Tg58.8 million ($42,000) per year in the two *gers* respectively.

From a service provider's perspective, the first option—a system of collection by sanitary workers—seems the most cost-effective, considering initial required investment cost and annual operation and maintenance cost.

All of the proposed options will increase both the frequency of collection and the volume of collected solid waste, putting additional pressure on the city landfill. Operating costs for the landfill,

TABLE 6.8. Initial Investment Cost and Operation Cost to Improve Waste Collection Service

ITEM			UNIT	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Option 1 (Sanitary workers/ handcarts)	Initial investment	Buying Handcart	EA	—	6	9
			Million Tg (unit)	—	0.73	0.73
			Million Tg (total)	—	4.38	6.58
		Installing T/S	Million Tg	—	8.82	13.23
		Total Cost	**Million Tg**	—	**13.20**	**19.81**
	Operation	Labor cost	Million Tg/year	—	15.22	29.23
		Operating C/V	Million Tg/year	—	1.37	6.41
		Total Cost	**Million Tg/year**	—	**16.59**	**35.65**
Option 2 (Small transfer stations)	Initial investment	Installing STF	EA	—	84	125
			Million Tg (unit)	—	2.87	2.87
			Million Tg (total)	—	240.96	358.58
		Buying C/V	EA	—	—	1
			Million Tg (unit)	—	—	76.00
			Million Tg (total)	—	—	76.00
		Total Cost	**Million Tg**	—	**240.96**	**434.58**
	Operation	Labor cost	Million Tg/year	—	6.75	33.06
		Operating C/V	Million Tg/year	—	1.37	6.41
		Total Cost	**Million Tg/year**	—	**8.12**	**39.48**
Option 3 (Improved status quo)	Initial investment	Buying C/V	EA	2	1	2
			Million Tg (unit)	76.00	76.00	76.00
			Million Tg (total)	152.01	76.00	152.01
		Total Cost	**Million Tg**	**152.01**	**76.00**	**152.01**
	Operation	Labor cost	Million Tg/year	32.81	13.51	49.59
		Operating C/V	Million Tg/year	7.09	2.66	9.12
		Total Cost	**Million Tg/year**	**39.90**	**16.17**	**58.71**

currently around Tg1.54 billion ($1.1 million) annually, will increase as the frequency of delivery increases. With the likely boost in volume, the estimated 20-year life of the landfill may be shortened slightly. The costs of an additional landfill site are estimated at Tg52.36 billion ($37.4 million) for a 7.5 million m^3 landfill. (Detailed estimated landfill development and operating costs can be found in Annex H.)

The current collection tariff level is set by the municipal council at Tg2,500 per household (about $1.79 per month) in *ger* areas, higher than the tariff for apartment residents at Tg2,000 ($1.43). In three *ger* areas, tariffs range from Tg1,500 to Tg 3,000 ($1.07 to $2.14). This relatively high level of tariff is mostly due to the low collection rate and also to the lack of government subsidy. In order

to estimate the financial burden for households, the tariff level was estimated just to cover operation and maintenance costs, not investment or depreciation. The resulting tariff varies considerably across *ger* areas depending on service options. Households in the Mid-tier *Ger* are expected to pay at least Tg410 to Tg830 ($0.29 to $0.59) per month; in the Fringe *Ger* from Tg1,320 to Tg1,960 ($0.94 to $ 1.40) and in the City Center *Ger*, Tg410 ($ 0.29) for new apartment areas.

TABLE 6.9. Expected Tariff Level for Solid Waste Management

		CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Household		3,000	1,677	2,500
Current Tariff (Tg)		2,996	1,498	2,492
Option 1: Sanitary workers	Annual O&M cost (million Tg/year)		16.59	35.65
	Cost per household (Tg /month)		**826**	**1,190**
Option 2: Small transfer systems	Annual O&M cost (million Tg/year)		8.12	39.48
	Cost per household (Tg /month)		**406**	**1,316**
Option 3: Improved status quo	Annual O&M cost (million Tg/year)	14.54	16.17	58.71
	Cost per household (Tg /month)	**406**	**112,798**	**1,960**

7 Heating

Ulaanbaatar is one of the coldest capitals in the world, making reliable and affordable heating vital for sustainable livelihood and development. The heating season lasts around eight months, from mid-September until mid-May. The fuel for all of the heating options in Mongolia is based on indigenous coal or wood. The use of raw coal in heat-only boilers and household stoves is considered one of the main causes of worsening air quality in Ulaanbaatar. According to a recent air pollution assessment in UB, the ground-level air pollution, measured in terms of Particulate Matter (PM10), during winter time is estimated to be between three and six times higher than the levels recommended in Europe and North America, and 10 to 20 times higher than the World Health Organization-recommended standards. It has been well established that airborne particulate matter is a critical pollutant responsible for negative health outcomes, such as respiratory illnesses, premature death, and restricted activity days. This implies a severe impact on both human health costs and economic costs to the society. The Municipality of Ulaanbaatar is keen to ban the use of raw coal, and to develop and promote the use of cleaner fuels, such as semi-coke briquettes. In fact, in recent years the UB Government has spent several billions of Tugrik in subsidies to promote the use of cleaner briquettes.

Based on the above context, this chapter describes the current situation of heating systems in the three *ger* areas, brings forward possible service improvement options, and estimates associated costs and benefits.

CURRENT STATUS OF HEATING IN *GER* AREAS

In general, four different types of existing heating systems are used in Mongolia: a) centralized (or district) heating systems; b) small-district heating systems for groups of buildings (heat-only boilers or boiler houses); c) individual heating systems (water heaters); and d) household stoves.

Centralized (or district) heating offers a number of benefits over decentralized heating options in areas of high heat load density. One of the key advantages of centralized heating is an increased use of combined heat and power (CHP) production, which results in increased efficiency of the use of the primary energy (coal in the case of Mongolia) and a positive impact on the ambient air quality. There are significant economic benefits of centralized (or district heating), such as low production costs, compared to any other types of individual boilers, and fuel savings (and related environmental impacts), due to economies of scale and high heat load density. Combined heat and power generation provides fuel savings up to 30 percent compared to of those of heat-only boilers. Therefore, centralized (or district) heating is more efficient in terms of cost of service and environmental friendliness. This efficiency is widely understood: in Germany there is even legislation which subsidizes combined heat and power generation.

District heating can be efficient and suitable for densely populated urban areas with high heat load density per km of network. The heat density in *ger* areas is very low, however, and can be as much as 40–50 times lower compared to apartment complexes. Because of the unplanned development of *ger* areas, it is technically almost impossible to provide district heating. Even if it was technically feasible to connect these *ger* areas, without proper heat insulation and energy efficiency measures on the demand side, it would be a waste of resources. Traditional *gers* and detached houses in *ger* areas are not efficient in terms of heat insulation. On average, *gers* lose about 4–5 times and houses about 2–3 times as much heat as national standards for heat insulation.

In Mongolia the electricity sector is closely linked to the heat sector because the majority of heat supplied in the Central Energy System (CES) is produced from five combined heat and power (CHP) plants in Ulaanbaatar, Darkhan and Erdenet. Though co-generation of heat and power provides the most efficient energy utilization, significant improvements are required to reduce energy losses in the existing heat distribution system, meter properly and regulate heat consumption on the demand side.

Coal-fired water heaters can heat up to 100–500 m^3 space (40–200 m^2) and are installed in the boiler houses. The number of these stoves has increased significantly since the early 1990s with the transition to the market economy system and the establishment of numerous small businesses and services. Coal-fired water heaters have low capacity and are used mostly in *ger* areas by small businesses, shops, services, etc. All of these heaters use raw coal, contributing to UB city air pollution. A recent study revealed that 1,005 coal-fired water heaters in six districts in UB use about 11,900 tons of raw coal per heating season. In terms of capacity, there are 514 (51.1 percent) water heaters of capacity 1–10 kW, 226 (22.5 percent) of capacity 10–20 kW, 192 (19.1 percent) of capacity of 20–50 kW, 40 (4 percent) of capacity 50–90 kW, and 33 (3.3 percent) of capacity of 90–120 kW. All of these water heaters are designed for heating only one structure, with usually two or three rooms.

Heat-only boilers include boilers that can produce 0.2–1.0 Gcal/hour (250–1000 kW) and are used mostly to heat one or several schools, kindergartens and hospitals. There are 166 boilers, of 24 different types, in 89 boiler houses in UB. In the 2007–2008 heating season their total coal consumption was 66,643 tons. In terms of capacity, there are 32 (35.6 percent) boiler houses of capacity 0–0.2 Gcal/h; 40 (44.9 percent) of capacity 0.2–0.6 Gcal/h; 10 (11.2 percent) of capacity of 0.6–1.0 Gcal/h; and 7 boiler houses with a capacity of more than 90–120 kW.

Heating stoves are used in a variety of ways. Stoves can be used directly for space heating, or a heating wall is attached to the stove for better heat distribution. Some stoves have a hot water distribution system and radiators to heat the house; this is commonly known in Mongolia as small, low-pressure boiler. Recently, different modifications of improved stoves have been developed to reduce fuel consumption and CO2 emissions. In the three targeted *ger* areas, almost all households, except some apartments-dwellers in the City Center *Ger* (Naran), use traditional stoves for heating.

City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District: At this moment, three different types of heating are represented in this area: small business water heaters; households with individual stoves; and apartment buildings and public organizations connected to district heating system (See Table 7.1).

For households using individual stoves, the heat loss is considerably higher—two or three times the standard rate1. Average heat load for private houses is about 5.9 kW and for *gers* is about 4.8 kW. The

TABLE 7.1. Current Status of Heating Supply in Selected *Khoroos*

#	*KHOROO*	TOTAL HOUSEHOLDS	TYPES OF HEATING: DISTRICT HEATING	HEAT ONLY BOILER (HOB)	WATER HEATERS	STOVES
1	Bayangol district, 11th *khoroo*	2970	130 households 6 organizations 10 apartment buildings		30 small businesses	2840
2	Songino Khairkhan district, 8th *khoroo*, Bayankhoshuu *ger* area	1677	N/A	HOB at school #67 15 small businesses and 20 private houses	20 small businesses	1677
3	Bayanzurkh district, 9th *khoroo*, Sharhad *ger* area	2567	N/A	N/A	43 small businesses	2567

total current heat load for houses and *gers* is 16.8 MW, and these households use 11,930 tons of coal and 2,550 tons of firewood. Annual spending on fuel amounts to about Tg1 billion[42] ($714,000).

Approximately 30 small businesses, mainly service companies, use their own heaters. These boilers generate hot water for heating. There is also one bath house with four individial cabins and six common showers connected to the centralized heat networks. The community expressed that an additional two or three bathhouses need to be built in the near future. Their total design heat loads are 1,157.5 kW.

In addition, one boiler house in this *khoroo* supplies heat to 46th secondary school (for 2,000 students) and the *khoroo*'s administrative building. The 46th secondary school was originally connected to the central heating system, but due to limited heating capacity, it was disconnected from the system in 1996; since then the school has operated its own boiler house. The heat load of the school is 400 kW.

Mid-tier *Ger* (Bayankhoshuu), 8th *Khoroo*, Songino Khairkhan District: Broadly, there are three types of heating systems in the *ger* area: a) larger consumers, such as schools and kindergarten connected to boiler houses; b) small businesses and services with their own heaters and c) individual houses or *gers* with stoves.

The 67th secondary school and 117th kindergarten are connected to and receive heating from the boiler house operated by the ANU Service Company. The design heat load is 920 kW, heating is billed per cubic meter of space, and the heating charge is Tg462 per cubic meter. Also, approximately 20 small businesses and services have their own heaters. The total design heat load is 1,378 kW. Most of the small businesses are located at Bayankhoshuu's bus station and use inefficient stoves from local and Chinese manufacturers.

Similar to Naran, most households that use stoves suffer from high heat loss—two or three times the standard rate1. The average heat load for private houses is about 5.9 kW and for *gers* is about

4.8 kW. The total current heat load for houses and *gers* is 13.7 MW; these households use 7,044 tons of coal and 1,510 tons of firewood annually, spending about Tg593.8 million (~$424,000) for heating and other purposes[43]. One bathhouse in this *khoroo* near family hospital "Eeltei" is not working, and the community has requested at least 2 or 3 new bathhouses.

Fringe *Ger* (Sharhad), 9th *Khoroo*, Bayanzurkh District: Similar to the other two, the following heating systems are in this *khoroo*: a) larger consumers, such as schools and kindergarten connected to boiler houses; b) small businesses and services with their own heaters and c) individual houses or *gers* with stoves.

Within this *khoroo* is the 79th elementary school with 1,160 pupils, the 3rd kindergarten with 190 children and the National Centre of Psychological Health (Psychoneurological hospital). The kindergarten and school have their own boiler houses. The Psychoneurological hospital boiler house has two sections: heating and hot water supply. Their total design heat loads are 2760 kW. The commercial service facilities within this *khoroo* are located close to each other near the Sharhad Bus terminal. Also, near the bus terminal is also an old boiler house building which stopped functioning due to the lack of maintenance. It would be possible to use this building and site for a modern boiler house.

Of 2,567 household in this *khoroo*, about 70 percent have wall stoves. Heat loss for almost all houses is 2–3 times the standard rate. The households consume over 10,000 tons of coal per year and another 2,300 tons of wood for heating. The wholesale price of one ton of coal is about Tg65,000 ($46) and its retail price is about Tg130,000 ($93). The wholesale price of one ton of wood is about Tg90,000 ($64), which amounts to Tg200,000 ($143) in retail price. The "Khuslen" service center has one bath house with 10 common showers. Price of service is Tg1,600 ($1.14) per one person. The community requested 2 or 3 bath houses in the near future.

OPTIONS FOR SERVICE IMPROVEMENT AND FINANCIAL IMPLICATIONS

City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District: This area will be connected to district heating given its proximity to the district heating network, but the following factors need to be taken into account:

TABLE 7.2. Total Investment Costs of Installation New Heat Sub-Station with Heat Network

	LOCATION AND PROPOSED INVESTMENTS	UNIT	UNIT COST2,	VOLUME	TOTAL, $
1	Installation of new heat substation in east side of Maternal and Children's Hospital.	MW	15,000.0 $/MW	10.0	150,000.0
2	Installation of new heat pipe line from main line to new heat substation	2xD200 mm	310.0 $/m	150 m	46,500.0
3	Installation of new heat pipe from new heat substation to apartments	2xD250 mm	330.0 $/m	730 m	240,900.0
	Total				**437,400.0**

For newly developed apartment areas. There is 6.0 MW of heating capacity at the 728th substation, which is already planned to be connected to buildings located in neighboring *khoroos*. The construction of some of these buildings has already started, with plans to build a heating substation with a capacity of 10 MW capacity on the east side of the Maternal and Children's Hospital. This substation will supply the heating to a new apartment complex, which is planned to be built by 2010. The complex will have 900 apartment units; some of these will serve about 120 households that have lived in the area and will receive apartments in exchange for their land. The cost to provide a centralized heating system in the apartment area is around Tg612 million ($437,400), including the installation of new heat substation for around Tg210 million ($150,000) and a heat pipe network for Tg402 million ($287,400), or around Tg680,400 ($486) per connection of each apartment unit.

The cost of connecting existing small businesses to a district heating network is high, even if district heating capacity is available. There is a limited technical possibility of connecting about 20 small private businesses located near secondary school # 46 to district heating. The total connection cost would be $170,000 or about $8,500 per connection. A recent survey conducted among small businesses shows that they all are interested in being connected to district heating.

The cost of connecting existing detached houses and *gers* to the district heating is also high. The cost per individual connection will be about Tg3.4 million ($2,415), including Tg476,000 ($340) for construction of the main heating pipeline, Tg1.2 million ($850) for construction of boiler and Tg1.8 million ($1,250) for installation of indoor heating and water system. The total cost of connecting to district heating network will be around Tg9.2 billion ($6.6 million) for a heat network of 4.6 km and a boiler house with capacity 16.0 MW.

To connect new apartment areas into the district heating, the capacity of existing district heating would have to be enhanced. Ulaanbaatar district heating networks have already reached maximum heating capacity. Unless the new heating sources are in place, it is technically not feasible to allow new connections. The total available heating capacity from the three power plants in UB is 1,585 Gcal/h, and the applications for new connections would add 283 Gcal/h, creating a deficit of 1,37.4 Gcal/h if connected. Starting in 2010, the UB city will not be able to make any new connections in district heating because of heat supply shortages. In addition, obsolete heating pipelines and networks require significant rehabilitation measures, without which the UB district heating network cannot ensure reliable heat supply. The Ministry of Mineral Resources and Energy is in the process of tendering bidders to develop power plant PP#5, which is planned in the eastern part of the city, with heat capacity around 700 Gcal/h.

Mid-tier *Ger* (Bayankhoshuu), 8th *Khoroo*, Songino Khairkhan District: Two options for service improvements are: expanding the capacity of local heat only boilers and connecting to them the local heating network, or connecting to the district heating system.

Expansion of capacity at existing boiler house at the school 67th and connection of nearby users. This would increase the heating capacity of ANU Service Co. Ltd's boiler at 67th secondary school from 1,170 to 1,470 kW and connect to its network all potential customers near Bayankhoshuu bus terminal. Total heat load of customers near the bus terminal is 300 kW, with 200 kW for customers located in the *khoroo*. The capacity of the heating boilers located in the 67th secondary school could be increased to allow connections to the small service buildings close to Bayankhoshuu's former bus

TABLE 7.3. Total Investment Cost of Installation New Boiler House and Heat Network

	LOCATION AND PROPOSED INVESTMENTS	UNIT	UNIT COST	VOLUME	TOTAL COST ($)
1	Installation of new boiler house in *ger* area	kW	144.1 $/kW[1]	5,9*2720= 16050.0 kw	2,312,800
2	Installation of heat network from new boiler house	2xD250 mm 2xD180 mm 2xD150 mm 2xD125 mm 2xD100 mm 2xD70 mm 2xD50 mm Total	330.0 $/m 300.0 $/m 260.0 $/m 220.0 $/m 150.8 $/m 145.8 $/m 135.0 $/m	45.0 m 545.0 m 400.0 m 700.0 m 1,100.0 m 866.4 m 950.0 m 4606.0 m	14,850 163,500 104,000 154,000 165,880 126,320 128,250 856,600
3	Installation of indoor heating and water system in private houses		1250.0 $/one house	2720.0	3,400,000
	Total				6,569,400

[1] *Carborobot.*
[2] *Investment costs for installation new heat pipelines, Tugrik per one meter pipeline(by 2008 year).*

terminal. Approximately 20 services companies have their own heaters, which generate hot water for heating. Technical data of heat consumers and boilers are shown in Table 7.3. Their total design heat loads are 1,378.0 kW.

The capital investment to improve the heating capacity of this boiler by 300 kW, is Tg121.8 million ($87,000), including Tg58.8 million ($42,000) for upgrading boiler capacity, and Tg63 million ($45,000) for construction of new heating pipelines. The coal price is Tg84,000) ($60) per ton. After improvements to the boiler, the price for one Gcal heating will be Tg66,500 ($47.5). This price is less than the current expense of heating small buildings. The owners of the these services all accept this option. Total investment costs of installation new boilers and heating network are shown in Table 7.4.

Expansion of capacity at existing boiler house at School 76 and the connection of nearby users. Customers located near Bayankhoshuu's bus terminal can be connected to the heating network of Talst Echim

TABLE 7.4. Total Investment Cost of Installation New Boilers and Heat Network

	LOCATION AND PROPOSED INVESTMENTS	UNIT	UNIT COST	VOLUME	TOTAL COST, $
1	Installation of a new boiler at the boiler house at 67th school	kW	140 $/kW[1]	300.0	**42,000.0**
2	Installation of a heat pipe at the boiler house at 67th school	2xD100 mm 2xD 80 mm	150.8 $/m 145.8 $/m	105.0 m 200.0 m	15834.0 29166.0 **45,000.0**
	Total				87,000.0

[1] *Carborobot.*
[2] *Investment costs for installation new heat pipelines, Tugrik per one meter pipeline(by 2008 year).*

TABLE 7.5. Total Investment Cost of Installation of Improved Boilers and Heat Network

	LOCATION AND PROPOSED INVESTMENTS	UNIT	UNIT COST	VOLUME	TOTAL COST, $
1	Replacement of three BZIU-100 by Carborobot at the boiler house at 67th school	kW	140 $/kW[1]	1100	**154,000.0**
2	Installation of a heat pipe at the boiler house at 76th school	2xD125 mm 2xD100 mm 2xD 80 mm **Total**	220.0 $/m 150.8 $/m 145.8 $/m	387.0 m 390.0 m 110.0 m	85,150.0 58,812.0 16,038.0 **160,000.0**
	Total				314,000.0

[1] *Carborobot.*
[2] *Investment costs for installation new heat pipelines, Tugrik per one meter pipeline(by 2008 year).*

Co., Ltd., boiler house at the 76th secondary school. There are three BZIU-100 and one ECO-500 boilers in the boiler houses, with a capacity of 2,600 kW. Since the BZIU-100 units are quite inefficient, they should be changed to modern boilers of the same capacity and high efficiency. The actual heat load is 980 kW (0.84 Gcal/hour), and the designed heat load for new customers from the Fringe *Ger* is 500kW (15 commercial services and about 20 private houses) and from the Mid-Tier *Ger* is 100 kW.

The capital investment for renewing the boiler located in Bayankhoshuu's new bus terminal with a high effeciency version is Tg439.6 million ($314,000), including Tg215.6 million ($154,000) for renewal and Tg224 million ($160,000) for construction of new heating pipelines. The coal price is Tg 84,000 ($60) per ton, and the fuel-cost ratio of total operating and maintenance costs for Ulaanbaatar city is 0.6. After the improvement of the boilers, the price for one Gcal heating is expected to be around Tg66,500 ($47.5). This is less than the current heating expense of small buildings.

TABLE 7.6. Total Investment Cost of Installation New Boiler House and Heat Network

	LOCATION	PROPOSED IMPROVEMENT	UNIT	UNIT COST	VOLUME	TOTAL COST, $
1	Boiler house in *Ger* area	Installation of new boiler house	kW	144.1 $/ kW1	5,9*1,192= 9,894.0 kw	1,425,725
2	Heat network from new boiler house	Heat pipes installation	2xD250 mm 2xD180 mm 2xD150 mm 2xD125 mm 2xD100 mm 2xD70 mm 2xD50 mm **Total**	330.0 $/m 300.0 $/m 260.0 $/m 220.0 $/m 150.8 $/m 145.8 $/m 135.0 $/m	52.6 m 311.0 m 236.0 m 440.0 m 670.0 m 540.0 m 590.0 m **2840.0 m**	**17,360** **93,300** **61,360** **96,800** **101,036** **78,732** **79,650** 528,240
	Ger or private houses	installation of indoor heating and water system		1,250.0 $/ one house	1677.0	2,096,250
	TOTAL					**4,050,000**

[1] *Carborobot.*
[2] *Investment costs for installation new heat pipelines, Tugrik per one meter pipeline(by 2008 year).*

Total investment costs of installing new boilers and heating network are shown in Table VII.5. After implementing these options, the coal consumption is likely to be reduced by 922 tons annually, and greenhouse gas (GHG) emissions will be reduced by 1,250 tons annually.

Cost of connection of existing houses to the district heating. About Tg5.67 billion ($4.05 million) would be required to connect these households to the centralized heating system (heat network of 2,840 meter and boiler house with capacity 9,894.0 kW). The investment amount per household is Tg3.4 million ($2,415), including Tg441,000 ($315) for construction of heating main lines, Tg1,190,000 ($850) for boiler construction and Tg 1,750,000 ($1,250) for installation of an indoor heating and water system. The annual heating cost for households will be 2.7 times higher than conventional system, or Tg 931,000 ($665) per year. Household income could not cover these expenses unless there is a significant government subsidy, which is at this point is unrealistic.

A more realistic and effective option would be to improve building insulation. The insulation cost for a house of 36 square meters is Tg266,000 ($190). Once insulation is complete, the consumption of coal can be reduced by 2.2 times, to around two tons per heating season. In addition, it is likely that fuel expense will be reduced by Tg260,000 ($185.71) and GHG emission reduced to 2.7 tons per season.

Residents expressed a strong interest in having hot water and showers in their houses or at a nearby area. In the middle of the *ger*, two bath houses with individual heaters can be built. The investment cost of installing one bath house, capable of serving 100 persons daily (35,000 annually), is Tg140 million ($100,000). If the service fee is Tg1,250 ($0.89) per person, the capital investment will be recovered in three years after the installation.

Fringe *Ger* (Sharhad), 9th *Khoroo*, Bayanzurkh District: Options available to improve heat supply include: a) installation at the bus terminal of a new, high-efficiency boiler house larger than 1.6 MW; b) installation of a new heating network from a new boiler house; c) replacement of three old boilers (type BZIU-100) at Psychoneurological hospital with new, high-efficiency boilers; and d) installation of two new bath houses in the center of the *ger* area.

Most of 43 small service buildings are located near the Sharhad bus terminal. There is no boiler house in this location. It is possible to build a new boiler with 1.6 MW capacity to connect these service buildings to the centralized heating system. The capital investment for this is estimated to be

TABLE 7.7. Total Investment Cost of Installing New Boilers and Heating Network

	LOCATION	PROPOSED IMPROVEMENT	UNIT	UNIT COST	VOLUME	TOTAL, $
1	Sharhad bus terminal	Installation of new boiler house with higher efficency	kW	140 $/kW[1]	1600.0	240,000
2	Sharhad bus terminal	Installation new Heat pipeline	2xD125 mm 2xD100 mm 2xD80 mm	220.0 $/m 150.8 $/m 145.8 $/m	230.0 284.5 264.0	50,600 42,910 38,490 **132,000**

[1] *by data of Carborobot*

Tg604.8 million ($432,000), including Tg420 million ($300,000) for improvements to the building and installation of the new boiler, and Tg184.8 million) ($132,000) for the construction of new heating pipelines. The coal price is Tg 84,000 ($60) per ton. The fuel-cost ratio of total Operating and Maintenance costs for Ulaanbaatar city is 0.6.

After the boiler is installed, the price for one Gcal heating will be Tg66,500 ($47.50). This price will be affordable to the small store owners. The total investment costs of installing new boilers and heating network are shown in Table VII.7. If this option is implemented, the coal consumption will be reduced by 1,000 tons, and GHG emission will be reduced by 1,360 tons annually.

To replace three old boilers (type BZIU-100) at the Psychoneurological Hospital's boiler house with high-efficiency new boilers, an investment cost of about Tg372.4 million ($266,000) is estimated. Upon running high effeciency boilers, the coal consumption will be reduced by 1,245 tons and the heating expenses will be reduced by Tg104.6 million ($74,700) annually. The capital investment will be recovered in three to four years due to the reduction of coal consumption. Total investment costs of installation new boilers are shown in Table 7.8.

To connect households to the centralized heating system, an estimated Tg8.7 billion ($6.2 million) will be needed (the heat network of 4,320 meters and boiler house with capacity 15,145.0 kW). The investment amount per household would be Tg34 million ($2,412), including Tg436,800 ($312) for the heat network, Tg1.2 million ($850) for the boiler and Tg1.8 million ($1,250) for installation of the indoor heating and water system. Similar to the Mid-Tier *Ger* scenario, this option is not financially viable, and a better option would be to improve building insulation.

Based on the analysis above, the following conclusions can be drawn:

- Integrating *ger* areas into the district heating system is costly even in the City Center *Ger*, where the central networks are already distributed nearby. The estimated cost per connection for a limited number of small businesses to existing centralized heating system will be around Tg1.8 million ($8,500), and the cost per connection of individual households is around Tg3.4 million ($2,415). Connection to the district heating system does not make much sense without improving the heating insulation of existing houses and small structures. In addition to scattered locations and low heat density, the existing individual houses and homes lose as much as 2–3 times more heat compared to national heat insulation standards.
- For the mid-tier and fringe *gers*, expanding or rehabilitating on-site boilers, improving housing insulation and existing stoves (as well as providing public bath houses) seem to be more economical options.

TABLE 7.8. Total Investment Cost of Installation New Boilers

	LOCATION	PROPOSED IMPROVEMENT	UNIT	UNIT COST	VOLUME	TOTAL, $
2	Psychoneurological hospital's Boiler house	Replacement of old boilers	kW	140 $/kW[1]	1900	**266,000**

Note: For this table, 1 $=1450 tugrik
[1] by data of Carborobot

TABLE 7.9. Total Investment Cost of Installation New Boiler House and Heat Network

	LOCATION	PROPOSED IMPROVEMENT	UNIT	UNIT COST	VOLUME	TOTAL COST, $
1	Boiler house in *Ger* area	Installation of new boiler house	kW	144.1 $/kW[1]	5,9*2567= 15145.0 kw	**2,182,440**
2	Heat network from new boiler house	Heat pipes installation	2xD250 mm 2xD180 mm 2xD150 mm 2xD125 mm 2xD100 mm 2xD70 mm 2xD50 mm **Total**	330.0 $/m 300.0 $/m 260.0$/m 220.0 $/m 150.8 $/m 145.8 $/m 135.0 $/m	40.0 m 515.0 m 340.0 m 670.0 m 1030.0 m 825.0 m 900.0 m **4320.0 m**	13,200 154,500 88,400 147,400 155,325 120,285 121,500 **800,610**
	Ger or private houses	installation of indoor heating and water system		1250.0 $/ one house	2567.0	**3,208,750**
	TOTAL					**6,191,800**

[1] *Carborobot.*
[2] *Investment costs for installation new heat pipelines, Tugrik per one meter pipeline(by 2008 year).*

- The *ger* residents will have no choice but to continue using stoves because alternative improvements such as district heating or local boilers are too expensive. Given this reality, technical options for energy-efficient stoves, alternative fuels and housing insulation would have to be further developed.
- *Ger* residents bear a high financial burden of heating costs. According to a recent Bank survey[44], the estimated total expenditure per household during the heating season is Tg174,767 ($125) for raw coal and Tg84,853 ($61) for firewood. More importantly, the same survey reveals that lower income households in the *ger* districts spend a significant amount of money to heat their *gers* or homes. The financial burden is extremely high for households in the bottom fifth income quintile; they spend as much as 40 percent of their monthly winter income on heating fuels, compared to similar expenditures of only 9 percent by households in the top income quintile.

8 Electricity

OVERVIEW OF CURRENT STATUS OF ELECTRICITY

Ulaanbaatar city is growing rapidly, both as the *ger* areas swell due to the influx of migrants from rural areas, and with the rapid construction of the urban center and housing developments. The World Bank-financed Energy Sector Project (ESP) has produced good results in reducing technical and non-technical losses in *ger* areas in UB, improving revenue collection, and commercializing the distribution business of the Ulaanbaatar Electricity Distribution Network Company (UBEDN). The project has successfully lowered technical and non-technical losses from an average of 31 percent to 20 percent in Ulaanbaatar *ger* areas. Billing and revenue collection have improved dramatically (bill collection days have been reduced from 98 to 57 days in UB).

Despite these improvements, the city's electricity service still faces significant challenges. Nearly 70 percent of underground cables have exceeded their technical life spans, and some 425 cable faults are reported annually. Half of the 75 main substation transformers have been in service for more than 25 years; nine have been in use for more than 40 years. Because of the global financial crisis and the sharp drop in commodity prices for Mongolia's major export commodities, the risk of compounding the economic crisis if the electricity system fails is very high.

Mongolia's current total installed electricity capacity is 878.4 MW. The recently updated Energy Sector Master Plan forecasted that power demand is expected to increase at an annual rate of 2.9 percent between 2001 and 2020. However, the actual average power demand growth for the last three years average was 5 percent. Due to reduced reliability and insufficient capacity of the distribution network, the UBEDN has to stop new connections (almost 150 connections for new buildings in 43 locations). The Government had announced a bid to construct a new combined heat and power (CHP) plant #5 in Ulaanbaatar, but due to the lack of proper planning and due diligence process, the tender has been cancelled. The Government has requested additional financing from the ongoing ESP for crucial investments in UB's distribution and transmission networks. Immediate financing is needed to meet the increasing demands for expansion and rehabilitation of the distribution and transmission networks in Mongolia's Central Region, estimated to be around $150–$200 million.

While electricity tariffs are not low by international standards (on average $4.7 cents/kWh), they are below the level that is necessary to reflect the cost of service and particularly the system expansion. A World Bank study in 2007 revealed that electricity and heat tariffs need to increase by 60 percent in order to cover costs. Lack of capacity and political will to adjust tariffs in a timely manner reflecting increasing costs (for fuel, coal, imported spare parts, goods and equipment) have exacerbated financial losses.

The Energy Regulatory Authority (ERA) of Mongolia also introduced a lifeline tariff rate to mitigate the social impact on poor and low-income consumers. Though the ERA introduced lifeline tariffs a few years ago, very few households have subscribed for these tariffs largely due to the lack of registration (by newly migrated households) or outstanding payables for previously used electricity. Paying electricity bills is not a problem for most *ger* area residents, but they would not be able to pay for new connections due to the high poverty incidence in *ger* areas. Because of the lack of proper planning and enforcement, it would be problematic to provide new connections, which need to be coordinated with district and city authorities.

The tariff for electricity in *ger* areas is between 58 and 66 Tg/kWh without VAT, depending on monthly consumption. Households in *ger* areas pay around Tg8,000 to Tg12,000 per month for electricity; this represents about 4 percent to 5 percent of total income (Tg200,000 to Tg250,000 per month) (See Table 8.1).

UBEDN's Performance

UBEDN's overall operational performance has improved considerably over the past three years. Distribution losses (technical and non-technical) have declined progressively from 28.4 percent in 2005 to 21.7 percent in 2008. The average billing collection rate has been satisfactory, and has ranged between 100 percent (in 2007) and 95.9 percent (in 2008). The recent decline in the overall collection rate suggests that older outstanding bills are becoming increasingly more difficult to collect, and also reflects the current economic downturn.

The underlying growth in demand and reduction in network losses over the last three years has resulted in high sales growth averaging 12.3 percent per annum. Total number of customers as at December 31, 2008, reached 176,000, registering an average annual growth of just under 8,200 customers. The average number of customers per employee has gone up marginally from 114 in 2006 to 117 in 2008. The customer mix for 2008 is indicated in Table 8.2.

Electricity tariffs increased by 27 percent effective July 15, 2008. The weighted average electricity revenue has increased from 48.51Tg/kWh (0.041US$/kWh) in 2006 to 57.84Tg/kWh (0.049US$/kWh) in 2008, representing growth of 19.2 percent. However, the distribution and supply component of the tariff (i.e. excluding bulk supply or power purchase costs) has risen by 40.4 percent from 9.71Tg/kWh (0.008US$/kWh) in 2006 to 13.64Tg/kWh (0.049US$/kWh) in 2008. The following chart illustrates the development of the retail tariff[45] over the past three years.

The overall financial performance of UBEDN has improved over the last three years due to efficiency improvements (lower distribution losses and higher billing collections) and sharp increases in the distribution and supply component (i.e. UBEDN's share) of the tariff. The col-

TABLE 8.1. Electricity Tariffs for Residential Consumers

#	CUSTOMER GROUPS	TARIFF (TG/KWH)
1.1 UB apartment dwellers		
a	<150 kWh per month	60.00
b	151–250 kWh per month	64.00
c	>251 kWh per month	68.00
1.2 UB *ger* residents		
A	<150 kWh per month	58.00
B	151–250 kWh per month	62.00
C	>251 kWh per month	66.00

TABLE 8.2. UBEDN Customer Mix

	CUSTOMERS		SALES, GWH	REVENUE, MILLION TG	AVERAGE TARIFF (TG/KWH)
***Ger* Area (peri-urban)**	92,876	52.8%	222.5 (19.1%)	11,452.9 (17.0%)	51.6
Apartment	73,339	41.7%	167.7 (14.4%)	9,768.6 (14.5%)	58.3
Commercial & Industrial (CI)	9,791	5.6%	774.7 (66.5%)	46,081 (68.4%)	59.5
Total	**176,006**	**100%**	**1,165**	**67,370**	**57.8**

lected revenues compared with cash revenue requirements illustrate that the company has closed the financing gap and has lived within its means in the last two years.

UBEDN's distribution and supply costs, other than depreciation, have increased as percentage of operating revenue from 19.0 percent in 2006 to 19.7 percent in 2008. Payroll costs per employee have risen by 47 percent over the past three years, and total payroll costs accounted for 12.5 percent of operating revenue in 2008. Repairs and maintenance costs in 2008 were 86 percent higher than in 2006 and represented 12.5 percent of operating revenue; however, such costs are still far below system requirements. Depreciation charges are excluded because of a peculiar and unexplained drop, reflected in UBEDN's income statements, from Tg4.1 billion in 2006 to Tg1.8 billion in 2008.

Capital investments during the last three years amounted to $12.3 million. Of this amount, 49 percent was funded through long-term borrowing and 14 percent through government grants. The remaining 37 percent was financed from UBEDN's internal resources and short-term bank borrowing.

The company's liquidity remains weak, although it has improved since 2006. The current ratio (the proportion of current assets to current liabilities) has gone up from 0.6 in 2006 to 0.8 in 2008. The debt/equity ratio has increased from 98 percent to 103 percent. The unsatisfactorily high ratio is mainly due to the fact that fixed assets have not been revalued for many years. A professional revaluation of fixed assets is expected to be completed by end 2009.

CURRENT STATUS OF ELECTRICITY IN *GER* AREAS

Recent household surveys report that more than 95 percent of *ger* residents in Ulaanbaatar have electricity in their households[46]. Despite the extensive coverage of electricity in the *ger* areas, the lack of capacity of electricity supply and unreliable service remain as main challenges, often resulting in power outages. The key issues with the electricity supply in *ger* areas are insufficient capacity of transformers and substations, and poor service quality due to the capacity shortage.

Households without access to electricity tend to be those in the fringe *ger* areas. Though new connections were made in recent years in *ger* areas, financed from the state and municipal budget, about 8,000 families still do not have electricity in UB. The UBEDN estimated that about Tg2.8 billion

TABLE 8.3. Current Status of Electricity Supply in Selected *Khoroos*

	KHOROO	TOTAL HOUSEHOLDS	ELECTRICITY SUPPLY	SERVICE IMPROVEMENTS NEEDED	NO ELECTRICITY
1	Bayangol district, 11th *khoroo*	2970	2920	30	50
2	Songino Khairkhan district, 8th *khoroo*, Bayankhoshuu *ger* area	1677	1677	50	N/A
3	Bayanzurkh district, 9th *khoroo*, Sharhad *ger* area	2567	2497	48	70

would be necessary to provide electricity to these households. In the three *ger* areas under review, only about 120 households are reported to have no access to electricity (Table 8.3).

OPTIONS FOR SERVICE IMPROVEMENT IN *GER* AREAS

City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District

Consumers living in apartments pay slightly higher tariffs than residents in *ger* areas. The tariff for apartment areas is 68 MNT/kWh, compared to 66 MNT/kWh in *ger* areas. Connection costs of electricity to residences are presented in the next section.

Mid-Tier *Ger* Area Bayankhoshuu *ger* area, 8th *Khoroo,* Songino Khairkhan District

This *khoroo* has eight *khesegs* (micro-districts), six of which have undergone technical rehabilitation under the ESP in 2005–2007. This includes the installation of rubber-insulated aerial conductors (XLPE) cables and electricity tariff meters together with meter boxes. The project implementation in the two remaining *khesegs* is pending. Within the USIP project, street lighting has been improved and 51 lighting fixtures were installed at both ends of eight streets. Cadastre mapping of the *khoroo* was prepared, including the systematic mapping of *hashaas* of each *kheseg*. However, the actual locations of *hashaas* and streets can be difficult to determine because of poor mapping and labeling in the cadastre system. In general, electricity supply in this *khoroo* has improved significantly with the implementation of ESP. There are voltage drop issues only on Streets # 8 and 9 of the Zuun Bayan Tsagaan area for about 40 households; also, some newcomers have not been provided with electricity due to the lack of official registration.

Seven outdoor transformer stations (OTS) and indoor transformer stations (ITS) are in operation in this *khoroo*. This *khoroo* is located in the *Nuur* (lake) area, where four brick manufacturing factories operate during summer months. Given the high density of the location, it has limited space for newcomers. Sometimes several families live in one *hashaa* and as a result may easily move to another place without paying their electricity charges. The installation of electricity meters under the technical part of ESP allows the use of time-differentiated meters, while the new XLPE cables help reduce non-technical losses, such as theft of electricity.

Around 70 households of Eej khairkhan 8th street (or 4th *Kheseg*) do not have electricity. In addition, around 47 newcomers in 7th *Kheseg* settled in swampy, low-lying area without registering;

these households constructed a 0.4kV distribution line privately and have taken electricity only from one pole. In the 6th and 2nd *khesegs,* 20 households and 30 households, respectively, on 2nd street are taking electricity from one meter, thus increasing loading and causing voltage drops. On the other hand, the central *khesegs* have relatively reliable electricity supply where ESP is completed.

In one particular situation, on 8th street of Eej Khairkhan or Belkh, area households are engaged in cattle breeding; the poor road condition makes the construction of distribution lines very difficult. Generally the territory of this *khoroo* has a muddy and craggy surface. Nine OTS's and ITS's are in operation in this *khoroo*, and the remaining customers are supplied from other OTS's.

Occasional electricity interruptions are reported in this *khoroo* during evening peak loading. The *khoroo* is located far from the city center and has a relatively high number of newcomers. Also, temporary households move into the area during the summer season to plant vegetables and to camp, thus increasing electricity demand. It is estimated that annual demand growth will be as much as 5 percent–6 percent per annum. During discussions, *khoroo* and *kheseg* leaders noted that the average monthly electricity consumption of *ger* area households is around 150 kWh or (Tg10,000 without VAT).

The Western Distribution Center of UBEDN is responsible for technical aspects of electricity supply, and the Bayangol district Customer Service Center (CSC) is responsible for customer billing and revenue collection, as well as day-to-day service and maintenance.

In the Mid-tier *Ger* there is an issue of improving services for about 50 households who live in 8th and 9th streets of the Zuun Bayan Tsagaan area. The per capita cost of upgrading and rehabilitation is estimated to be about Tg336,742.6 (about $230).

Current *ger* residents will a benefit from the improved and reliable supply of electricity, and so the consumption level is likely to rise. Recently, the Project Steering Committee of ESP decided to rehabilitate 38 transformer sub-stations in Songino Khairkhan district, at a total cost of around Tg545.5 million ($390,000). It is expected that non-rehabilitated *khesegs* of the 8th *Khoroo* will be included in this work.

Fringe *Ger* (Sharhad), 9th *Khoroo*, Bayanzurkh District

Of the eight *khesegs* in this *khoroo*, upgrades under the ESP werebeen implemented in six *khesegs* in 2005–2006, including installation of XLPE cables and electricity meters together with meter boxes.

The cost of connections for households without electricity will be around Tg712,500–Tg956,783 ($500–$670), depending on the distance from existing substations, topography, etc. The nearby UBEDN network does not have enough capacity, so there is a need to build a new transformer substation with capacity 160 kVA and an associated distribution network of 10 kV and 0.4 kV overhead lines.

TABLE 8.4. Cost of Service Improvements in 8th *Khoroo* for 50 Households

#	COST ITEMS	COST (THOUSANDS, MNT)
1	0.4 kV overhead lines, 0.5 km	12,014.6
2	Meters, boxes and other	4,822.5
	Total	16,837.1

TABLE 8.5. Cost of New Connections in 9th *Khoroo* for 60 Households

#	COST ITEMS	COST (THOUSANDS, MNT)
1	Transformer substation, 160 kVa	18,129.5
2	10 kV overhead lines, 0.5 km	10,000.1
3	0.4 kV overhead lines, 1.5 km	21,127.6
4	Meters, boxes and other	8,149.8
	Total	57,407.1

TABLE 8.6. Cost of Service Improvements in 9th *Khoroo* for 48 Households

#	COST ITEMS	COST (THOUSANDS, MNT)
1	Transformer substation, 100 kVa	15,515.0
2	10 kV overhead lines, 0.6 km	8,187.8
3	0.4 kV overhead lines, 0.8 km	16,033.1
4	Meters, boxes and other	5,628.3
	Total	45,364.3

Service improvements for about 48 households in 7th *Kheseg* of this *khoroo* would cost about Tg945,083 ($660) per household, including a transformer substation of 100 kVa, overhead lines of 10 kV and 0.4 kV, meters, and associated works.

CONCLUDING REMARKS

There are several major issues with electricity supply in *ger* areas, including voltage drops due to capacity shortages, insufficient capacity of transformers and substations, as well as households without electricity. Electricity is provided to most households of the three *ger* areas under review, except about 120 newly settled families. *Ger* area residents who have connections on average use about 100 kWh–110 kWh of electricity, for which they pay about 4 percent–5 percent of their monthly income, which is within the internationally recognized affordability limit. Service improvements for existing consumers, such as capacity improvements at nearby substations and improved metering and wiring would cost on average Tg280,000–Tg 560,000 ($200–$400) per household.

The cost of new connections for households in the selected *ger* areas varies between Tg840,000 and Tg1,120,000 ($600–800) per connection depending on (among many variables) topography and distance from and available capacity of nearby transformers and substations of the distribution network. Households currently without connections would not be able to pay for new connections on their own. Even though the Energy Regulatory Authority (ERA) has introduced lifeline tariffs, very few households have subscribed for these tariffs due to the lack of registration (because they are newly migrated), or outstanding payables for previously used electricity. The lack of proper planning and enforcement among district and municipal authorities make it more difficult to provide new connections.

9 Education and Health Services

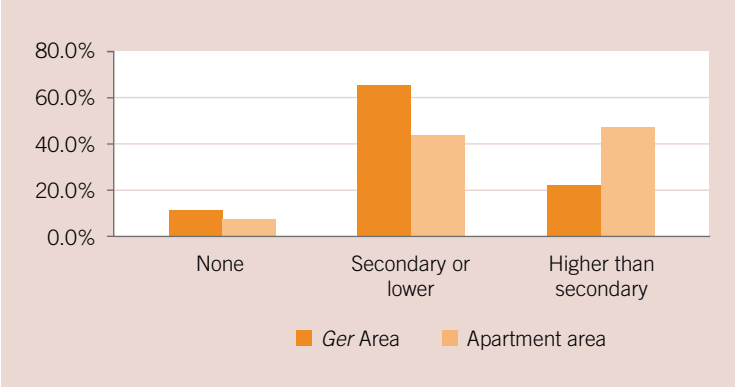
Social services in education and health are generally in poor condition in *ger* areas, though are probably better in terms of access and availability than most other key infrastructure sectors. Similar to other transition economies, the government is traditionally responsible for providing basic health and education services, which are heavily subsidized. In light of a series of policy reforms in recent years, the private sector has played an increasing role in these sectors and the share of private out-of-pocket costs has steadily increased. However, the private cost of schooling and hospitals remains generally low compared with many other transition economies. Despite inefficiencies and structural issues embedded within these sectors, key indicators on educational attainment and health suggest a gradual but steady improvement toward meeting the Millennium Development Goal (MDG) targets.

Improving service delivery in education and health would require addressing a set of related policies, institutional structures and systems of financial incentives at the national level, which is beyond the scope of this report. This chapter describes some of the relevant sector background; diagnoses key issues in education and health sectors that were highlighted during the focus group discussion in three *gers*; and summarizes options for service improvement and the financial implications.

CURRENT STATUS OF EDUCATION AND HEALTH SERVICE PROVISION IN *GER* AREAS

Education. Overall, Mongolia ranks high among countries in the East Asia region in terms of enrollment rates and the percentage of students completing basic education[47]. Nevertheless, enrollment figures mask important disparities in completion rates by geographic area and wealth. Educational attainment in *ger* areas is lower than that in apartment areas, showing a clear correlation between income and educational levels. In *ger* areas, about 37 percent of residents have completed secondary school, 14 percent of children recently have finished primary school and another 14.5 percent have dropped out of secondary school. In apartment areas, by contrast, almost half of students have advanced past secondary school to vocational training or college education.

FIGURE 9.7. Highest Education Level Obtained in *Ger* and Apartment Areas (%)



Source: HIES, 2007

The share of government spending devoted to education remains relatively high. Since 1997, when the share of education spending reached a low of 16 percent of the total budget, education's share of the budget has increased[48], reaching 20 percent of total public expenditures in 2005. This is in line with the Government's policy to maintain education's share of total government budget at about 20 percent. This level of spending is relatively high compared to most low-income countries[49]. Total spending on education as a percentage of total public expenditure was 19.1 in 2004 compared with an average of 16.2 percent for other developing countries in the East Asia and the Pacific Region[50].

At the national level, primary and secondary education is given a high priority by the government with the view of achieving the MDG of Universal Primary Education. Strengthening basic education is listed as a priority area in the Government's National Development Strategy Plan[51]. The bulk of funding for pre-tertiary education continues to come from the state budget. Since 1991, non-state participation in education has increased and schools have been more active in raising additional sources of revenue. Nevertheless, state financing is by far the largest source of funding for the education sector. Funding via the state budget remains predominant; in 2006, it was an estimated at 98 percent. Primary and secondary education receive more than 50 percent of the overall education budget and account for 70 percent of all students in the education system[52].

The government also runs education aid programs, including tuition subsidies for the poor and the provision of free textbooks and school supplies. The evaluation of these programs indicates that while there is some leakage to the non-poor and room for improvement to expand coverage of the poor, the poor do greatly benefit and are the largest share of beneficiaries.

The state financing and aid programs in primary and secondary education translate into relatively low-to-moderate household spending on education. According to the Household Income Expenditure Survey (HIES) analysis, in *ger* areas nearly 70 percent of primary and secondary students do not pay any tuition, compared to less than 45 percent in apartment areas. Among those who do pay for tuition in *ger* areas for primary and secondary school, the average annual tuition is Tg50,000 ($107) per student, compared to Tg350,000 ($250) per student in apartment areas. Other than tuition, books and school supplies, food and transport are the major expenses for primary and secondary education.

TABLE 9.1. Average Annual Household Expenditure on Primary and Secondary Education (Tg)

AREA	GER AREA	APARTMENT
Rent	169	10,908
Books and Supply	34,893	44,078
Uniforms	11,306	14,957
Transport	27,178	34,228
Food	29,207	55,611
Others	12,344	22,335
Total	**115,098**	**182,117**
% of Average income	7.2	7.0
% of students enrolled in public school	89	77
% of HH who pay tuition	30	44

Source: HIES 2008

Focus group discussions in the three *ger* areas indicate that the distance and time spent on commuting to school does not seem to be much of an issue, although it was often highlighted that students from newly settled, more distant *gers* would have to walk more than one hour to get to school. About 60 percent–65 percent of primary and secondary students walk to school; the rest rely on public transportation or fam-

ily vehicles. On average, primary and secondary students are reported to spend about 25–35 minutes getting to school. This is similar to the result of the HIES survey, which showed average travel times of about 18 minutes for apartment areas and 22 minutes for *ger* areas.

However, road safety and school transportation are often cited as main areas for improvement in schooling in *ger* areas. There are virtually no road safety measures in front of or near schools, and this increases the incidence of traffic accidents. With almost half of the *ger* students taking some kind of vehicle to go to school, unreliable and infrequent transportation services can add difficulties.

TABLE 9.2. Secondary School in Three *Ger* Areas

	CITY CENTER *GER* (NARAN)	MID-TIER *GER* (BAYANKHOSHUU)	FRINGE *GER* (SHARHAD)
Number of kindergarten	2	1	1
Number of teachers at kindergarten	21	18	18
Enrollment at kindergarten	576	490	190
# of Secondary School	2	1	1
Total number of students in this *khoroo* enrolled in secondary school	2781	500	4430
Total number of students attending school(s)	4580	3200	1196
Pupil-teacher ratio (PTR)	N/A	64	35
Number of class shift per day	3	3 to 4	4
Average travel time (minutes)	25	35	36
Average travel distance	3.2	2.5	1.8

Source: Based on survey with kheseg leaders during focus group discussion

Considering the relatively low drop-out rates and acceptable educational attainment (by international standards) and the relative affordability per household, the main challenge for primary and secondary schools in *ger* areas is to maintain or increase their capacity in response to urban migration and growth. The expansion of *ger* areas has put significant pressure on existing school facilities. In the three *ger* areas under review, there are one or two secondary schools with 1,200 to 3,200 students. The pupil-teacher ratio varies from 35:1 to 64:1, compared with 34:1 in Ulaanbaatar on average. In the Mid-tier *Ger*, the pupil-teacher ratio is far higher than Ulaanbaatar's average mainly because it has to absorb about 2,700 students from neighboring *khoroos* that do not have a secondary school. Similarly, the City Center *Ger* (Naran) secondary schools accommodate an additional 1,800 students from neighboring *khoroos.* In the Fringe *Ger*, existing school facilities can only serve 30 percent of the total students in the *khoroo*. The rest attend schools in neighboring *khoroos*. All schools run three to four shifts per day to accommodate the growing number of students, appreciably limiting the length of school days for students.

Focus group interviews with *khoroo* and *kheseg* leaders show that all schools in *ger* areas suffer from poor maintenance and a lack of adequate facilities. In case of the Mid-tier *Ger*, the kindergarten is shared with three neighboring *khoroos* (No. 17, 19 and 24) and is far too small. Many of these kindergartens are donor-funded and rely on external funding for operation and maintenance. If for some reason the budget support or external funding should fall short, most of these facilities will be closed.

The absence of recreational centers for after-school activities is another problem facing *ger* residents. Schools operate on three or four shifts per day, making after-school activities at school difficult, if not impossible. In all three *ger* areas, there is no recreational center at the *khoroo* level. Lack of supervised leisure activities is often cited as a main factor contributing to juvenile crime. When school children have no constructive way to spend their spare time, they end up wandering in the

streets and getting into trouble. In fact, crime in *ger* areas is emerging as a social issue in Ulaanbaatar; this is a common social phenomenon in economies experiencing drastic social and demographic changes, along with rising income inequality. International donors have financed a number of youth centers across *ger* areas, providing various programs free of charge to children from disadvantaged backgrounds. However, the maintenance of the facilities and programs that would continue to attract youth is the main challenge. This would require a small but steady and reliable budget allocation from district governments, which are often strapped for cash.

Health Services: Health indicators in Mongolia fare well compared to countries at similar levels of development, reflecting the traditional role of the government as the main provider of health services. Infant and child mortality is low and has been declining steadily. The infant and under-five mortality rates were 35 and 43 per 1,000 in 2007, respectively,[53] and mortality from communicable diseases has also decreased notably, especially for TB and other diseases that can be prevented with immunization programs[54]. While infant and child mortality seem to be declining, the adult mortality rate is reported to be rising because of lifestyle-related diseases and non-communicable conditions such as heart attack, stroke, cancer, and diabetes.

The Social Health Insurance introduced in 1994 provides compulsory coverage to people in Mongolia. Revenues are based on payroll contributions by individuals in the formal labor market and a flat rate contribution of Tg500 ($0.36) by individuals in the informal sector labor market. In addition, full government subsidies apply for vulnerable groups such as the unemployed, children under 16, pensioners, and parents with children under two years old. According to the HIES survey, almost 90 percent of *ger* residents have health insurance and slightly less than 95 percent of apartment residents have insurance. Health care is mainly financed from the government budget. Government expenditures accounted for approximately 63 percent of total health expenditures in 2003. From an international perspective, government spending on health as a share of GPD is high (6.9 percent), and private out-of-pocket expenses are considered low compared with other transition economies.

The government reform in the mid-1990s in the health sector shifted the emphasis of the system from hospitals to a primary health care (PHC) system with support from donors, including the Asian Development Bank and the UN agencies[55]. In line with the government's decentralization policy, responsibility for the health care system was also decentralized to the local governments, who are now mainly responsible for the delivery of health services. Policy making, strategic planning and evaluation remain as responsibilities of the Ministry of Health (MoH).

In urban areas, PHC services are delivered by family group practices, consisting of community nurses who refer emergency patients to district health centers. Specialized care is delivered by urban district general hospitals, which cover all major clinical specialties and typically have capacities of 200–300 beds for delivering inpatient services.[56] There are also state clinical hospitals and specialized health centers, mainly located in the city area of Ulaanbaatar.

One key issue in the health sector is the inefficient allocation of resources between curative hospital services and preventive services. The level of expenditures for hospital care is high—the hospital sub-sector accounts for about two thirds of the health budget—compared with the level of spending on public health and primary care.[57] The above-mentioned policy change that emphasizes the

PHC system and decentralization of responsibilities of health care system was not accompanied by the sufficient redirection of resources to PHCs and local governments. Consequently, the roles and responsibilities among the MoH and local governments remain unclear. It is often noted that Mongolia has far too many hospitals: 23.4 hospitals per 100,000 people, more than twice the average in the European Union and other transition economies.[58] These hospitals, however, are concentrated in urban areas, and PHCs in remote areas are left without adequate facilities and resources.

TABLE 9.3. Primary Health Providers in Three *Ger* Areas

	CITY CENTER (NARAN)	MID-TIER *GER* (BAYANKHOSHUU)	FRINGE *GER* (SHARHAD)
Population	12,245	7,979	11,130
Number of Clinics in *khoroo*	2	1	1
Number of doctors and nurses in the clinic	6–7	6–7	11
Number of patients received per day	N/A	N/A	240

Source: Based on survey with kheseg *leaders during focus group discussion*

Aside from an oversupply of hospital services, the provision of health services in Ulaanbaatar is inequitable and favors the non-poor areas of the city. Despite laws, regulations, and policies that underscore the importance of PHC, financial support for public health has been insufficient. PHC is known to receive only around 5.5 percent of total health funding; the hospital sector, by contrast, continues to account for about two thirds of the state health budget.

The lack of health care quality and investment in infrastructure, facilities, and equipment are also well illustrated in the three *ger* areas. PHCs in the *ger* areas face problems in keeping up with the demand placed on the services. Each *khoroo* has one or two PHCs and the ratio of patients to doctors is high compared to a similar PHC in apartment areas. Due to limited budget allocations, the facilities in the areas are reported to have outdated equipment and are under-staffed, with less than ten staff per facility, including part-time workers. The health clinics in remote *ger* areas, in particular, tend to be over-crowded given the lack of alternatives that residents have for primary health providers. In contrast, in the central *ger* area, the health clinic is usually under-utilized as the residents have alternative choices of primary and secondary hospitals as well as other primary health clinics in the city center.

The focus group discussion highlighted dissatisfaction with the quality and accessibility of primary health services, as well as a lack of trust in primary care providers. Most households would prefer to go to secondary or tertiary level hospitals in the city for better and more reliable services but are often discouraged from doing so because of the much higher cost that individuals have to pay themselves. While there is no hard data to support this in *ger* areas, community representatives expressed a concern that an increasing number of poor households do not have access to health services because they lack civil registration and are therefore not officially entitled to free health and education services or other social welfare benefits, nor are they eligible to register for the social health insurance scheme.

OPTIONS FOR SERVICE IMPROVEMENT AND COST IMPLICATION

Improving service delivery in education and health services in *ger* areas would require a set of policy reforms which revisit the underlying institutional, financing, and incentive systems in the two

sectors at the national level. This goes beyond the scope of the present study. Hence, options discussed here will focus on providing facilities and services in the three *ger* areas.

For education,

- The most urgent problem in *ger* area schooling is a lack of facilities to absorb the increasing number of students. This can be partly addressed by providing additional primary and secondary schools or expanding the existing ones to ease the burden on existing facilities. Either approach would require not only physical investments in facilities but also adding teachers and other supporting infrastructure such as roads, water supplies and sanitation.
- An initial assessment suggests costs would be around Tg1,820,000 ($1,300) per capita to provide school facilities and supporting infrastructure operating on a normal single shift. This does not include costs associated with remuneration for school teachers, etc. Similarly, the provision of youth and recreational centers should be considered in the *ger* areas. Around Tg175,000 ($125) per capita is estimated for the physical investment only. More importantly, maintaining existing facilities and programs, which are critical to ensure the long-term sustainability of the centers, will probably add another 10 percent–15 percent to the capital investment cost every year.
- In parallel, general improvements in road conditions and connectivity to schools can help improve school access. Increasing the frequency of public/mini buses, which students most frequently ride to schools, can be similarly beneficial. Related cost implications are discussed in detail in the Transport Chapter.

For health,

- Expanding or adding primary care providers can be especially important in the remote *ger* areas where choice of other hospitals is rather limited. This will have to be accompanied by replacing some outdated equipment and ensuring enough staff are in place in order to prevent under-utilization of the facilities.
- An initial cost estimate for additional primary health care facilities suggests around Tg505,400 ($361) per capita, not including salaries and other variable costs.
- Some health clinics are often under-utilized because of a shortage of staffing and outdated facilities. This is especially common in the *ger* areas closer to the city center where people have more liberty to choose alternative primary care providers or secondary or tertiary hospitals. In this case, updating existing facilities and adding competent doctors and nurses should be given a priority.

10 Conclusion

The following policy directions and scenarios have emerged as a result of the above analyses.

***Smart Growth*:** It would make economic sense to adopt "smart growth" policies as principle directions in the long run, i.e. to increase density in the center of the city where appropriate while controlling further expansion at the outskirts of the city. In general, high density development would make it easier to provide better urban services with higher efficiency and lower cost. The public also has the desire to live in high density development: low-rise apartments or collective housing with utility services. Realistically, however, the majority of *ger* areas will remain in their current conditions because achieving higher density development is very complicated, as elaborated below.

***Conversion of central gers to apartments will take time*:** Converting center *ger* areas into apartment complexes has not progressed as fast as the government had envisaged. One reason is that most *ger* area residents cannot afford the cost of apartments in the city center. The lack of mortgage finance also makes buying large assets (such as apartments) difficult for many people. A third reason is that the absence of a functioning real estate market—including proper methods for determining prices for private land transactions—has impeded the development of new housing.

***Retrofitting urban services in mid-tier gers is exorbitantly expensive*:** A majority of *ger* areas outside of the city center are older establishments. Many residents have lived there for a long time and have invested in their dwellings, a large number of which are detached houses. These residents are relatively content with their neighborhoods and would like to see improved urban services for their houses or development of low-rise, small-scale apartment complexes. These areas are not suitable for conversion to large high-rise apartment complexes—at least for the mid-term—mainly because they are not near network infrastructure, except along the major transportation corridors.

While a minimum level of urban services have reached most of these areas, upgrading services to the full-fledged level now available in apartment areas would be exorbitantly expensive and almost impossible. The unit costs of services to individual houses are several times higher than for apartment units. Instead, improvements in housing—such as conversion to low-rise, smaller collective dwellings, which might make connection to network infrastructure feasible—could be envisaged if residents' income increases. In the meantime, gradually improving services within the affordability limit of residents and public financial resources would seem the most practical approach for the majority of *ger* areas.

***Room for relocating fringe ger residents*:** The situation in the more remote fringe areas of the city is slightly different. *Gers* in these areas are inhabited by recent migrants. Their income level is even

lower than those of city center residents or the residents of long-established *gers*. They are farther away from the economic activities of the city and have little access to health and education services. Utility services also are even worse than for residents in established *ger* areas. Therefore, residents of these fringe *gers* are very dissatisfied with living conditions and are ready to relocate, if affordable better housing is available elsewhere. But again, affordability is a very serious issue for these residents because of their economic circumstances.

IMPLICATIONS FOR PLANNING AND DEVELOPMENT

Given the situation above, seven priority areas require attention by the government:

1. *Access roads within ger areas:* The majority of the residents in *ger* areas are lower-income and are further disadvantaged by very poor access to markets, work places, education and other services. Modest improvements in the secondary access roads from major corridors to inside the *khoroos* (including basic drainage and street lighting) would give residents major benefits, including easier access by taxis or mini-buses and reduced dust, storm-water torrents and crime. Therefore, it would make sense to initiate planning for development of access roads within the *khoroos*. Community-driven initiatives on land re-plotting, if appropriate, would also make it easier to plan roads and provide access for utilities.

2. *Better heating systems to improve efficiency and reduce air pollution*. Because the development of apartment complexes is likely to take a long time and most *ger* areas will not be connected to central heating systems in the near future, short-term measures are needed to improve air quality in the city. Such measures could include better access to cleaner and more efficient stoves and fuels, as well as programs to increase the energy efficiency of houses.

3. *Solid waste management and community infrastructure*: Solid waste management is often listed by *ger* area residents as one of their most serious concerns. The current solid waste collection practices seem to be very inefficient and costly. Other community infrastructure and services, such as pathways, foot bridges and community youth centers, also would be helpful in meeting day-to-day needs of many *ger* area communities, given the lack of proper site development and the shortage of schools and extracurricular activities in *ger* areas.

4. *Research on affordable collective housing in mid-tier gers*: So far, all apartment developments have been concentrated in the center of the city and been targeted only for higher-income residents. Therefore, the development of apartments has not benefited the majority of *ger* residents. On the other hand, some residents in the older, established mid-tier *ger* areas located along major roads seem willing to consolidate their individual plots and develop low-rise collective housing; this would provide easier and less costly access to utility services. Therefore, it would make sense to begin reviewing the feasibility of affordable collective housing development along transport corridors and utility supply lines in the established mid-tier areas.

5. *Fringe gers*: Providing networked utility services in the fringe *ger* areas is very expensive. Many residents in those areas are very dissatisfied with current living conditions (including the poor quality and availability of public utility services) and might want to find better housing and economic

opportunities elsewhere. For these reasons, a major expansion of networked utilities in the fringe *ger* areas does not make much economic sense. Instead, services should be provided at the minimum humanitarian level. Since the future of these *gers* will depend, in part, on the social integration of new migrants, some lessons from social housing in Hong Kong or Singapore might help Mongolia develop clearer policies.

6. *Utility capacity expansion and reforms*: The more residents enjoy a higher standard of living, the higher the required capacity will be for utility services. However, most utility services—water supply, heating and electricity—already have reached capacity limits. As gradual progress is made on housing and utility services, capacity also can be expanded. Because estimated investment requirements are significant and utility services face considerable financial constraints, reforms of pricing and regulations of utility services will be essential prerequisites.

7. *Further research in related sectors*: The municipal budgetary resources of UB are quite limited, at around Tg30 billion–Tg60 billion ($21 million–$43 million) per year. Given the slow implementation of pricing reforms, many infrastructure services in UB already receive large implicit subsidies. Furthermore, expansion of key network infrastructure will easily require investments of Tg30 billion–Tg50 billion ($21 million–$36 million) or more. Other problems noted in this report, including inadequate housing development, the lack of mortgage financing and problems in the banking sector, create additional challenges for the housing sector. Further research on municipal finance and the banking sector, including mortgage financing, might help the government develop clearer policy directions.

Endnotes

[1] Angel Shlomo et. al., 2005

[2] JICA, June 2008

[3] JICA, June 2008

[4] Population of nine districts where majority of *ger* areas are located. UB Census 2004

[5] Unless otherwise referenced, the data for this sub-chapter was provided by the National Statistical Office's Household Socioeconomic Survey (HIES). For a detailed description of the analysis methodology of the HIES data in this report, see Annex B.

[6] Older than age 16, younger than 60

[7] Paid out of the Development Fund, and contingent on there being money in the fund.

[8] Child Benefits and Poverty Reduction: Evidence from Mongolia's Child Money Programme", UNICEF, 2007.

[9] The total sample size of this survey was 440. The survey was carried out in four areas including three *ger* areas plus a representative apartment area with 110 sample size in each area, and some results, where appropriate, have been weighted and adjusted to reflect the overall dwelling types (apartment, detached houses and *gers*) in the *ger* areas. The sampling method was based on a random sampling. Given the small sample size, figures and findings here should be taken only as indicative references.

[10] Law on Mongolia Land Fees, Article 3

[11] Law on Mongolia Land Fees,

[12] GTZ, "Land Management–Fiscal Cadastre in Mongolia", April 2008

[13] Generally speaking, the international benchmark for housing affordability is estimated with Price to Income Ratio (PIR). In most countries, PIR that is considered as affordable generally ranges from three to five. In the case of Mongolia, this ratio is much higher than the internationally accepted affordability ratio, even in the apartment area.

[14] *COWI Mongolia: exploring Options for Management Contracting-out in Water Supply and Sanitation Services for Ger Areas in Ulaanbaatar: Progress Report A*, World Bank/PPIAF, March 2009

[15] COWI, March 2009

[16] Centre for Social Development, Mongolia *The Current Situation of the Public Utility Services of the Ger Areas in Ulaanbaatar, Study Report* (2006): 4.2.

[17] *COWI, March 2009: p. 18.*

[18] Centre for Social Development, Mongolia (2006): 4.2.

[19] COWI, 2009, p. 16.

[20] COWI, 2009

[21] USUG financial data, management performance data, 2008

[22] WB team estimate based on USUG 2008 financial statements for truck department and piped kiosk department

[23] Centre for Social Development, (2006): Table 5.5.

[24] USUG 2009, World Bank UISP2 Project

[25] Present Serviceability Rating (PSR) is an assessment of pavement serviceability based on observation. This subjective scale ranges from 5 (excellent) to 0 (essentially impassable).

[26] "The Study on City Master Plan and Urban Development Program of Ulaanbaatar City," Japan International Cooperation Agency, July 2008.

[27] The Sharhad bus station, which large buses can access, is located in Sharhad *Ger*, 9th *Khoroo*, Bayanzurkh District.

[28] Throughout this chapter, figures used for the three *Khoroos* are approximations based on relatively small sample sizes.

[29] Traffic counts, which were taken over a two-day period in April 2009, were observed at: Bayangol District, 11th *Khoroo*—Tasganii Ovoo Intersection; Songino Khairkhan District, 8th *Khoroo*—Zuunsalaa and Bayankhoshuu Streets; and Bayanzurkh District, 9th *Khoroo*—National Health Center Intersection.

[30] "Databook on Socio-Economic and Environmental Conditions of Ulaanbaatar City," Japan International Cooperation Agency, May 2008.

[31] Residents informed the team that the highest number of crimes occurred in areas without lighting.

[32] "Databook on Socio-Economic and Environmental Conditions of Ulaanbaatar City," Japan International Cooperation Agency, May 2008.

[33] IBID.

[34] Estimated costs include all materials, labor and equipment.

[35] In Mongolia, the cost to construct a seven meter carriageway with 1.5 meter shoulders using hot mix pavement is about $275,000 per km.

[36] Municipal guidelines call for a cement sub-base of 20 cm and two separate applications of asphalt binder material and mineral aggregate on a prepared surface of no more than 1.5 cm each (3 cm total).

[37] This price excludes the cost of simple box culverts (10 meters), which range in cost from $1,500 to $2,000 each.

[38] Street lights would be placed every 50 meters.

[39] It is assumed that one-meter wide sidewalks and street lighting will be provided on at least one side of all improved roads.

[40] GDP $3 billion / 50,000 km of network (international, state and local roads).

[41] Using a rough estimate of 27 km of roads per *Khoroo*, one street light every 50 meters and $1,500 per *Khoroo* per month to maintain street lighting equals $2.75 per street light per month.

[42] Note: Fuel cost estimates has been done using wholesale prices. 1 ton of coal cost is Tg 65,000 per ton (wholesale) and Tg 130,000 per ton (retail). 1 ton of firewood is Tg 90,000 per ton (wholesale) and Tg 200,000 per ton (retail).

[43] Note: Fuel cost estimates has been done using wholesale prices. 1 ton of coal cost is Tg 65,000 per ton (wholesale) and Tg 130,000 per ton (retail). 1 ton of firewood is Tg 90,000 per ton (wholesale) and Tg 200,000 per ton (retail).

[44] Energy Efficient and Cleaner Heating in Poor, Peri-urban Areas of Ulaanbaatar, Summary Report on Activities, the World Bank, 2009

[45] All tariffs quoted in this annex are exclusive of 10% value added tax (VAT) charged to electricity customers.VAT is applied on the base cost.

[46] HIES Survey

[47] Mongolia, Consolidating the Gains, Managing Booms and Busts, and Moving to Better Service Delivery, A Public Expenditure and Financial Management Review, World Bank, 2008. The completion rate of basic education in Mongolia is 77%, which compares with 56% in Vietnam, 43% in Indonesia and 38% in Cambodia.

[48] Ibid

[49] Ibid

[50] ibid

[51] Mongolia Education Sector Reform, TA report, Asian Development Bank, 2008

[52] Ibid

[53] World Development Indicator, 2007

[54] The Ministry of Health, National Center for Health Development, Health Indicators of 2004

[55] Evaluation on the Health and Social Protection in Mongolia, Asian Development Bank, 2008

56 Ibid

[57] Mongolia, Consolidating the Gains, Managing Booms and Busts, and Moving to Better Service Delivery, A Public Expenditure and Financial Management Review, World Bank, 2008.

[58] Evaluation on the Health and Social Protection in Mongolia, Asian Development Bank, 2008

ANNEXES

ANNEX A
List of People Met

State Great Hural (Parliament)

Mr. Batabayar Nyamjav	Member of the State Great Khural; Cabinet Member, Ministry of Construction and Urban Development
Dr. A. Bakey	Member of the State Great Hural, Chair of the Standing Committee on Environment, Food and Agriculture
Mr. Namjildorj Enkhabayar	Senior Advisor, Prime Minister's Office
Mr. Tsogy Batbayar	Member of the State Great Hural

Ministry of Finance

Mr. Khurenbaatar	International Cooperation Department
Mr. Davaasuren Angar	Director, Debt Management Division, Treasury Department
Mr. Khaltarpurev Mart	Director-General, Procurement Policy and Coordination Department, MOF

Ministry of Roads, Transport, Construction, and Development

Mr. Jadamba Bat-Erdene	State Secretary
Mr. Zundui Tuul	Officer, Construction and Public Utility Policy and Coordination Department, MCUD
Mr. Gombo Myagmar	Director of Construction, Housing and Public Utilities Policy and Coordination Department
Mr. Badrakh Batbold	Chairman, Dr. of Engineering, Ph. D, Department of Urban Development
Mr. D. Bailikhuu	Adviser, State Property Committee
Mr. Sorogjoo Ochirbat	Director, Doctor (Ph.D), Department of Urban Development Policy and Coordination
Dr. Shairai Batsukh	Director General, Administration of Land Affairs, Geodesy and Cartography, Regulatory Agency of the Government of Mongolia
Mr. Jadambaa Davaabaatar	Deputy Head, Administration of Land Affairs, Geodesy and Cartography, Regulatory Agency of the Government of Mongolia

Statistical Offices

Mr. Oyunchimeg	Head of Department, National Statistical Office
Mr. Bayanchimeg	Chair of Office, UB City Statistical Office
Mr. Batbaya	Senior specialist, UB City Statistical Office

Municipal Government of Ulaanbaatar

Mr. Tudev Bilegt	Capital City Governor and Mayor
Ms. Tsogzolmaa Tsedenbal	Vice Mayor
Mr. Munkhbaatar, Begzjav	Vice Mayor
Mr. Choimpog Bat	General Manager of Ulaanbaatar City and Chief of the Mayor's Office
Mr. B. Bayanjargal	Head, Urban Development Policy Department, Office of the Capital City Governor
Ms. A. Zulgerel	Urban Development Policy and Planning Department, City Government of Ulaanbaatar Mayor's Office
Mr. Tserenbyambaa Batkhuu	Head, International Relations and Cooperation Department
Mr. Gantulga Jigjidsuren	Specialist, International Relations and Cooperation Department
Mr. Garamyn Manaljav	Head of the Property Privatization Department, Secretary of the Property Privatization Commission of the Capital City
Mr. Delgerbayar	Director, Management Department, Environmental Pollution, and Waste
Mr. Natsagdorj	UB General Architect
Amgalan	Governor, Bayangol District
Mr. Natsagdorj	Governor, 11th *Khoroo*, Bayangol District
Ms. Buyankhuu	Governor, 8th *Khoroo*, Songino Khairkhan District
B. Mukhtseteseg	Governor, 7th *Khoroo*, Songino Khairkhan
Ms. Altantsetseg	Governor, 9th *Khoroo*, Bayanzurkh District
D. Tsogbadrakh	NGO/JSDF coordinator
Ms. Enkhtuya	Social Worker, 9th *Khoroo*, Bayanzurkh District
H. Tuvaanolory	Community leader, Chingeltei District

World Bank Project Implementing Units (PIUs)

Second Ulaanbaatar Services Improvement Project (USIP2)	
Ms. Badamkhorloo, Lkhamsuren	Director
Ms. Tsendsuren, Dorjgotov	Manager and Engineer

Mr. Enkhtuvshin Oidov	Water Supply Engineer
Mr. Batbuyant, Jamsranjav	Accountant
Ms. Purevsuren, Yura	Translator
Ms. Bayartuya, Gursanjid	Communication Coordinator
Mr. Nyamdorj, Damdin	Land Management Specialist, Engineer
Ms. Enkhbayar, Miyegombo	Procurement Specialist

Second Sustainable Livelihoods Project (SLP2)

Ms. Khashtsetseg	Project Director

Water Supply and Sewage Authority Co. of Ulaanbaatar City (USUG)

Mr. Purevjav, Bat-Ochir	Director
Mr. Baatarkhuyag, Buyantogtokh	Deputy Director
Ms. Yanjindulam, Zagdaa	PIU Manager
Ms. Lkhamaasuren, Ligdev	Head, Financial Department
Ms. Altantsetseg Zandanbol	Economist
Ms. Oyun, Bayanzul	PIU Engineer
Mr. Folkert de Jager	Project Manager, Vitens-Evides International

Solid Waste Companies (Tuk)

Mr. Togtsaikhan	Executive Director, Bayanzurkh Tuk
Ms. Enkhjargal	Executive Director, Songino Khairkhan Tuk
Mr. Batsaikhan	Executive Director, Bayangol Tuk

Ulaanbaatar Electricity Distribution Network Company

Customer Service Centers in Bayangol, Songinokhairkhan and Bayanzurkh

Distribution Centers (Western and Eastern)

Asian Development Bank (ADB)

Mr. Shane Rosenthal	Senior Portfolio Management Specialist

GTZ

Ruth Erlbeck	Program Director, Integrated Urban Development, Construction Sector, and VET Promotion Program, GTZ
Ralph Trosse	Technical Director, Integrated Urban Development, Construction Sector, and VET Promotion Program, GTZ
Sugarrangchaa Tserendash	Senior Program Officer, Integrated Urban Development, Construction Sector, and VET Promotion Program, GTZ

KfW

Dr. Battushig	Officer Manager

Embassy of Japan

Mr. Takahiro Ishizaki	First Secretary

Japan International Cooperation Agency (JICA)

Mr. Yujio Ishida	Resident Representative, UB
Ms. Ryuko Hirano	Project Formulation Advisor, UB

Consulting Firms

Carsten Glenting	Head of Department, Economics and Management, COWI A/S
Michael Davidsen	Representative, COWI A/S
Leo F. Jensen	Senior Water Supply Engineer, COWI A/S
Kimiko Hibri Pedersen	Consultant, COWI A/S
Bumho Lee	Hankuk Engineering Consultants Co.
Tommy Zhang	Project Manager/Team Leader, Easen International
Kun Chen	Team Coordinator, Easen International

ANNEX B

Technical Note on Analysis of 2008 Household Socioeconomic Survey

The detailed data referenced as "HIES" are from the Household Socio-Economic Survey for 2008, conducted by the National Statistical Office of Mongolia. A total of 11,172 households were surveyed, of which 3,571 households are located in Ulaanbaatar. The data set provides information on general socio-economic characteristics and detailed income and expenditures, including monthly bills for key infrastructure costs. The survey also entails basic access data for electricity, water supply, heating and consumption. However, it does not include information on quality and reliability of most services, volume of consumption, spatial coordinates or sub-district (*khoroo*) identification, nor in-depth information for heating, sanitation, and transportation access. In those areas where data was not available in the survey, the chapter was supplemented with data as referenced in footnotes.

Since survey data does not specify individual sub-districts, or *khoroos*, it was not possible to determine the location of individual households either in *ger* areas or the apartment-dominated city center. The survey does specify geographic clusters of ca. 10 households[1], however. To establish a sub-sample of households located in *ger* areas, and to compare that to an urban sub-sample, the dwelling type in each cluster was further analyzed. Because the clusters were not selected based on the type of housing, there are clusters that overlap *ger* areas and urban apartment areas; in UB, 16 percent of the clusters contain this mix. There was no way of identifying these mixed areas as *ger* areas or apartment areas, the mixed areas were excluded from the report's sub-sample; as a result, *ger* areas as defined by this report contain no apartments, and apartment areas contain no *gers* or detached houses.

TABLE B.1. A Sample Size Summary for the 2008 Household Socio-Economic Survey

Total Sample in Ulaanbaatar	3,571
- Total Households (HHs) living in apartment areas	1,392
- HHs living in *gers*	819
- HHs living in detached houses	1,304
- HHs living in others	20
Total Sub-sample for analysis (% of total UB HHs)	2,978 (83%)
Total HHs surveyed in *ger* areas	1,808
- HHs living in *ger*s (% of total UB HHs)	693 (20%)
- HHs living in detached houses (% of total UB HHs)	1,103 (31%)
HHs living in apartments (% of total UB HHs)	1,170 (33%)

[1] Each cluster contains 7 to 10 households, though 95 percent of clusters contained 10 households. There are 360 clusters in the UB area.

ANNEX C

City Center *Ger* Planning Illustrations

FIGURE C.1. Planning Illustrations Including the City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District (West)

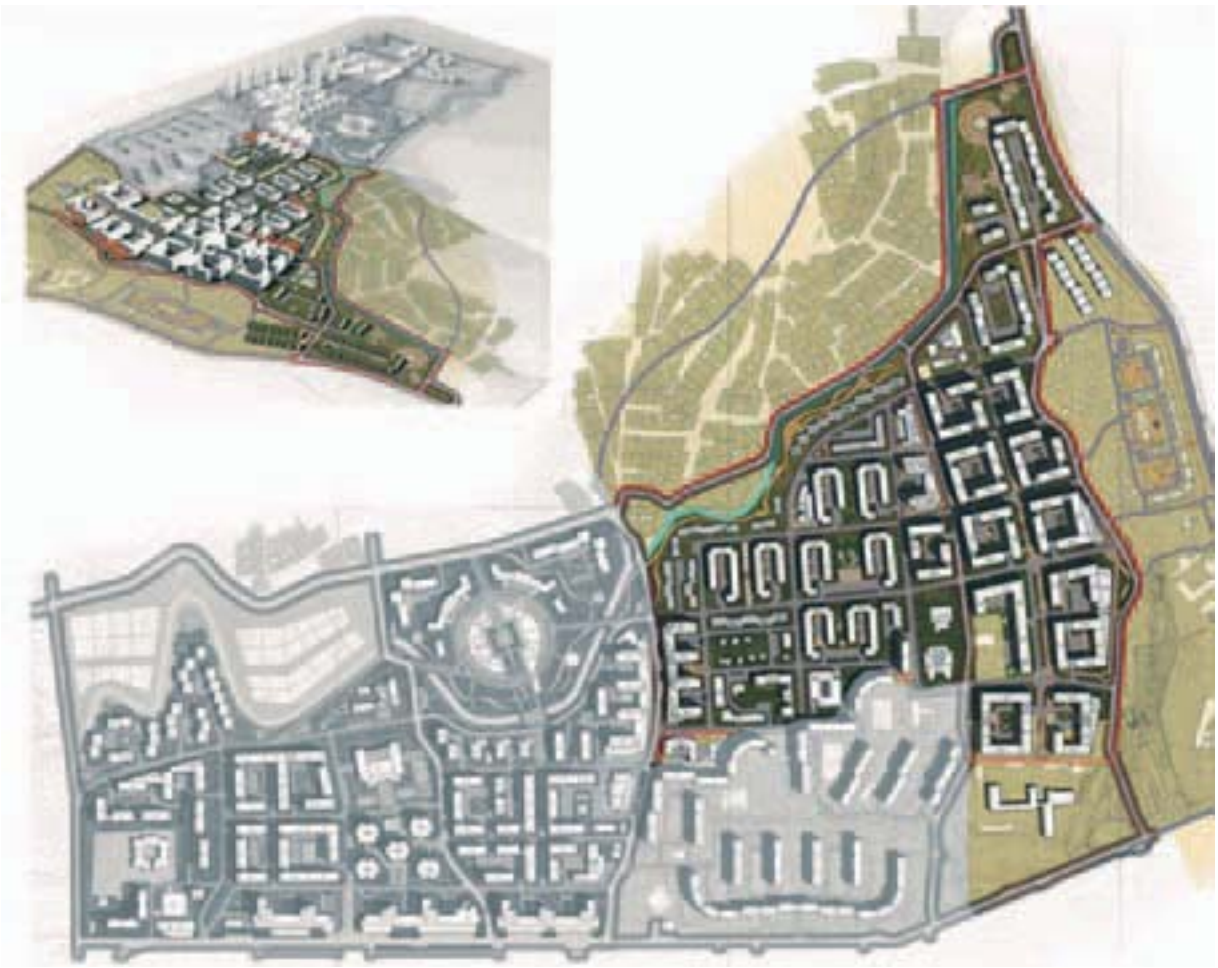


FIGURE C.2. Planning Illustrations Including the City Center *Ger* (Naran), 11th *Khoroo*, Bayangol District (East)

ANNEX D

Ulaanbaatar District Statistics

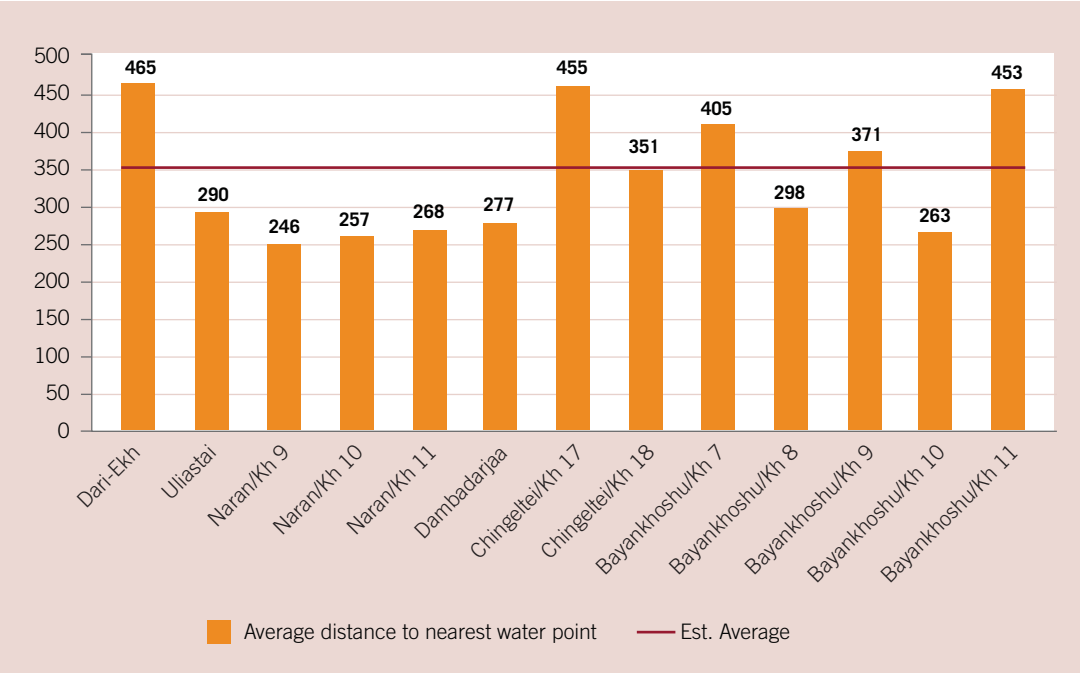
#	DISTRICTS	TOTAL AREA (km^2)	POPULATION	NUMBER OF *KHOROOS*	TOTAL FAMILIES	UNEMPLOYMENT (%)	DWELLING TYPE: APARTMENTS (AND MODERN HOUSES) IN HOUSING DISTRICTS	DWELLING TYPE: HOUSES IN *GER* DISTRICTS	DWELLING TYPE: *GERS*
1	Khan-Uul	484.7	94,670	14	23,214	62.4	31,373	40,711	21,586
2	Baganuur	620.2	25,969	4	6,525	55.3	10,424	4,478	10,701
3	Bayanzurkh	1244.1	221,565	24	51,857	51.7	74,258	75,158	70,347
4	Nalaikh	687.6	28,152	6	7,450	59.1	7,655	13,194	7,127
5	Bayangol	29.5	165,159	20	35,463	53.4	123,778	20,429	20,191
6	Sukhbaatar	208.4	129,486	18	30,137	54.3	58,695	40,338	29,709
7	Chingeltei	89.3	136,014	19	29,270	64	28,827	77,822	28,771
8	Bagahangai	140	3,864	2	876	55	2,062	751	1,034
9	Songinokhairkhan	1200.6	220,295	25	49,951	57.7	60,323	86,347	73,101
	Ulaanbaatar	**4704.4**	**1,025,174**	**132**	**234,743**	**56.99**	**397,395**	**359,228**	**26,2567**

Note: Unemployment rate = proportion of the number of unemployed persons, registered in the Department of Labour and Social Welfare to the economically active population.

ANNEX E

Distribution and Distances of Water Kiosks

FIGURE E.1. Distance to Nearby Kiosks[1]



[1] *Center for Social Development, 2006*

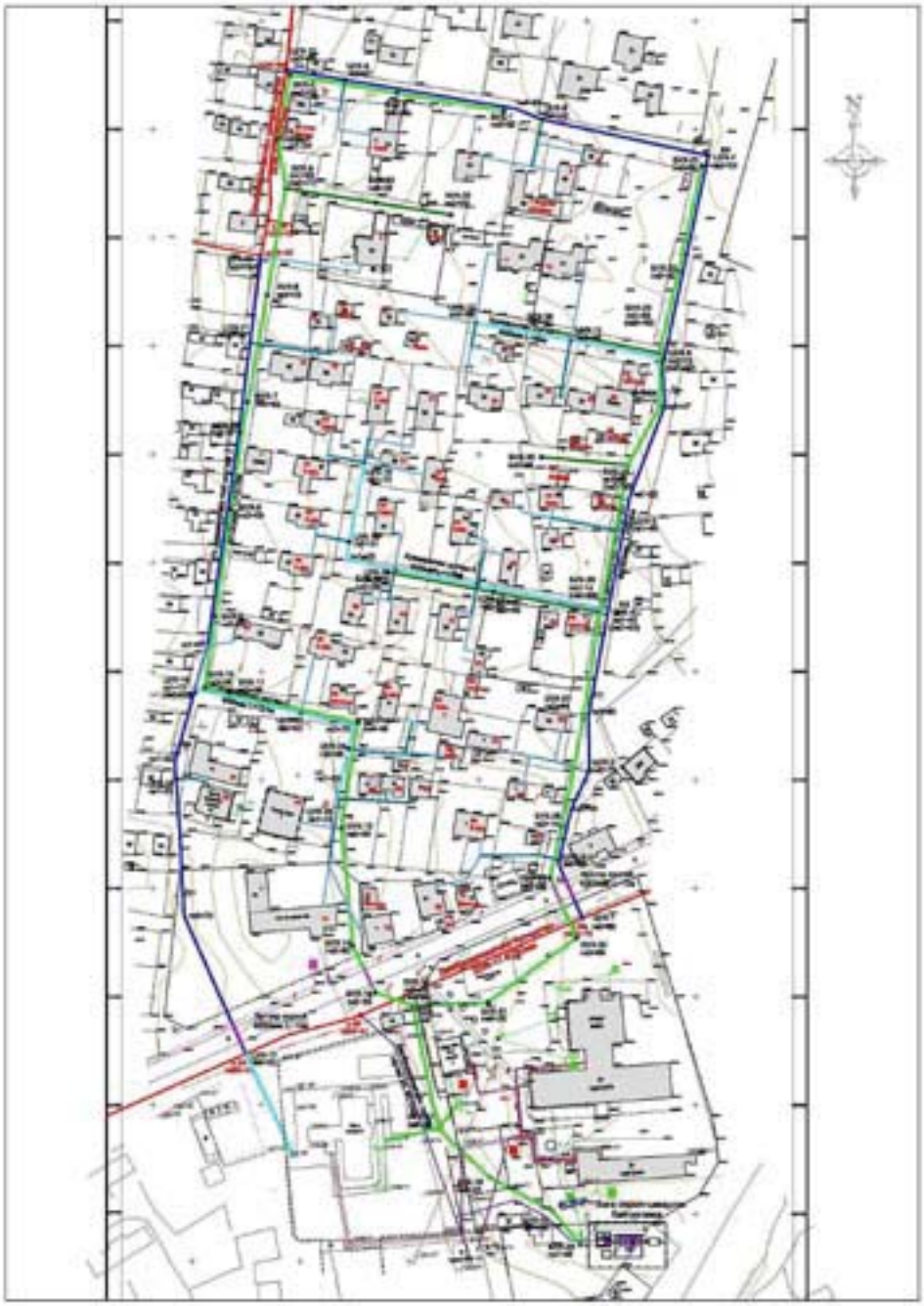
TABLE E.1. Distribution of Kiosks in *Ger* Areas of UB

DISTRICT	TOTAL POPULATION	*GER* AREA	TOTAL NUMBER OF KIOSKS	TRUCK SUPPLIED USUG KIOSKS	PIPE SUPPLIED USUG KIOSKS	PRIVATE KIOSKS	RED CROSS KIOSKS	SPRINGS
Khan Uul	59,088		53	10	37	3	3	
	12,611	Nisekh		2	16			
	23,322	Yarmaq		1	18		1	
	1,909	Blokombinat		3			1	
	116	Devshi SAA		1		1		
	3,552	Taini		2				
	3,006	Tuul Tosgon		1		2	1	
		Sonsgolon			1			
Bayanzurkh	137,431		152	84	22	34	7	5
	9,076	Amagalan		8	1	12		
	5,185	Attan-ulgil		9		1	1	
	9,576	Dar-ekn		17		5	3	2
	30,391	Shar Khad		8	17	1	1	1
	5,493	Tsaiz		9			1	
	15,785	Ulastal		13	1	10	1	1
	2,804	Knonkhor		5		3		1
	6,389	Ulaan-Khuaran		7				
	6,884	Tsagaan-Khuaran		4				
	7,840	Naran-tuul		4	1	2		
	6,600	Kino-Ulidver			2			
Bayangol	40,688		44	35	6	3		
	6,830	Gandan			6			
	11,526	Naran		15				
	10,274	Shine-Gemtel		9		2		
	10,547	1-r horpoloin ar		8		1		
Sukhbaatar	65,530		46	39		7		
	17,236	Dambadarjaa		9	2	3		
	9,290	Belkhi		5		4		
	4,052	Salkhit		3	1			

DISTRICT	TOTAL POPULATION	*GER* AREA	TOTAL NUMBER OF KIOSKS	TRUCK SUPPLIED USUG KIOSKS	PIPE SUPPLIED USUG KIOSKS	PRIVATE KIOSKS	RED CROSS KIOSKS	SPRINGS
	1,679	Doloon Buudai		8				
	13,156	Guchinkhoyor		7				
	7,725	Nogoonnuur		3	3			
Chingeltel	103,572		123	44	66	11	2	0
	23,783	Chingeltel		23	1	4		
	25,327	Denjiln Myanga		4	22	2	2	
	39,152	Khallaast		8	43	3		
	1,083	Zuragt		9		1		
Songino Khairkhan	149,294		143	91	21	26	3	2
	53,149	Bayanhoshuu		56	1	14	1	
	44,283	Tolgoit		23	23	6		
	2,745	Zuunsalaa		3		4		
	635	Zeel		2		2	1	
	7,243	Khaniln material		5				
Total	**555,603**		**561**	**297**	**161**	**84**	**14**	**5**

ANNEX F

Plan of Water Supply Pilot Project in Dambadarjaa



ANNEX G

Solid Waste Detailed Information

CURRENT	PROPOSED COLLECTION/TRANSPORTATION EQUIPMENT TO IMPROVE WASTE COLLECTION SERVICE	
	PRESS PACK TRUCK	HANDCART
		

Analysis of costs spent to improve waste collection equipment: The analysis of costs to improve waste collection equipment is based on the price of equipment currently used in Korea.

Price of equipment [$ 1 = 1,427.6Tugrug(Tg.) (Exchange Rate as of 20 April 2009)]

1. Press Pack Truck (5.0ton, 8.0 m^3): 54,288 $/EA (77,502,085Tg/EA)
2. Container Box (2.5ton, 5.0 m^3): 2,459 $/EA (3,510,492Tg/EA)
3. Handcart: 522 $/EA (744,650Tg/EA)

Analysis of the operational cost for waste management personnel: For the analysis of the operational cost for waste management personnel, the labor cost is based on the wage surveyed in Mongolia.

Standard of labor cost [$ 1 = 1,427.6Tugrug(Tg.) (Exchange Rate as of 20 April 2009)]

1. City Center *Ger* (Naran):
   - Driver: 3.2 $/capita.Race (4,500Tg./capita.Race)
   - Assistant Worker: 2.8 $/capita.Race (4,000Tg./capita.Race)
   - Sanitary Worker: 84 $/month (120,000Tg./month)
2. Mid-tier *Ger* (Bayankhoshuu):
   - Driver, Assistant Worker: 2.8 $/capita.Race (4,000Tg./capita.Race)
3. Fringe *Ger* (Sharhad):
   - Driver, Assistant Worker: 4.9 $/capita.Race (7,000Tg./capita.Race)

Analysis of the operational cost to maintain waste collection vehicle: The standard of operational cost to maintain a waste collection vehicle is based on the price index surveyed in Mongolia.

Standard of operation cost [$ 1 = 1,427.6 Tugrug(Tg.) (Exchange Rate as of 20 April 2009)]
1. Oil charge: diesel in 0.95 $/l (1,350 Tg/L)
2. Capacity of collection/transportation vehicle: Press Pack Truck (5ton)
3. Average travel speed of collection/transportation vehicle: 50 /hr
4. Standard to apply distance (in 1 round trip)
   - Case 1, 2: distance to Landfill
     * Distance of each *Ger*: City Center *Ger* (Naran): 30km; Mid-tier *Ger* (Bayankhoshuu): 18km ; Fringe (Sharhad): 60km
   - Case 3: distance to landfill + travel distance of vehicle in the area
     * Collection distance of vehicle in the area : interval between household is assumed to be 10m. City Center: 30km; Mid-tier: 17km; Fringe: 25km
     * Distance of each *Ger*: City Center: 60km; Mid-tier: 35km; Fringe: 85km
5. Standard to apply times of transportation: waste to be transported in each month (ton/month) / transportation quantity per trip (5ton/trip)
6. Average fuel efficiency of collection/transportation vehicle: 10km/l

Detailed Analysis of Annual Operational Costs for Waste Management Personnel

ITEM			UNIT	CITY CENTER *GER*	MID-TIER *GER*	FRINGE *GER*
Case 1	Sanitary Worker	Req person	person	—	6	9
		Unit Cost	$/month	—	84	84
		Cost	$/year	—	6,048	9,072
	Driver	Req person	person	—	1	1
		Unit Cost	$/month	—	134	328
		Cost	$/year	—	1,608	3,936
	Assistant Worker	Req person	person	—	2	2
		Unit Cost	$/month	—	134	328
		Cost	$/year	—	3,216	7,872
	Total Cost		**$/year**		**10,872**	**20,880**
Case 2	Driver	Req person	person	—	1	2
		Unit Cost	$/month	—	134	328
		Cost	$/year	—	1,608	7,872
	Assistant Worker	Req person	person	—	2	4
		Unit Cost	$/month	—	134	328
		Cost	$/year	—	3,216	15,744
	Total Cost		**$/year**		**4,824**	**23,616**
Case 3	Driver	Req person	person	1	2	3
		Unit Cost	$/month	237	134	328
		Cost	$/year	2,844	3,216	11,808
	Assistant Worker	Req person	person	2	4	6
		Unit Cost	$/month	207	134	328
		Cost	$/year	4,968	6,432	23,616
	Total Cost		**$/year**	**7,812**	**7,812**	**35,424**

TABLE H.2. continued

ANNEX H

Approximate Landfill Development and Operating Costs

TABLE H.1. Landfill Outline

ITEM	UNIT	AMOUNT	REMARK
Landfill period	Years	20	
Population	Population	1,030,000	
Waste generation per capita	kg/capita.d	0.7	
Waste Generation	Ton	5,263,300	For 20 years
Landfill Capacity	m^3	7,519,000	Compaction Density 0.7 ton/m^3
Landfill Height	m	25	
Landfill Area	m^2	300,760	

TABLE H.2. Approximately Sanitary Landfill Development Cost

ITEM	SIZE	QUANTITY	UNIT	UNIT COST ($)	COST ($)
Sanitary Landfill Development cost					**37,379,880**
I. Construction Cost					**33,981,680**
(1) Earth work					**8,034,000**
- Cutting the Ground	soil	2,762,000	m^3	1	2,762,000
- Transporting rest soil	soil	2,636,000	m^3	2	5,272,000
(2) Construction of landfill liners					**15,827,680**
a) Bottom Part					**13,104,000**
- Groundwater drainage layer	t=30cm	75,600	m^3	15	1,134,000
- Geotextile fabric filter	500g/m^2	252,000	m^2	3	756,000
- Compacted clay liner	t=50cm	126,000	m^3	30	3,780,000
- HDPE Sheet	t=2mm	252,000	m^2	20	5,040,000
- Geotextile fabric filter	1000g/m^2	252,000	m^2	5	1,260,000
- Leachate drainage layer	t=30cm	75,600	m^3	15	1,134,000
b) Slant Part					**2,723,680**
- Groundwater drainage layer	t=30cm	46,960	m^3	15	704,400

ITEM	SIZE	QUANTITY	UNIT	UNIT COST ($)	COST ($)
- Bentonite Mat	t=6mm	46,960	m^2	12	563,520

Continued on next page

- HDPE Sheet	t=2mm	46,960	m^2	20	939,200
- Geotextile fabric filter	1000g/m^2	46,960	m^2	5	234,800
- Leachate drainage layer	t=30cm	46,960	m^2	6	281,760
(3) Construction of stormwater removal system					**1,538,000**
- HUME concrete pipe	_600mm	1,100	m	300	330,000
- HUME concrete pipe	_800mm	660	m	400	264,000
- HUME concrete pipe	_1,000mm	440	m	600	264,000
- U type ditch	0.5*0.5	2,200	m	200	440,000
- Collection well	0.9*0.9	120	EA	1,500	180,000
- Stormwater manhole	D 1.2m	40	EA	1,500	60,000
(4) Construction of leachate collection system					**2,062,000**
- Leachate collection main line	400A	1,000	m	480	480,000
- Leachate collection branch line	200A	6,000	m	250	1,500,000
- Leachate extracton pipe	400A	50	m	300	15,000
- Leachate Vertical well	700A,800A	10	EA	700	7,000
- Leachate pumping station		4	EA	15,000	60,000
(5) Construction of groundwater removal system					**1,220,000**
- Groundwater collection main line	200A	1,000	m	250	250,000
- Groundwater collection branch line	100A	6,000	m	150	900,000
- Groundwater extraction pipe	200A	50	m	200	10,000
- Groundwater Pumping station		4	EA	15,000	60,000
(6) Construction of Leachate treatment facility					**4,230,000**
- Leachate treatment facility		300	m^3	14,000	4,200,000
- Leachate transport line		100	m	300	30,000
(7) Construction of etc facility					**1,070,000**
- Administration building		1	Lot	400,000	400,000
- Road pavement		2,200	m	200	440,000
- Parking lot pavement		20	a	3,000	60,000
- Washing wheel station		1	Set	30,000	30,000
- Weigh-Bridge		1	Set	20,000	20,000
- Landscape		1	Set	120,000	120,000
II. Consulting Cost (Design & Supervision Cost)					**3,398,200**

Approximate Sanitary Landfill Operating Cost Per Year

ITEM	QUANTITY	UNIT	UNIT COST ($/YEAR)	COST ($/YEAR)
Sanitary Landfill Operating cost per year				1,134,702
I. Landfill & Cover	*Annual landfill capacity standard*			
	263,165	m^3	3	**789,495**
II. Fixed cost				**72,600**
(1) Labor cost				**66,000**
- Office Manager	1	capita	6,000	6,000
- Clerk	2	capita	5,000	10,000
- Engineer	5	capita	4,000	20,000
- Technical Engineer	10	capita	3,000	30,000
(2) Management cost (10% of labor cost)				**6,600**
III. Variable cost				**272,607**
(1) Operating cost for facility & equipment				**249,908**
a) Operating cost for facility & equipment				**80,000**
- Backhoe (0.7 m^3)	1	EA	15,000	15,000
- Dozer (19ton)	1	EA	35,000	35,000
- Watering Cart (5,500L)	1	EA	15,000	15,000
- Disinfection cart	1	EA	15,000	15,000
b) Maintenance cost (0.5% of facility construction cost)	**1**	**LOT**		**169,908**
(2) Electric charges	**1**	**LOT**		**20,000**
(3) Etc cost (1% of Variable cost)	**1**	**LOT**		**2,699**

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