EXECUTIVE SUMMARY

This report constitutes the Final Report prepared within the project “Ulaanbaatar District Heating - Feasibility Study” launched by the EBRD with the overall objective of preparing a feasibility study for the Ulaanbaatar District Heating Company (UBDHC), the company responsible for the heat distribution in the primary network in Ulaanbaatar, and OSNAAUG, the company responsible for public central heating with approximately 130 group substations. The project has been carried out by COWI A/S (henceforth: COWI) in partnership with ICON Co., Ltd. (henceforth: ICON).

In Ulaanbaatar, heat is generated by three CHP plants (TES 2, TES 3 and TES 4) and Amgalan HOB, transmission is managed by the UBDHC and distribution by OSNAAUG and several housing companies and single-building off-takers. Reliable and adequate heat supply from the three CHP plants and Amgalan HOB is key. Many people are connected to the district heating system and, hence, depend on it. Furthermore, it helps reducing air pollution.

The number of inhabitants in Ulaanbaatar is increasing drastically. This development calls for an extension of the district heating system in the city. Furthermore, the district heating system suffers from many years of insufficient maintenance. Hence, medium to long-term investment needs of the district heating system are substantial. There is a need to ensure to extend the system, both in respect of heat production capacity and in respect of network capacity, while at the same time ensuring a proper maintenance of the system.

Against this background the Ministry of Energy of Mongolia and Ulaanbaatar Municipality have approached the EBRD with a request to assess the possibility of co-financing two Priority Project Projects (PIPs), one for the UBDHC and OSNAAUG, respectively. The PIPs include various investment components aimed at improving the efficiency and security of the district heating system.

The key objective of especially the UBDHC PIP is addressing the severe air pollution problem prevailing in Ulaanbaatar today by extending and reinforcing the district heating network enabling additional consumers to connect to the
The extension of the district heating system supports the infrastructure of Ulaanbaatar, renews and reinforces part of the pipe network and enables heat (and hot tap water) to be provided to the central heat sources (the three cogeneration plants, TES 2, TES 3 and TES 4, and the Amgalan HOB). The heat sources are coal fired but present a realistic alternative to the use of small individual heat only boilers and stoves.

The bulk of the UBDHC PIP is new district heating pipelines, replacing existing, old pipelines (with new pipelines of increased pipe dimension) and also new pipelines expanding the supply area of the district heating system, in total 11.4 km (trench length) of district heating pipe network. The UBDHC PIP also includes an additional new booster pump for Booster Pump Station No 2, replacement of 15, big dimension valves (in poor condition) with new and installation of 250 smart meters (energy meters). The budget frame is USD 15 million.

The key objective of the OSNAAUG PIP is improving the heat supply to existing buildings by replacing hydro-elevators with mixing loops, i.e. initiatives supporting the overall enhancement and technical upgrading of the district system, especially focusing on the substations and secondary systems (the distribution systems and the basement installations in the buildings). Several of the existing distribution systems suffer from hydraulic imbalance and installation of the energy meters provides a tool contributing to address this issue e.g. providing operators with a tool for obtaining valid information on actual flow in the distribution systems. The PIP incudes components (new heat exchangers) addressing difficulties the operator (OSNAAUG) has experienced during the day to day operation in maintaining adequate heat supply from some of the substations.

The bulk of the OSNAAUG PIP is supply and installation of new mixing loops (Individual Heating Substations – IHS), in total 1,154 items. Other components included in the OSNAAUG PIP are: a new central substation, selected equipment (151 energy meters for secondary side piping) for improved hydraulic balancing of secondary side networks, replacement of clogged heat exchangers (75 heat exchangers and also increasing capacity of other heat exchangers), pilot project for demonstration of modern heating technology and thermostatic radiator valves and heat cost allocators.

The budget frame is USD 12 million.

Key findings of the feasibility study carried out are the following:

- The PIPs will increase the supply of district heating to the population of Ulaanbaatar, improve supply reliability and reduce emissions of CO₂, SO₂ and NOₓ, as well as particle emissions (compared to the alternative of heating by stoves or small coal fired boilers).

  The assessment is that implementation of the PIPs reduce the emission of CO₂ by 265,478 ton CO₂ per year.
> There is sufficient capacity in the system. Additional load will be added to the system (in the range of 221 Gcal/h at peak load) increasing the supply of energy from the system in the magnitude of 10%.

> The primary energy source used today in coal. In the magnitude 5 million ton of coal is used annually for generation of electric power and heat to the district heating system (in the magnitude of 6,000 Tcal/year). Phasing out the coal and replacing it with biomass (e.g. wood chip / wood pellets or agricultural waste products) is not an option, as no biomass resources possibly to provide a significant quantity and be harvested in a sustainable manner is available in the vicinity of Ulaanbaatar. A conversion for the co-generation plants to biomass will require in the magnitude of 4.2 million ton per year of wood pellets and 246,000 ton per year of wood chips for the Amgalan HOB, i.e. even identification of bio-mass for converting say the Amgalan HOB to biomass is a challenge.

> District heating is an energy transport system able to transport energy generated by a big array of heat sources. A district heating system, or part of a district heating system, can be developed to match specific requirements from a specific heat source, i.e. district heating concept opens for possibilities for utilisation of e.g. energy generated by renewable sources (wind and solar). The key issues for introduction of renewable energy is price setting. Technical solutions can be developed if renewable energy sources are available in sufficient quantity, sufficient reliability of supply and at a competitive price. Typically, energy supply from solar and wind-based sources require a back-up and peak load facility, i.e. a function a district heating system can provide. The key message is that development of the district heating system does not prevent future utilisation of renewable energy sources but play an important role in limiting heat supply to be developed based on small stoves and dispersed boilers. The district heating concept opens for introduction of renewable energy sources when the pricing will favour this option.

> While, formally, the tariff setting methodology follows Cost+ approach, the absence of certain elements (bad debt provisions, sufficient investment margins, cost of equity and provisions for FOREX volatility) makes its use sub-optimal and serves mainly the purpose of maintaining stable low end-user tariffs.

> Tariff increases are required if the loans are to be repaid out of ongoing operations of the two companies. Full cost recovery in 5 years will require an annual increase in tariffs of 9.5% till 2024; thereafter, tariffs shall increase with the Consumer Price Index.

> For assessment of potential problems for population vis-a-vis projected tariff increase, an affordability assessment has been carried out. Based on these results, it can be concluded that increased tariffs will not pose affordability constraints on average households for meeting their heat payments. However, the households in the lowest decile (lowest income households) will have problems in meeting the payments in time, as it
exceeds the 10% affordability threshold. Hence, it is recommended that specific low-income household assistance programme is implemented in parallel with implementation of the project.

The Environmental & Social Assessment made finds that the long-term effects of the PIP implementation have mostly a positive character and relate to the facilities operation. In particular, one can expect more reliable heat supply in the city, improvement of the living conditions in the houses because of the IHS installation, lower rate of the heat supplies related accidents. Furthermore, the analysis of the PIP components shows that short-term adverse environmental and social impacts are possible during the implementation of construction works.