NTRES 6490

Inception Report

Improving Ger Livelihoods and Reducing Air Pollution in Ulaanbaatar

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List of Abbreviations

CPO	- Central Project Officer
DED	- Detail Engineered Drawing
GHP	- Geothermal Heat Pump
IRR	- Internal Rate of Return
M&E	- Monitoring and Evaluation
NPV	- Net Present Value
PPTA	- Project Preparatory Technical Assistance
ToR	- Terms of Reference
UB	- Ulaanbaatar

I. EXECUTIVE SUMMARY

A. Project Background

This report describes and responds to the ongoing air pollution crisis in the city of Ulaanbaatar, Mongolia. Air pollution levels reached eight times higher than the World Health Organization's recommended standard in 2016, and the crisis has had severe implications for the city's health, economy, and overall standard of living.

The pollution problem can be linked to the changes in the rural countryside as well as the larger urban planning and development paradigms in the city. Though sources of the pollution are many, it primarily pertains to the management of the large population of herders who are immigrating into the city seeking livelihood and other opportunities. These populations are currently disconnected from essential urban services including heating, which is forcing them to resort to informal means of heating (raw coal burning) during the freezing winter months; this is the prime source of the air pollution in the city.

Although the ministry banned coal burning and provided coal briquettes as a substitute in 2017, the system has not functioned without challenges. Thus, a longer term and sustainable mechanism is required for provisioning environmentally viable renewable energy as well as heat systems to improve air quality and accessible and adequate basic infrastructure for people in the *ger* district.

The focus of this project is creating sustainable and environment-friendly living conditions for the herder community in the *ger* areas of UB. Such an approach requires advanced alternatives for provisioning energy via renewable technologies, comprehensive urban master-planning, innovative policy reform, and integrated collaboration between government, local communities, and international partners. Better accessibility and connectivity to essential services along with improved heating and energy systems supported by a modified institutional landscape will not only alleviate the pollution problem in the capital; it will also empower the *ger* populations to improve their overall living conditions and livelihood opportunities.

While acknowledging the actions already initiated by the government, this report recommends three main approaches for future actions, which can enable the government to meet these objectives, by suggesting an alternative source for generating heating, supported with short- and long-term solutions to ease the implementation for all stakeholders. This project will directly contribute to Mongolia's national commitment to reduce air pollution as part of its Nationally Determined Contribution (NDC) which aspires to reduce 22.7% Greenhouse Gas (GHG) emissions by 2030 (CCAC Secretariat, 2020).

B. Appreciation of the Project

This Inception Report presents the project impact and proposed outcomes. It summarizes the outputs, which fall under three main categories: technology/renewable energy, urban planning and policy reform, and institutional reform. Output 1 aims to achieve improved geothermal and other energy sources installed for heating and electricity. The project will pursue technology

improvement by utilizing geothermal sources and develop a geothermal heat pump (GHP) system, which will substitute the inefficient and high carbon-emitting coal burning system. Output 2 is a lot allocation plan with structure extension operationalized and supported by community capacity building. It will encourage the district's spatial system improvement to achieve a more sustainable and financially independent traditional district in the peri-urban area. Lastly, Output 3 aims to achieve an improved pollution control policy and infrastructure development. It will reinforce the execution and implementation of the reviewed existing policies and the new policies regarding the geothermal installation and urban planning improvement.

For each output, the PPTA team aims to do a first phase project implementation called the sub-project. The challenges faced toward preparing the sub-projects include initial research on geothermal energy sources in Ulaanbaatar, population survey and mapping process in the *ger* district, social development safeguard, and adjustment on the government's bureaucracy system as well as reviewing relevant current planning and energy policies.

C. Current Status of Project Design

a. Output 1: Geothermal Infrastructure for Improved Heating System

Initial analysis has been done to determine the best alternative sustainable energy system for the *ger* population. Additionally, using data sources, we have estimated the number of households to cover, the cost of GHP based on the U.S. market, and the implementation cost. However, there are more technical analyses that need to be conducted to understand better how best to implement the GHP to the yurts. The first step is to do a technical analysis on whether GHP can be connected to a charging station system, that will allow the yurts to connect to it. Based on this technical analysis, a prototype can be run and tested before moving to implementation. Simultaneously, a mapping must be done to combine output 1 and output 2 in grouping the yurt areas for both the extension system and the charging station. This will create smaller ‘blocks’ that still could move a little freer than a regular neighborhood block.

Furthermore, since GHP is currently built only to control room temperature, research grants can be used to learn how to also use it for electricity. This is another initiative that can happen concurrently during the analysis period.

Additionally, another technical analysis that must be done is preparing a pollution measurement system to decide using what technique, how often this must be run, and under which department this must fall under.

b. Output 2: Lot allocation plan with structure extension operationalized and supported by community’s capacity building.

The current status of the lot allocation plan is in the technical assistance preparation phase. We gathered generic data such as population number, how big the *ger* district's area, and its residents' socio-economic condition (sources of income, age, number of household members) from secondary data sources like the published master plan and news articles.

To move forward into the lot allocation plan's framework drafting, we should determine primary data sources collection methods and initiate direct surveys. A collaboration between consultants, local governments, and local residents is significant during this process.

The initial key points of this output are conducting the spatial district mapping. We need both primary and secondary data to identify the density level, population survey to identify population forecast in the next five years, the amount and size of available lands for residential purposes in the *ger* district, and the ger community's socio-economic status. Aside from determining the lot allocation plan framework, the primary data surveys would also support the community capacity building programming.

The lot allocation plan will be supported with additional structure extension that provides water, sanitation, and an electric system. A field study on rural planning in Ulaanbaatar conducted by Hong Kong University in 2019 showed that the *ger* district could be improved into a more efficient and sustainable region with a structure extension system. This system complements the district's lack of basic infrastructure needs. A further study should be conducted, with the 2019 project report as the primary design precedent, to examine the feasibility of the structure's procurement and construction in regard to Ulaanbaatar's recent weather, geographical condition, and district budgeting.

c. Output 3: Improved air pollution control policy planning and infrastructure development

Combining spatial and sectoral approaches, the infrastructure development will support the transformation of *ger* areas into a more livable, improved and well-functioning urban areas with improved commercial, public and residential services. To implement this long-term policy reform, the project recommends sound physical investment planning, and institutional capacity building. The investment plan will prescribe a plan that will include supply of green energy, transmission, maintenance, framework for relevant institutional development, a legal and regulatory policy integration between environment and technology, and capacity development of the community. These long-term policy interventions are expected to bring sustainable, inclusive and well-structured urban development in the *ger* district.

Moreover, to make the alternative energy program effort sustainable, a long-term urban planning policy formulation and required infrastructural development are recommended to support the supply and transmission of renewable energy for the people. Development of infrastructure might require land acquisition from individuals. The team recommends that the Resettlement Framework prepared for the Ulaanbaatar Urban Services and *ger* areas be reviewed and updated, and the safeguard policy be implemented to avoid any potential conflict. The Land Acquisition and Resettlement Plan which is based on feasibility design must be updated based on the detailed measurement survey. Additionally, as part of the safeguards policy, budget for land acquisition and resettlement has to be allocated on time.

The team recommends the local government integrate the 'block' plan from Output 1 and 2 into the master plan as a recognized concept by 2030.

D. Progress to Date and Next Steps

After the concept paper and the feasibility study, which included calculating total pricing and budgeting for each output such as GHP and extension services, the terms of reference were also used to define what each output needed in terms of a consulting team. In the future after the Inception phase, the team of consultants will be needed to conduct surveys and work with the respective government ministries or officials to carry these out.

II. PROJECT BACKGROUND

A. General

Ulaanbaatar (UB) has an area of over 4,700 sq. km and it is situated in the Tuul River Valley, around 1350 m above sea level. It has an average temperature of 0 degrees Celsius and receives very little precipitation. The geography is characterized by large mountains and plateaus and is completely landlocked. Due to these physiological conditions it has a cold and dry climate, and this makes it the world's coldest capital. UB holds two-thirds of the country's total population. This population is characterized by Mongols and Kazakhs, and has been rapidly growing since

the 20th century, 4.1% annually (NASA Earth Observatory, 2019). Its low density of 272 people/sq. km (704/sq. mi) also makes it the least dense capital in the world.

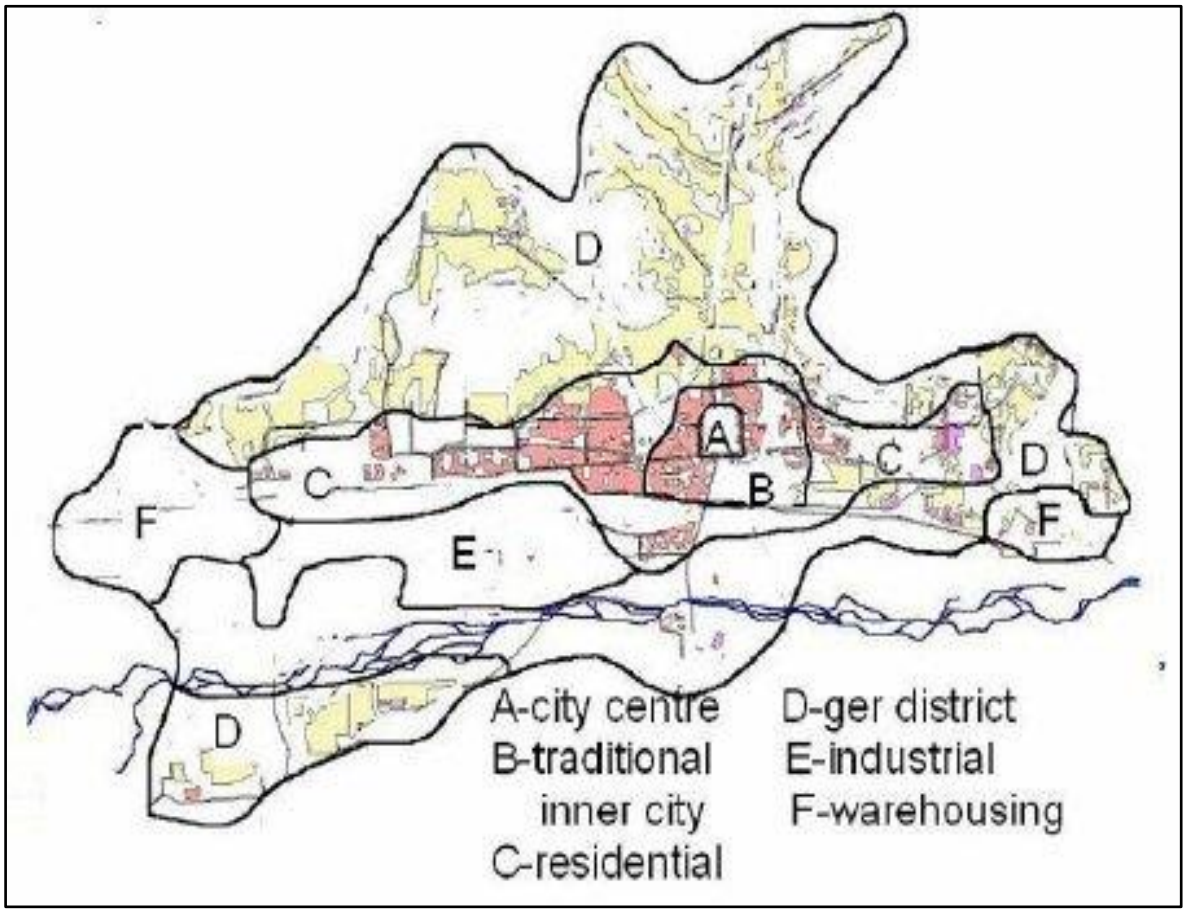


Figure 1*: Map of UB's varying districts. Amongst these, District "D" or the ger districts have the lowest density amongst the entire urban region. They are home to over 800,000 people- 60 % of the population) (Image Source: D. Amarsaikhan, Mongolian Academy of Sciences)*

Outside UB, Mongolia's weather is characterized by extreme variability and short-term unpredictability in the summer, with wide variations in precipitation, dates of frosts, and occurrences of blizzards and spring dust storms. The countryside is predominated by a traditional nomadic herder population. Challenging weather, especially the frequency of extreme winters known as "*dzuds*" or "white death", combined with natural resource constraints and climate change (UNOCHA, 2016) have posed severe challenges to human and livestock survival. As a consequence, lack of the accessibility and availability to fulfil basic needs have forced thousands of herders to lose their livelihoods and move to UB in search of opportunities for a better life, especially during the winter months.

The migration has been extensive: approximately 20 percent of the country's population has moved to UB in the past two decades, more than doubling its population and significantly expanding its physical footprint (Kingsley & Levene, 2017). As a response to the rising migrant population, in 2003 the government began allotting each citizen a plot of land of 700 sqm under

the land law (Sundaram et al., 2017) to enable the new 'citizens' to live in their traditional tents or yurts (ger) for housing. This changed the city's landscape and generated a new urban form- the *ger* district (district D in the map). This was a vast peri-urban unplanned area that is now home to an estimated 800,000 people (Geoghegan, 2014).

The increasing needs of the immigrating population for essential services have created significant pressure on the city to make basic services available to all. This has had implications both for the herders and the city. Urban planning paradigms have pushed the herders to live in the city peripheries without adequate connectivity to basic services, of which heat and energy have been especially challenging due to the extreme cold weather. For the city, the increased demands have exceeded its original capacity, putting increasing pressure on natural resources.

Figure 2*: The ger district lie on the peripheries of Ulaanbaatar, albeit neglected and marginalized (Source: Guardian, 2016)*

As a result of these conditions, the herder populations lack improved sanitation services like water, and have poor connectivity to the city's electrical grid, central sewage, and heating systems. With nighttime temperatures that can drop to -40°C eight of the 12 months, they have been compelled to use cheap heating methods, such as burning raw coal, plastics and small, inefficient, heat-only boilers (HOBs) without proper emission control devices to generate heat as well as for cooking. Life is difficult for them with inadequate opportunities for jobs and education. They are rooted in their cultural practices, which has been an important consideration for any intervention or project uptake.

Causes, negative impacts and contextual challenges

Coal burning especially from the *ger* district has contributed to 80% of the total pollution just in the winter season. Due to the poor urban planning and decentralization of services, the increasing traffic from the city center also creates a deadly toxic mix in the air and contributes to the pollution. There is a need for thinking about the sustainable planning of the city to

integrate the rising *ger* population, enhancing the landscape, and developing policies that can meet the increasing power demands in the city. Coping with rapid urbanization while tackling air pollution is the central paradox policy makers in Ulaanbaatar are currently confronted with.

As a consequence of the above factors, air pollution levels in UB have been found to be eight times the World Health Organization's recommended standard. During winter months, concentrations of PM2.5 persistently reach levels that are hazardous to human health. Health risks have been the greatest problem inflicted by the increasing pollution. Thousands, especially children have died or been suffering from acute and chronic pulmonary issues (UNICEF, 2018). A lot of business has been lost, and losses of over 400 million dollars have been suffered due to medical treatments and 18-28 percent of the country's GDP has been compromised (Sundaram et al., 2017).

Mongolia's energy usage is also unsustainable because of its overdependence on coal-based energy sources.[1] Coal based power plants, which supply 80 percent of the total energy (Jamsran, 2018) are less efficient and unsustainable compared to renewable sources because of the hazardous impacts it exerts on the environment. Green and sustainable energy can only be attained with a revamped and strengthened Environmental and Energy Policy Landscape.

III. THE CONSULTANT'S APPRECIATION OF THE PROJECT

A. The Design Environment

The PPTA team has listed the specialists needed to mobilize the preparation of each output's pilot project or sub-project. The CPO developed eligibility criteria for each sub-project in order to identify the distribution of international and national consultants and specialists. The PPTA team would develop further action plans and framework together with related consultants, which later should be reviewed and approved by the CPO. For Output 1's sub-project, the PPTA team would conduct field work and surveys with geothermal specialists and coordinate with the Ministry of Energy. This is intended to create an initial assessment toward geothermal source availability and feasibility study. The next step would be coordinating with social development specialists to analyze cultural impacts and the solutions in regard to GHP installation in the ger community's traditional houses or the yurts.

For Output 2's sub-project, the PPTA team would start a population mapping, working together and coordinating with national planning consultants and the City Planning & Development Board, to determine the density level in the *ger* district, to define how many households there are and would be, and how big the residential areas available for the district adjustment. While preparing the urban master planning, architecture consultants should start and develop the Detail Engineered Drawing (DED) for the structure extension. They would also need to conduct an environmental design assessment towards water source and sanitation availability. The CPO

[1] Approximately 79.3% of the total electricity is generated from coal-fired plants, 1.7%% by renewable energy sources (mainly hydropower) and 0.1% is produced by diesel generators. The rest 18.8% is imported from neighboring countries (Jamsran, 2018).

will be responsible to coordinate both Output 1's and Output 2's sub-projects in the electricity provision powered by GHP.

The PPTA team would consult with public policy specialists and hold a drafting workshop that involves consultants, government, and locals to review the current planning and energy policies. The two sectors, planning and energy, should be conducted in separate teams in order to prepare the Output 3's sub-project implementation. The whole process should include the Ministry of Energy and the City Planning & Development Board.

B. **Sub-project Preparation to Date**

The PPTA team would provide a comprehensive action framework summary, which should be approved by the CPO. The summary will be the main guide for the PPTA team, international, and national consultants to work on each sub-project's preparation steps. The summary should include timetables of each sub-project, which parties should be coordinated with and included in the action plans.

IV. THE PROPOSED PROJECT

In response to the air pollution crisis and uncontrolled urban sprawl in the peri-urban area of Ulaanbaatar, we propose a sustainable and environmental-friendly approach to resolve the issue. A multi-sectoral comprehensive solution is needed to answer the complex air pollution issue. We combined three sectors of renewable energy, urban planning and institutional and policy reform into our proposed project. Each sector has its own output, which is divided based on the project phasing. Now, we are pursuing the implementation of the first phase, which is the short-term project period (1-5 years), and we are currently preparing the technicalities for each output's sub-project. The proposed projects are detailed in the table below:

	Short-Term (1-5 years)	**Medium-Term (6-10 years)**	**Long-Term (>10 years)**
Technology/ Renewable Energy	● GHP installation (Phase 1 - 30%, 2 60%) ● Battery/generator distribution	● GHP installation (Phase 2 - 10%) ● Adjust GHP to deliver electricity	● Renewable energy power source (wind, solar)
Urban Planning	● Lot allocation plan (20%) ● Community capacity building	● Lot allocation plan (40%) ● District expansion ● Community capacity building	● Lot allocation plan (40%) ● District expansion ● Road connection ● Community capacity building
Institutional & Policy Reform	● Infrastructure incentive and subsidy	● Improved sustainable district master plan	● Green-energy policy

A. Output 1: Geothermal Infrastructure for Improved Heating System

As mentioned earlier in the background, a primary source of the dangerous pollution in Ulaanbaatar is the material used for heating. Therefore, we are suggesting changing this source of heating to a friendlier source. Considering the level of extreme cold weather in Ulaanbaatar and the need for a consistent energy source, we advise using a geothermal heat pump (GHP). The idea is that although the geothermal heat pump will be stationary, the specialists will connect this to something similar to a charging station, allowing households to decide where to build yurts around this charging station. Additionally, during the research period, we use GHP for standard households' prices as our standard for calculating costs and household coverage. 1 GHP that costs around $10,000 can power one medium household in the United States, that have floor plans of around 2,687 sq. ft. One yurt has a floor plan of around 325 sq. ft, and therefore, we assume that 1 GHP can heat around 8 yurts. The project will be broken down into 3 phases. Phase 1 (covering 30% of the households) and Phase 2 (60% of households) as part of the short-term plan and Phase 3 (10%) that will fall into the medium-term plan.

Upon further study on the way yurts are built as well as its culturally significant features, the stove within the yurt in the middle must be maintained, although the source of heat of this stove can be replaced with the GHP (if our research can figure out how to do this) or be complemented (at least for the short term) with a generator or a battery. Therefore, the yurt can still have a center with a pipe going up towards the sun from the stove (the center of the yurt). This can be done by utilizing a heat floor, a study being conducted by a team at University of Pennsylvania.

This will further support keeping a center in the middle of the yurt by way of designing the floor, to respect the cultural significance of the center of the yurt.

Additionally, to ensure that GHP is decreasing pollution substantially, a monitoring station will be installed around the *ger* districts evenly. The appointed government division will be responsible for monitoring and storing the information gathered regularly.

B. Output 2: Lot allocation plan with structure extension operationalized and supported by community's capacity building

The first phase of this project aims to allocate 20% of the existing population in the new district's land system. The *ger* district is currently housing around 800,000 people, with 4.1% population growth in the next five years. To gain a rough estimation for the sub-project, we assumed that there would be 160.000 households or families who live in the yurts, for five people in each household. In the first five years, the lot allocation plan should be able to assign lands for 32,000 households along with the structure extension, that each could be shared with 5 households. The goal for the sub-project or the first phase of Output 2 is summarized in the table below:

Population	Households/ Families	Sub-project Target (1-5 years)	Estimated Lot Allocated	Estimated No. of Structure Extension
800,000	160,000	32,000 households	960,000 sqm + 10% buffer area	6,400 units

The sub-project includes encouraging the local government to provide community capacity building to support the lot allocation plan. The *ger* community should be aware of the plan's concept and technical measures, including the structure extension scheme. The community would be the ones whom the government appoints to become the 'host' family. They should be responsible for their lot and district management system. Financial and district budgeting workshops should be included in the community capacity building. The idea is to empower the *ger* community to be capable of maintaining and developing their neighborhood and, later, being independent of their socio-economic aspects.

The impact of this output is to achieve a sustainable and more efficient spatial district system. The new district system would give residents access to clean water, sanitation, and electricity, ultimately leading to a decrease in raw coal use. It also accommodates the district's urban growth that comes from the incoming herder communities each year.

C. Improved air pollution control policy planning and infrastructure development

To improve the living conditions in the *ger* district of Ulaanbaatar, we recommend sustainable and visionary urban planning through long-term infrastructural development which will enable adoption of green energy for the *ger* people. To ensure sustainable development, some policies and strategies related to urban planning and development are prescribed. We also recommend the following supplementary strategies to achieve the goal:

At the initial stage, the government of Mongolia must provide some financial and technical support to help the public as well as private institutions to adopt green energy sources and green building materials. Poland, Denmark and Singapore follow this approach. This will cover not just adoption of green and renewable energy sources but also use of energy efficient technologies.

Although Mongolia government adopted a new environmental law in 2012 which covered environmental components, there is still some confusion in regard to measuring the intrinsic value of natural resources like water. For example, Mongolia adopted ‘Polluter Pays’ principles but it did not specify how to measure the value of polluted water. Likewise, this problem persists with air pollution and a unified yardstick is needed to measure the price for polluting. This complexity must be resolved. In addition, the environmental audit must have ‘freedom’ to audit and report independently as well as make polluters pay. Yearly or half yearly monitoring, and evaluation report may be made available to track the progress of air pollution in the adjacent areas.

Engaging media to raise awareness and involve stakeholders about air pollution and the causes behind it are critical. Social and public media can shape people's concept in a positive manner. Besides, awareness about tackling air pollution in the ger community can be raised through academic means. For example, Singapore initiated a Green School initiative to raise awareness among young learners about tackling indoor air pollution through greening buildings and adopting efficient technology.

The most crucial aspect of this process is to maintain a consistent monitoring and evaluation framework for continuous assessment of air quality in the ger areas. The project strongly recommends an evaluation framework that analyzes data, receives feedback from stakeholders, and devises upgraded strategies based on the findings on air quality status. As part of this process, a continuous assessment of the air quality in the *ger* district will be done at least once in two months to track the progress made by implemented strategies. If air quality is not satisfactorily improved, new policy measures can be taken based on evaluation and findings.

To implement this whole process, it is critical to apply both expert knowledge and local perspectives to devise an effective and locally workable development plan. To devise improved air pollution control policy planning, infrastructure development, and creation of a monitoring and evaluation framework, two consultants will work -one international and one national. The international consultant will work for six months whereas the national consultant will continue for two years. Both the consultants will cooperate with each other and work collaboratively. While devising and revising plans, it is crucial to consider local context, stakeholders' perspectives and feedback. In this aspect, the local consultant will assist the international consultant by providing necessary information and technical support.

D. Cost and Financing Plan

Output 1

Parts	Total Cost	Phase	Total Cost
GHP	US$ 200,000,000	Phase 1: 60,000,000 (30%)	**US$200,000,000**
		Phase 2: 120,000,000 (60%)	
		Phase 3: 10,000,000 (10%)	

Output 2

	Population	Households/ Herder Families	Number of Structure Extension (1 for 5 households)	Total Structure Extension Cost (1=US$ 13,600[2])
Recent	800,000	160,000	32,000	US$ 435,200,000
Phase 1 (20%)	**160,000**	**32,000**	**6,400**	**US$ 87,040,000**
Phase 2 (40%)	320,000	64,000	12,800	US$ 174,080,000
Phase 3 (40%)	320,000	64,000	12,800	US$ 174,080,000

Output 3

Type of Consultancy	Man X Month(s)	Scale (in US Dollar)	Total cost (est.)
International	1x6	20,000	US$120,000
Local	1x24	6,000	US$144,000
Subtotal	-	-	**US$264,000**

V. ISSUES AND CONCERNS

A. Data, Information and Maps Needed Post Inception Phase:

1. Maps for layout of the *ger* districts, with population densities and connections to the power stations.
2. Information about energy usage and households in the *ger* districts.
3. Previous data from past urban planning ministries would be previous legislation and surveys on willingness to support lot allocation and expansion.
4. For the Environmental Audit: Budget related data on how much money is available to fund the creation of this department/personnel, and data on operation costs for them.

B. **Technical & Financial:** Concerning the GHP, a funding-related technical issue of sufficient amounts from research grants, as well as tax credits from energy companies. Previous research grants have been short-term. So, it is a concern for how much funding would be received for continuing the long-term research to equip *ger* community with GHPs.

[2] Based on Incremental Urbanism: Ulaanbaatar Ger's Settlements project by Joshua Bolchover, University of Hong Kong (Bolchover, 2019).

C. **Administrative:** The project has three administrative issues. The first one is sufficient capacity and willingness in the government department's to carry out the lot allocation as in the past the government has shown some reluctance or has turned away from expanding services to the *ger* districts and being more accommodating as they are worried about the implications it might have on in-migration. The second administrative issue is efficient coordination between the private and government sectors to implement environmentally friendly economic development policies that benefit both groups, and the third is the Environmental Audit, as there could be an administrative issue involved with setting up and carrying out a bias-free environmental audit system without influence from the government, companies, or industries in the field to report independently.

D. **Safeguards:** There are several concerns pertaining the effect either direct or indirect that might result from this project.

1. **Environmental Concerns:** this project is estimated instead to decrease pollution significantly in Ulaanbaatar and its periphery. However, air quality measurement stations will be implemented throughout the *ger* districts, to ensure that these goals are met, and if not, adjusted so that the project attacks the main problem.
2. **Anthropological Concerns:** the *ger*'s yurt structure have several cultural significances, including the center being where the stove is located with a pipe pointing upwards as a connection to the sun. The GHP and heat floor prototyping stage will ensure that these cultural concerns are addressed by consulting the local anthropologist and by doing a round of testing before the GHP is be installed.
3. **Possible Cultural Tensions:** the *ger* communities are used to being independent or using resources that do not tie them or make them 100% reliable on the government. However, the implementation of GHP might threaten that status. The consulting team will work with communities to see if collective ownership (for either the GHP or the charging station) is possible and or how best to introduce GHP to the *ger* community.

VI. PROGRESS OF THE PPTA

A. Progress to Date

The PPTA Team was launched in April 2020. The team is currently selecting a team of specialists for each of the output outlined in this inception report. We are also selecting a team of local specialists/consultants to join this team for the implementation phases.

B. Next Steps

Work Plan for Feasibility Study and Project Preparatory Activities (2021)

Task	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov	Dec.
Output 1: Multi-scale water treatment infrastructure												
Design for infrastructural installation and operations.												
Procurement of contractors for major and minor constructions												
Detailed budgeting in local currency												
Output 2: Lot allocation plan with structure extension operationalized and supported by community's capacity building												
Spatial *ger* district mapping, surveys, and analysis												
Secondary data collection and surveys												
Design environment and existing infrastructure assessment												
DED for structure extension												
Community capacity building programming												
Detailed budgeting												
Output 3: Institutional capacity-building and strengthening partnership												
Baseline capacity assessment of key implementing agencies												
Stakeholder mapping and coordination assessment												
Final programming and budgeting												

The next step for the PPTA Team to do is after selection, to hold a kick-off workshop at Ulaanbaatar on 30 January 2021. After the kick-off, we will continue by having initial field assessments with the specialists to get adjustments to the project based on on-the-ground assessment. This will be executed in parallel with meeting with government departments that will be owners of the whole or subsections of this program.

For Output 1, the utmost priority is to conduct analysis and build a prototype before implementation can be conducted. This is estimated to take around 6 months, as prototype building is done along with testing and fitting to a sample yurt or a group of yurts. Simultaneously, local cost calculation must be done to estimate cost of this adjusted GHP and the floor heats to accompany the GHP implementation. The second half period of the cost calculation will include detailing the NPV and IRR of the forecasted cost and income to build a ToR to allow the government to open a bid for contractors.

For Output 2, the spatial *ger* district mapping is the priority to proceed as well as the data collection and surveys. This would help to assess the *ger* district spatial configuration, and to determine which areas should be examined further for the lot allocation plan. The process should be done simultaneously with the structure extension design process. Local architecture consultants should start with the design environment study and existing infrastructure assessment. After the required data for lot allocation and structure extension are collected, the consultants should start working on DED and the community capacity building programming.

For Output 3, baseline capacity assessment is the first key step to assess the strength and institutional capacity of the implementing agencies in UB. This process will involve baseline data analysis of relevant projects, document review and identification of the key strengths required for implementation of the current project. Measures will be initiated to strengthen coordination among the implementing agencies for a smooth execution of plans. At the second phase, strategies will be devised as to how stakeholders' participation and coordination can be integrated to optimize the outcome. These will be carried out by the national and international consultants. Finally based on the primary and secondary data analysis and assessment, a detailed program framework and budget will be determined.

Appendices:

Appendix: 1: Terms of Reference for Consultants

A. Background

The technical assistance (TA) is to devise solutions for the severe air pollution in Ulaanbaatar, Mongolia, as well as to address issues within the *ger* district and their household infrastructure. The strategy will identify the air pollution mitigation from economic and development perspectives, as well as from an environmental and policy related standpoints for effective and sustainable functioning of the GHP, as well as the lot allocation program.

B. Team Leader and Planning Specialist

a. Scope of Work

The consultant will lead a team of international and national consultants to first carry out a needs and feasibility assessment of the first output proposed for the program of Ulaanbaatar Air Pollution Crisis Management Project. The first output of the program is the implementation of *Ger*-customized GHP for healthier energy sources. It involves yurt's structural and cultural analysis, GHP prototyping, and policy and costing deep analysis. The consultant will deliver an action plan based on the feasibility assessment and work under technical guidance of the project officer, Asian Development Bank (ADB) Ulaanbaatar. The team leader will be responsible for the overall Technical Assistance (TA) implementation. Secondly, the team leader will also lead the consultants to carry out a need and feasibility-based assessment and work on the second output, which is the lot allocation system with structure extension in *ger*

district. It involves urban planning methods, community development, and participatory design. The consultant will deliver an action plan based on the feasibility assessment and work under technical guidance of the project officer, Asian Development Bank (ADB) Ulaanbaatar. The team leader will be responsible for the overall Technical Assistance (TA) implementation. The tasks will include the following:

i. In collaboration with all specialists identify methods for consolidated data collection.
ii. Be the person of contact and communicator of any updates, complications, and or question between the consulting team with the government and ADB and maintain effective communication with collaborating bodies.
iii. In collaboration with the government of Mongolia and Ulaanbaatar, determine municipal key actors for different parts of implementation.
iv. In collaboration with local government, urban planning specialist, public policy specialist, identify efficient spatial survey and mapping methods in *ger* district.
v. In collaboration with local government, urban planning specialist, public policy specialist, identify Geographic Information System (GIS) data and overlay maps to reconstruct lot allocation schemes in existing *ger* district settings.
vi. Monitor progress toward reaching TA milestones, inform ADB of problem areas, and recommend corrective action.
vii. Conduct local design workshops, present action plan drafts, and secure consensus
viii. Lead the implementation of phase 1 of the project, coordinate specialists to fix any issue, and be a person of contact to the government on the project's progress.
ix. In collaboration with the geothermal energy specialist, urban planning specialist, public policy specialist, and environmental energy specialist, create an initial study on combining GHP with structure extension.
x. In collaboration with local government, urban planning specialist, public policy specialist, identify Geographic Information System (GIS) data and overlay maps to reconstruct lot allocation schemes in existing *ger* district settings.
xi. Monitor progress toward reaching TA milestones, inform ADB of problem areas, and recommend corrective action.
xii. Conduct local design workshops, present action plan drafts, and secure consensus.
xiii. Lead a group of assisting consultants to monitor and manage expenses incurred by the team leader and other specialists.
xiv. Prepare Phase 1 initial action plan draft (2021-2023) and its strategic framework showing feasible lot allocation areas, numbers of existing and future *ger* district population in the next five years, land procurement process, structure extension design and construction plan, and community development plan and submit to ADB

b. Implementation Arrangements, Reporting and Deliverables

The consultant will work under the direction of the responsible project officer, or such other ADB staff member as from time to time may be delegated for the task by the program director. The team leader will deliver the needs assessment report; *ger* district lot allocation feasibility assessment, and the lot allocation strategic framework and action plan. This will include a cost estimate for implementing the 2021-2023 action plan, and an indicative cost estimate and financing strategy for implementing the strategic framework.

C. Geothermal Energy Specialist

a. Scope of Work

The geothermal energy specialist will work with the team leader to carry out a needs and feasibility assessment of the first output proposed for the program of Ulaanbaatar Air Pollution Crisis Management Project, which is the implementation of *Ger*-customized GHP for healthier energy sources. The main tasks and responsibilities of the consultant include the following:

i. The Geothermal Energy Specialist will need to work with consultants in order to devise the appropriate model of geothermal pumps (GHP) for *Ger* households.
ii. Conduct research with the History Specialist to design prototypes of the GHP's power supply form.
iii. Build a prototype of a GHP sample with the yurt and fix issues from the testing period and the final product.
iv. Lead the implementation to the ground in the *Ger* areas for the first phase of implementation.
v. Identify methods for GHPs maintenance.
vi. The Geothermal Energy Specialist will need to work with consultants in order to devise the appropriate model of geothermal pumps (GHP) for ger households
vii. Studying and testing the suitable site for GHPs drilling
viii. Locating easily accessible stations to GHPs energy for the ger people
ix. Building and operating GHP power plant

b. Implementation Arrangements, Reporting and Deliverables

The consultant will work under the direction of the responsible project officer, or such other ADB staff member as from time to time may be delegated for the task by the program director. The team leader will deliver the needs assessment report; *ger* district lot allocation feasibility assessment, and the lot allocation strategic framework and action plan. This will include a cost estimate for implementing the 2021-2023 action plan, and an indicative cost estimate and financing strategy for implementing the strategic framework. The specialist will deliver the assessment report and follow ups on geothermal stations and operations to the government and project office.

D. Household Energy/Electricity and Heating Specialist

a. Scope of Work

The household energy and heating specialist will work with the team leader to carry out a needs and feasibility assessment of the first output proposed for the program of Ulaanbaatar Air Pollution Crisis Management Project, which is the implementation of *Ger*-customized GHP for healthier energy sources. The electricity and heating specialist will need to work with consultants in order to smoothly transmit energy from other sources of power and to decrease "system loss" as per part 1 of output 2 and ensure installing and maintaining of the electrical components in related areas in the *ger* district. They must also inspect and test these systems as necessary, determine any repairs and replace worn or defective parts. The main tasks and responsibilities of the consultant include the following:

i. The electricity and heating specialist will need to work with consultants in order to smoothly transmit energy from other sources of power and to decrease "system loss" as per output 2 part 1
ii. The electricity and heating specialist will work with the geothermal energy specialist and the history specialist to build a GHP sample that fits the yurt's cultural values and construction.
iii. The electricity and heating specialist will coordinate with municipalities in calculating and estimating cost.
iv. The household energy/electricity and heating specialist will work under the direction of the responsible project officer from time to time and may be delegated for the relevant task by the project director.

b. Implementation Arrangements, Reporting and Deliverables

The consultant will work under the direction of the responsible project officer, or such other ADB staff member as from time to time may be delegated for the task by the program director. The team leader will deliver the needs assessment report; *ger* district lot allocation feasibility assessment, and the lot allocation strategic framework and action plan. This will include a cost estimate for implementing the 2021-2023 action plan, and an indicative cost estimate and financing strategy for implementing the strategic framework.

E. <u>Urban Planning Specialist</u>

a. Scope of Work

The urban planning specialist will work with the team leader to carry out a needs and feasibility assessment of the second output proposed for the program of Ulaanbaatar Air Pollution Crisis Management Project, which is the lot allocation system with structure extension in *ger* district. The main tasks and responsibilities of the consultant include the following:

xv. Conduct population survey and mapping to identify existing infrastructures, residents' characteristics and behavior, the numbers of current population in the *ger* district, the occupied areas, and future feasible areas for the lot allocation system to be implemented.
xvi. Coordinate with local government/municipality on the *ger* district's data collection, master plan design process, and structure extension construction design process.
xvii. Coordinate and involve the local's representation on each design process to better understand the district and design context and to achieve participatory planning.
xviii. Coordinate with GIS experts for inputs on population density, households mapping, and existing infrastructures.
xix. Deliver a specific master plan for the *ger* district to develop a peri-urban setting that endorses efficient area numbers for each household, future household expansion and infrastructure improvement.
xx. Collaborate with local architects in designing the structure extension and its environmental design.
xxi. Coordinate with the public policy specialist, to identify the criteria for the land's payment, deposit, and maintenance fund system.

b. Implementation Arrangements, Reporting and Deliverables

The consultant, working under the direction of the ADB project officer, will report to the team leader on an as-needed basis, and prepare a report on the master plan concept and draft, including the construction design of the structure extension.

F. Public Policy Specialist

a. Scope of Work

The public policy specialist will work with the urban planning specialist to create strategic public policy to enforce the lot allocation system and future district's master plan. The responsibilities will include the following:

i. Assess and/or review the current policies regarding the *ger* district's land-zoning, infrastructure and management.
ii. Conduct a research in current public policies to find relevance in implementing the lot allocation system.
iii. Create a policy concept draft to enforce the master plan implementation, land's payment, deposit, and maintenance fund system.
iv. Identifying and reviewing feasibility assessments for constructing GHPs and their impact
v. Working with consulting team and Ulaanbaatar government on environmental and energy and policy issues
vi. Identify negative and positive impact from the GHP prototypes and coordinate with the geothermal energy specialist to minimize the negative impact and maximize the positive impact
vii. Work with consulting team and Ulaanbaatar government on environmental and energy and policy
viii. Identify means of integration between environmental safety and green energy stated in the national energy policy of the Mongolian government

b. Implementation Arrangements, Reporting and Deliverables

The consultant, working under the direction of the ADB project officer, will report to the team leader on an as-needed basis, and prepare a report on the current policies research and a policy concept draft that supports the master plan and lot allocation implementation. The team leader will deliver the needs assessment report; *ger* district lot allocation feasibility assessment, and the lot allocation strategic framework and action plan. This will include a cost estimate for implementing the 2021-2023 action plan, and an indicative cost estimate and financing strategy for implementing the strategic framework.

G. National Consultants

a. Scope of Work

The domestic consultants will be required for the team leader as general affairs consultant and for each specialist. The domestic consultants will have the following responsibilities:

General Affairs

The domestic consultants will be required for the team leader as general affairs consultant and for each specialist.

ix. Assist the team leader in organizing local stakeholders' consultations and design workshops.
x. Assist the team leader in organizing meetings with municipalities and between specialists
xi. Assist and facilitate field work of cross-discipline specialists.
xii. Help collect data and information from relevant local government/municipality, local residents and stakeholders.
xiii. Assist each specialist as they are assigned to conduct research, prototyping, and or meetings with stakeholders according to each specialists' field and responsibilities

Urban Planning & Architecture

i. Assist the urban planning specialist in conducting surveys and mapping.
ii. Help collect data and information from relevant local government/municipality, local residents and stakeholders.
iii. Assist and facilitate the urban planning specialist in delivering the *ger* district master plan and design workshops.
iv. Provide structure extension construction concept study and modelling.
v. Deliver structure extension construction drawings.

Public Policy

i. Assist the public policy specialist in researching and reviewing the current policies regarding the *ger* district's land-zoning, infrastructure development and management.
ii. Provide inherent recommendation for the policy concept draft to enforce the master plan implementation, land's payment, deposit, and maintenance fund system.
iii. Assist the team leader in managing budgeting and spending for the project

Community Development

i. Assist and facilitate the community development specialist in organizing local stakeholders' consultations and community workshops.

Social Development and Safeguard

I. Assisting the team leader in carrying out a need and feasibility-based assessment of the first output, which is GHP implementation
II. Collect information on yurt structure and its cultural importance, identifying parts/structure that needs to stay and parts that can be modified for the GHP implementation
III. Give consultation to the geothermal energy specialist during the GHP prototype creation to adhere to *Ger* yurts cultural significance

c. Implementation Arrangements, Reporting and Deliverables

The domestic consultants will work under and report directly to their specific specialty

H. <u>Community Development Specialist</u>

a. Scope of Work

The community development specialist will work with the team leader and consultants on the following initiatives to design a strategic action plan

i. Ensure outreach of services to all segments of people in *ger* area
ii. Identify urban communities and establish close ties with boards concerned
iii. Track impact and results of the project and relay it to government and relevant partners
iv. Assist in collecting data, surveys, research and evaluation and interpreting them, and providing feedback
v. Assimilate and develop resources through project and ADB approved channels
vi. Assimilate and disseminate environmental and energy data and reports to concerned authorities
vii. Devise assessment plans, keep precise records of works and suitable strategy based on the local context and environment
viii. Collaborate with urban planners, policymakers and relevant departments of government
ix. Help maintain smooth coordination and cooperation with international specialists
x. Ensure periodic follow ups of job responsibilities
xi. Assist and facilitate in-country field work for the international members on the team
xii. Help to improve the project performance through advice, strategy, guidelines and feedback

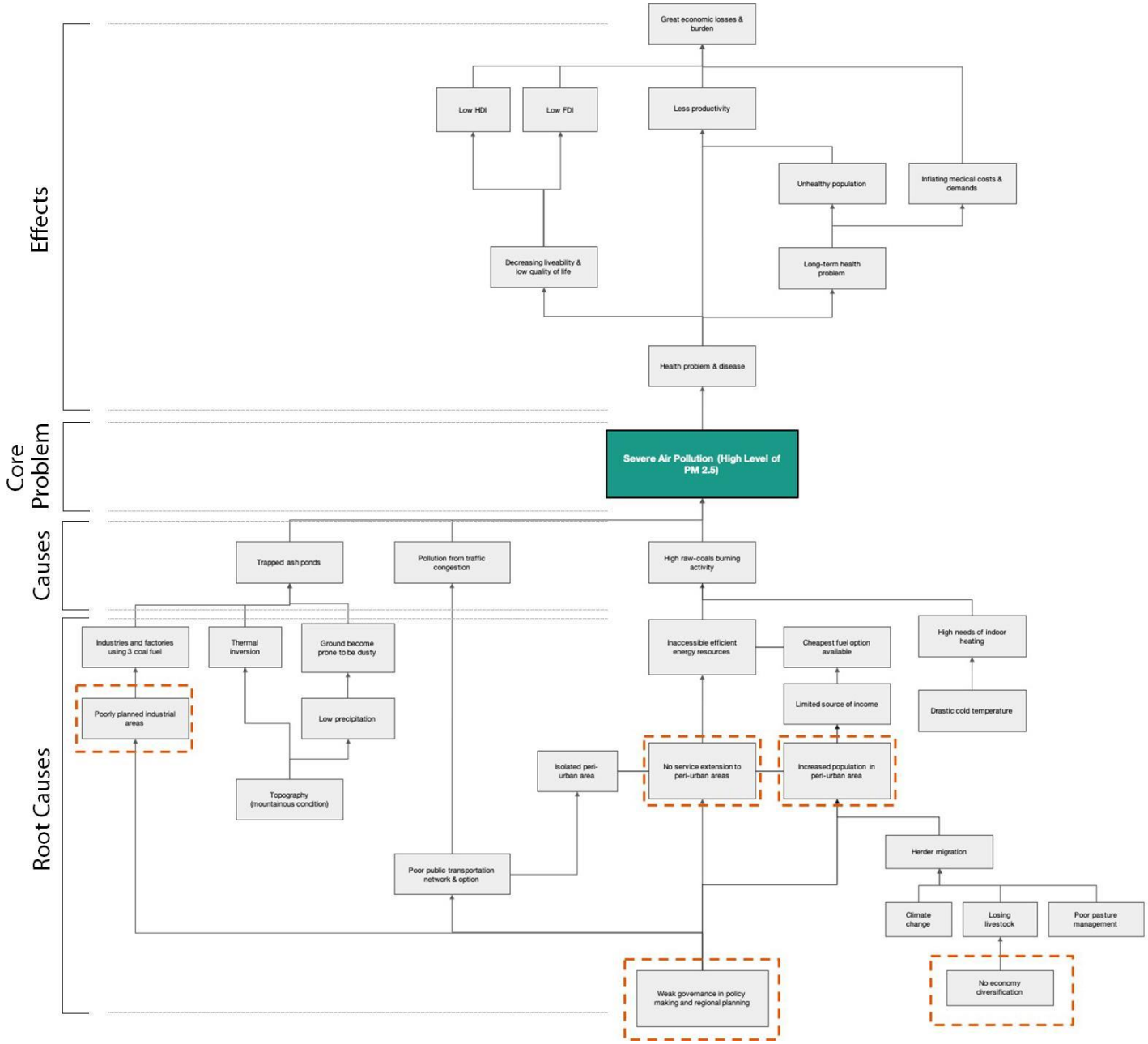
I. ADB and Mongolian Country Program and Portfolio Analyst

a. Scope of Work

The analyst will have the following responsibilities:

i. Making investment plan for ADB
ii. Prepare portfolio analysis reports for ADB and the project
iii. Recommending the best means of channeling and utilizing the fund
iv. Keep track records and maintain communication with the implementing body

Appendix 2: Problem Tree



Appendix 3: Design and Monitoring Framework (DMF)

Impact:
Reducing deaths and medical treatment cost through better air quality in the *ger* district in Mongolia
Impacts the Project is Aligned with:
The project corresponds with the Phase 1 (short-term: 3-5 years) intervention and investments program of the Air Pollution Crisis Management Project in Ulaanbaatar.

Results Chain	Performance Indicators with Targets and Baseline	Data Sources and Reporting	Risks
Outcome Enhanced air quality in the *ger* district.	1. The level of PM2.5 is reduced by xx% compared to 2021 baselines of …. 2. The number of people with respiratory health issues decreased by xx% compared to the 2021 baseline of….	1. Annual reports: Air Quality Index 2. Urban Planning, Architecture & Design Institute of Ulaanbaatar City report 3. Annual reports: MUB	1. Transition in utilizing new energy sources. 2. Delay in infrastructure construction due to weather and material sources. 3. Poor district spatial management.
Output 1 Improved geothermal and complementary energy sources installed for heating and electricity.	1. GHPs are installed in xx% of the *ger* district 2. xx% of household in the *ger* district use GHP as main heating system 3. xx% of the *ger* district has at least battery/generator Xx % of households in the *ger* district have access to heating, electric, and water sources. 4. xx% of household's expenses is reduced from not using raw coal	1. Energy Regulatory Authority report 2. Annual reports: MUB 3. Urban Planning, Architecture & Design Institute of Ulaanbaatar City report 4. Annual reports: MUB	1. Malfunction in equipment. There should be a weekly monitoring system. 2. Unequal equipment distribution can be minimized. 3. There could be a host family that marks-up the rental price. This should be monitored closely by the local government.
Output 2 Lot allocation plan with structure extension operationalized and supported by community's capacity building.	1. Xx sqm of lot are prepared for xx household 2. Xx structure extensions in each khoroo are constructed 3. Xx% of households in each khoroo are connected to the structure extension. 4. Xx household in each	1. Urban Planning, Architecture & Design Institute of Ulaanbaatar City report 2. Annual reports: MUB	1. Delay in construction due to weather conditions and material procurement.

	khoroo implemented the 'host family' method 5. Xx households in each *khoroo* have 'maintenance' deposits with the amount of $xx on average.		
Output 3 Improved air pollution control policy planning and infrastructure development	1. A policy regulating incentive/subsidy for GHP installment is established. 2. A policy regulating incentive/subsidy for lot allocation operations is established	1. Urban Planning, Architecture & Design Institute of Ulaanbaatar City report 2. Annual reports: MUB	1. Lack of expertise in specific areas such as geothermal energy, urban planning and community development to support policy makers. 2. Lack of sound coordination among relevant departments and sectors

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