



1. Project Data

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| Project ID P122320 | Project Name MN-Ulaanbaatar Clean Air | |
| Country Mongolia | Practice Area(Lead) Energy & Extractives | |
| L/C/TF Number(s) IDA-50390,IDA-64930 | Closing Date (Original) 30-Jun-2017 | Total Project Cost (USD) 25,714,823.00 |
| Bank Approval Date 03-Apr-2012 | Closing Date (Actual) 31-Dec-2023 | |
| | IBRD/IDA (USD) | Grants (USD) |
| Original Commitment | 15,000,000.00 | 0.00 |
| Revised Commitment | 26,906,655.71 | 0.00 |
| Actual | 25,823,254.19 | 0.00 |

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2. Project Objectives and Components

a. Objectives

The Original Project Development Objective (PDO) was “to enable consumers in ger areas to access heating appliances producing less particulate matter emissions and to further develop selected medium-term particulate matter abatement measures in Ulaanbaatar in coordination with development partners.” (Financing Agreement, page 5). The PDO was stated identically in the Project Appraisal Document (PAD) (PAD, page vi).



The Revised PDO was “to enable consumers in selected areas to access heating appliances and services producing less particulate matter emissions and to further develop selected medium-term particulate matter abatement measures in Ulaanbaatar in coordination with development partners.” (Amendment to the Financing Agreement dated December 22, 2021, page 1)

For the purposes of this Implementation Completion and Results Report (ICR) review, the Original Objective will be assessed as follows:

PDO 1: To enable consumers in ger areas to access heating appliances producing less particulate matter (PM) emissions in Ulaanbaatar;

PDO 2: To further develop selected medium-term PM abatement measures in Ulaanbaatar in coordination with development partners.

The Revised Objective will be assessed as follows:

PDO 1: To enable consumers in selected areas to access heating appliances and services producing less PM emissions in Ulaanbaatar;

PDO 2: To further develop selected medium-term PM abatement measures in Ulaanbaatar in coordination with development partners.

b. Were the project objectives/key associated outcome targets revised during implementation?

Yes

Did the Board approve the revised objectives/key associated outcome targets?

Yes

Date of Board Approval

22-Dec-2021

c. Will a split evaluation be undertaken?

Yes

d. Components

1. Original components

Component A Ger Area Particulate Matter Mitigation (cost at appraisal: US\$16.1 million, actual cost: US\$16.7 million) was to finance: capital subsidies to households for stoves and low-pressure boilers, including old stove replacement and related technical support, monitoring and evaluation, and training (including international). Technical support would include: (i) additional equipment, materials, technical assistance (TA), and operating expenses for the Stove Emissions and Efficiency Testing (SEET) laboratory; and (ii) TA for the design and production of stoves and low-pressure boilers, including the drafting of emissions standards, market development, and quality monitoring.



Component B *Central Ulaanbaatar (UB) Particulate Matter Mitigation* (cost at appraisal: US\$2.3 million; actual cost: US\$5.35 million) consisted of four sub-components:

Sub-component B1 *Mitigation of Fugitive Dust from lack of City Greening* would finance the preparation of an action plan and a pilot for city greening, including: an assessment of the current programs and recommendations to improve greening; and a pilot greening project.

Sub-component B2 *Mitigation of dust from Power Plant Emissions and Ash Ponds* would finance a feasibility study for: improved emission controls in UB's combined heat and power plants; and mitigation of dust from power plants' ash ponds.

Sub-component B3 *District Heating Feasibility Study and Knowledge Building* would finance a feasibility study for the rehabilitation and sustainable expansion of district heating in UB; and training, including international training, on district heating policy, regulation and management. The issues to address included fragmentation (separately owned and managed transmission and distribution), billing (including unmetered heating and hot water), and planning.

Sub-component B4 *Affordable Housing Policy Technical Assistance* would finance the following: an assessment of policies, laws and practices for affordable housing provision; and the development of an affordable housing strategy for UB.

Component C *Public Awareness Raising, Program Coordination and Project Management* (cost at appraisal: US\$3.0 million; actual cost: US\$4.1 million) consisted of three sub-components.

Sub-component C1 *Air Quality Monitoring, Management and Analysis* would finance equipment for air quality monitoring and analysis, including for the UB Air Quality Agency, and related training, including international. This sub-component was designed to maintain momentum after an ongoing Japan International Cooperation Agency (JICA) air quality capacity building project would close.

Sub-component C2 *Program Coordination Support* would finance consultants, as well as air quality management and policy making training, including international.

Sub-component C3 *Project Management, Public Awareness, and Monitoring and Evaluation* would finance a communications program and the Project Management Unit (PMU) costs.

Contingencies: US\$0.6 million.

Revised Components:

The components were revised, as described in detail in section 2.e under "Restructurings".

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost: The appraisal estimate was US\$21.9 million, and the actual disbursement was US\$26.9 million. The difference is explained by: (i) the December 2019 additional financing (AF) of US\$12.0 million, which increased the total Project cost to US\$33.9 million; (ii) the cancellation of the Borrower



contribution of US\$6.89 million, bringing the Project cost to US\$27.01 million; (iii) and the 95.6 percent disbursement rate at closure, resulting in the disbursement of US\$26.9 million.

Project Financing: The Project was financed by two IDA credits. The credit approved at appraisal amounted to US\$15.0 million; and the actual disbursement at closure was US\$14.1 million. The second credit, approved through an AF in December 2019, amounted to US\$12.0 million; and the actual disbursement at closure was US\$11.7 million.

Borrower/Recipient contribution: The Borrower's contribution was estimated at US\$6.9 million at appraisal, but there was no Borrower contribution.

Project Dates: The Project was approved on April 3, 2012, and became effective on December 18, 2012. The MTR review was on January 19, 2015. The Project was restructured six times: (i) on November 10, 2014; (ii) on June 14, 2017; (iii) on June 15, 2018; (iv) on June 26, 2019; (v) on December 31, 2019 (AF); and (vi) on December 22, 2021. The original closing date was June 30, 2017. The Project was extended five times, for the total of six years and six months (or 78 months), to December 31, 2023, which was the date of the Project's actual closure.

Restructurings: The Project had six restructurings:

Restructuring 1 (November 10, 2014) was to add a new social safeguards policy, OP 4.11 Physical Cultural Resources, which was triggered when a site of a high religious significance was selected for a greening pilot under Sub-component B1. The Project's safeguards category was to remain "B".

Restructuring 2 (June 14, 2017) involved the following main changes:

- i. **Changes to Components.** Savings that occurred due to a co-financing for the clean stoves program were used to fund the following new activities under Components A and C: a feasibility study on non-coal heating, energy efficiency measures for detached ger houses, support to local stove and boiler manufacturers, and high-efficiency particulate air (HEPA) filters to kindergartens and schools. Proceeds were reallocated across disbursement categories, with no impact on total Project cost.
- ii. **Changes to the Results Framework (RF).** The following new intermediate results indicators (IRIs) were added: "Number of kindergartens that receive high-efficiency particulate (HEPA) filters"; "Persons/local producers trained in clean stove development, ceramic molding and production"; "Number of households benefited from energy efficiency demonstration work and retrofitted their detached houses"; and "Number of heat only boilers (HOBs) replaced by non-coal heating appliances at government buildings".
- iii. **Change in the closing date** for 12 months, from June 30, 2017, to June 30, 2018, to allow time to implement new activities.

Restructuring 3 (June 15, 2018) was to extend the closing date for 12 months, from June 30, 2018, to June 30, 2019, to allow time to complete the remaining activities (the remaining disbursement was US\$1.72 million of the US\$15 million loan) and to prepare the AF, in order to continue finding solutions to winter air pollution in UB and ger areas, as per Government request. (Restructuring Paper, page 3)



Restructuring 4 (June 26, 2019) was to extend the closing date for six months, from June 30, 2019, to December 31, 2019, to finalize the AF processing and complete the remaining activities (the remaining disbursement was US\$0.13 million of the US\$15 million loan).

Restructuring 5 (December 31, 2019) was to approve the AF in the amount of US\$12 million (the second IDA credit). The AF was to add Component D and revise Components A and C, as follows:

- i. **Revision of Component A:** activities were added, including pilots to replace high emitting HOBs and improve house insulation; and TA, awareness programs, knowledge exchange, and trainings on clean heating options and air quality monitoring and analysis. The estimated cost was increased to US\$21.7 million.
- ii. **Revision of Component C** was to re-focus it on Project management, and monitoring and evaluation (M&E), while the previous activities on awareness raising and air quality monitoring and analysis were moved to Component A. The estimated cost was increased to US\$3.8 million.
- iii. **Adding a new Component D *Electricity for Heating in Targeted Ger Areas* (estimated cost at AF: US\$5.6 million (Restructuring paper, page 16); actual cost at closure: US\$0.75 million (ICR, page 51))** to support ger households in switching from traditional coal-burning stoves to modern electric heating appliances, such as Electric Thermal Storage (ETS) heaters. The component was to finance the ETS heaters, related distribution network upgrades (meters, power cables, and wire upgrades), and TA and capacity building on advanced heating technologies. The heating appliances would be provided under a rent-to-own model: a monthly fee would count against the price, until it is repaid and the ownership is transferred to households.
- iv. **Changes to the RF:**
 - o Two PDO indicators were added: “Additional number of households provided with access to clean heating appliances” and “Percentage of Project beneficiaries reporting an improvement in quality of heating”.
 - o Nine new IRIs were added: seven under Component A and two under Component D.
- v. **Change in the closing date** for 24 months, from December 31, 2019, to December 31, 2021, to allow time to implement new activities.

Restructuring 6 (December 22, 2021) involved the following changes:

- i. **Revision of the PDO to reflect the added activities:** words “and services” were added after “heating appliances” and the wording “in ger areas” after “consumers” was changed to “in selected areas”.
- ii. **Utilizing savings under Component D for new demonstration activities** in buildings’ energy efficiency and RE for heating. There was a related reallocation of costs across components, with no impact on total Project cost;
- iii. **Changes to the RF:**
 - o The following indicator targets were reduced:
 - o For the PDO indicator “Number of households provided with access to clean heating appliances”: from 5,000 to 340 households;
 - o For the IRI “Persons/local producers trained in clean stove development, ceramic molding and production” (Component A): from 50 to 28 trainees;
 - o For the IRI “Additional capacity of clean heating appliances provided to targeted households (Megawatt)” (Component D): from 25 to 1.36 MW.
 - o The following indicator targets were increased:



- “Number of HOBs replaced by district heating or renewable energy heating sources”: from 1 to 7 replacements;
 - “Estimated GHG emissions reduction” was revised to reflect Components A and B, in addition to D, end target was revised from 22,615 to 165,005.
 - The following indicators were added to monitor new activities:
 - PDO indicator “Number of buildings completed energy efficiency renovation or provided with access to clean heating services”;
 - IRIs: “Number of geothermal heat pump systems installed at school/kindergartens” (Component A); “Number of air quality monitoring stations supplied to government agencies of air Quality” (Component A); “Additional city greening facility built (Number)” (Component B); “Number of precast concrete apartment buildings insulated” (Component B)
 - The following IRI was dropped due to the discontinued activities: “Number of complementary activities piloted at selected service center” (Component A);
- **Change in the closing date** for 24 months from December 31, 2021, to December 31, 2023, to allow time to complete the implementation of the remaining and new activities.

Split evaluation. The Project was restructured six times, but only Restructuring 6 of December 2021 necessitated a split evaluation due to the following: (i) PDO revision; (ii) reduced targets for one PDO indicator and two IRIs (a scale-down of some of the activities); and (iii) one dropped IRI.

3. Relevance of Objectives

Rationale

Country and Sector Context. At Project appraisal, UB was the coldest capital city globally, with extreme weather in the winter. The city suffered from inadequate public services and heating infrastructure, exacerbated by rapid urbanization and population concentration. Winters were characterized by extreme PM pollution levels, well above the Mongolian Air Quality Standards (the worst recorded were over ten times above the PM10 standard and 25 times above the PM2.5 standards), which was mainly caused by the widespread use of coal-fired stoves and the dust from unpaved roads. The ger areas, accommodating 60 percent of the UB's population, predominantly poor, faced most severe pollution. Addressing this crisis, the Government and the UB Municipality focused on short-term measures, including stove replacement programs and energy efficiency measures.

Relevance to Government Strategies at closure. The Project was aligned with Mongolia's Five-Year Development Guidelines for 2021-2025, specifically, with Area 2 “Human Development”, Objective 2.5 “To create a healthy and safe environment”, which highlighted the need to reduce air pollution and expand clean and green areas. It was also aligned with Area 6 “Green Development”, which aimed at reducing environmental pollution and degradation, promoting appropriate use of natural resources and their restoration, and introducing environmentally friendly green technologies. In addition, Area 9 “Ulaanbaatar and Satellite Cities”, Objective 9.2 “To ensure a healthy and safe living environment for citizens and introduce a recyclable, responsible and economical consumption” aimed at reducing the air pollution in Ulaanbaatar by 80%. However, there was a strategic shift in addressing urban pollution in 2015: the subsidized model for the provision of clean stoves was replaced by a commercial one, effectively



eliminating subsidies for clean stoves once the program achieved market scale, thus making clean stoves unaffordable for many households.

Relevance to the WBG’s Assistance Strategies at closure. The Project was aligned with the WBG’s Interim Strategy Note (ISN) for 2009-10 and the Country Partnership Strategy (CPS) for 2013-2017. The Project directly supported the ISN’s goal of protecting poor and vulnerable populations in UB, specifically targeting air pollution mitigation in ger areas. It was also aligned with the CPS’s focus on addressing vulnerabilities through improved access to services, particularly in enhancing clean heating services and reducing health vulnerabilities for residents in ger areas. The Project was aligned with the WBG Country Partnership Framework (CPF) FY2021-25, specifically with Focus Area 3 “Improving Quality of Life”, Objective 3.4 “Improving livability of urban centers”, which underscored the importance of reduced air pollution in UB, and Focus Area 2 “Boosting competitiveness”, aiming at reforming the existing energy system, as it was heavily dependent on coal, contributing significantly to both greenhouse gas emissions and air pollution.

Previous sector experience. Project design incorporated lessons from World Bank air quality mitigation support and cook stove support. The EAP *Energy Access Flagship Study* (2011) emphasized the use of advanced stoves by poor households who did not have access to cleaner fuels. The Bank’s *Household Energy Access for Cooking and Heating: Lessons Learned and the Way Forward* (2011) reviewed experience of the Bank’s household energy projects, and their success factors were taken into consideration. Also, the pilot heating stove replacement activities undertaken in Ulaanbaatar during the 2009-2010 winter season and in previous years were closely examined.

At appraisal, the objectives were pitched at the correct level considering the country’s situation and were aligned with both the Government strategy and the World Bank country strategy. At closure, the objectives were still well aligned with the World Bank strategy, but there was a disconnect with the Government strategy due to the removal of subsidies for clean stoves, as detailed under the heading “Relevance to Government strategies at closure” above. Overall, relevance of objectives is rated as Substantial.

Rating

Substantial

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective

PDO 1: To enable consumers in ger areas to access heating appliances producing less PM emissions in Ulaanbaatar.

Rationale

The theory of change (ToC) for the Project was not included in the PAD; it was prepared for the ICR, separately for the Original Project and for the Revised Project (ICR, page 9, page 17). The ToC for the



Original Project showed causal links from Project components to outputs and outcomes, and to the long-term outcomes. To achieve the desired results, the Project supported the following Components: Component A *Ger Area Particulate Matter Mitigation*; Component B *UB Particulate Matter Mitigation*; and Component C *Public Awareness Raising, Program Coordination and Project Management*. The expected outcomes of the implementation of the activities under these components were: (i) consumers in targeted areas have access to cleaner heating appliances; (ii) green spaces increased and dust reduced; (iii) mid-term PM abatement measures developed; (iv) coordination across air pollution reduction programs strengthened; and (v) public engagement in air pollution reduction action increased, leading to behavior change. The achievement of these outcomes would ultimately result in the following long-term outcome: enhanced urban livability and improved population health in ger areas. The critical assumptions were listed; they focused on such important conditions for the achievement of the objectives as household willingness to adopt new technologies, effective dissemination of knowledge and skills among local manufacturers, effective policy implementation and community engagement, public receptiveness to awareness campaigns, and effective collaboration among stakeholders. The ToC for the Revised Project added Component D to the list of components, as well as the related outputs, and revised the expected Project outcomes to the following list: (i) improved quality of heating; (ii) mid-term PM abatement measures developed; and (iii) consumers have access to heating appliances and services producing less PM emissions. The long-term objective remained the same, except the phrase “and in central UB” was added to the end of the statement to reflect the change in the PDO. The assumptions were adjusted to the new PDO.

While the ICR’s ToCs provide a clear overall picture of the Project’s logic, from components, to outputs, to main outcomes, and to the long-term outcome, they have deficiencies: many important details are missing (i.e. the intermediate outcomes), and the causal links do not include the interconnections across results chains.

The efficacy under Objective 1, Original Project, was assessed using the following indicators:

Outputs/Intermediate Outcomes:

1. “Number of laboratory tests supported by the Ulaanbaatar Clean Air Project (UBCAP)” (baseline: zero, target: 155 tests). The achievement at closure was 761 tests; the target was significantly exceeded.
2. “Subsidy mechanism disbursing, %” (baseline: zero, target: 100 percent). The achievement at closure was 100 percent, the target was reached.
3. “Number of stoves declared eligible for UBCAP support” (baseline: zero, target: five stoves). The achievement at closure was 22 stoves; the target was significantly exceeded. The ICR noted that this is explained by the “better than expected private sector participation and capacity build-up” (ICR, page 36).
4. “Number of stove models proposed for participation” (baseline: zero, target: ten models). The achievement at closure was 77 models; the target was significantly exceeded. The ICR noted that this is explained by the “better than expected private sector participation” (ICR, page 37).
5. “Persons/ local producers trained in clean stove development, ceramic molding and production (Number)” (baseline: zero, target: 50 trainees). The achievement at closure was 28 trainees; the target was 56 percent achieved (partially achieved).



6. "Number of kindergartens that receive high-efficiency particulate (HEPA) filters" (baseline: zero, target: 970 kindergartens). The achievement at closure was 1,500 kindergartens; the target was exceeded.
7. "Number of public buildings in ger area benefited from energy efficiency and retrofitting work" (baseline: zero, target: 12 buildings). The achievement at closure was 30 buildings; the target was significantly exceeded.
8. "Number of households who benefited from energy efficiency demonstration work and retrofitted their detached houses" (baseline: zero, target: 970 households). The achievement at closure was 1,768 households; the target was significantly exceeded.
9. "Number of HOBs replaced by non-coal heating appliances" (baseline: zero, target: one HOB). The achievement at closure was seven HOBs; the target was significantly exceeded.
10. "Number of females trained on clean heating options and air quality monitoring and analysis" (baseline: zero, target: 100 trainees). The achievement at closure was 100 trainees; the target was reached.
11. "Additional capacity of clean heating appliances provided to targeted households under Component D (Megawatt)." (baseline: zero, target: 25 MW). The achievement at closure was 1.36 MW; the target was barely reached.
12. "Estimated GHG emission reduction under Component D (tones/year)." This indicator was dropped at Restructuring 6 of December 2021 (replaced by the indicator measuring GHG emission reduction under Components A, B, and D jointly), and the achievement at closure is unknown. Considering that the related target of creating capacity of clean heating appliances under Component D was not reached, it is likely that this target was not achieved either.

PDO outcomes:

1. "Coverage of targeted households with eligible services, %" (baseline: zero, target: 80 percent). The achievement at closure was 90 percent; the target was exceeded. This indicator measured the number of households with installed Project-supported heating appliances. The ICR noted that the 80 percent target translated into 36,000 households, while the achievement was 40,813 households (ICR, page 18). Ten years after the installation of cleaner appliances in 2013-15, 60 percent of the 40,813 households were still using them, while others have switched to more efficient options. According to the Borrower's Project completion report, the 3.6 percent reduction in PM emissions, registered in UB from 2012 to 2019, can be attributed, to a large extent, to these achievements (ICR, page 18).
2. "Additional number of households provided with access to clean heating appliances" (baseline: zero, target: 5,000 households). The achievement at closure was 283 households; the target was six percent reached (barely reached). This target was to be achieved through the distribution of the ETS heaters to households using a rent-to-own model under Component D, which was added at Restructuring 5 of December 2019. The ICR noted that the Project faced several challenges in achieving this target. First, the 2019 national technical standards limited the capacity of the ETS heaters, negatively affecting the Project, as the smaller capacity heaters could only be used in smaller houses, typically occupied by low-income families, for which the monthly fees under the rent-to-own model were often unaffordable. Second, the collection of the ETS fee was challenging. Third, the Government's December 2020 decision to cover utility bills for a wide range of entities and all households until July 1, 2021, as well as an increase in refined coal subsidy, pushed down demand for



ETS heaters. The target was revised down to 340 households at Restructuring 6 of December 2021. (ICR, page 19) This low achievement is counted under the Original Project versus through adding a split in efficacy evaluation at Restructuring 5, when Component D and this PDO indicator were added, since addition of indicators or increase in scope do not merit a split. Also, Component D was added in 2019, well into the Project implementation, when the team had already had time for a proper due diligence to set the indicator targets adequately.

3. “Percentage of Project beneficiaries reporting an improvement in quality of heating” (baseline: zero, target: 85 percent). The achievement at closure was 89 percent; the target was exceeded.

Rating. The Original Project partially achieved its intended Objective 1 results, and its efficacy rating is Modest. Specifically, the Project exceeded two PDO indicator targets (on households with Project-installed heating appliances, and the reported better quality of heating), but did not deliver on the third PDO target (on households provided with access to ETS heaters under Component D); the target was only six percent reached.

Rating
Modest

OBJECTIVE 1 REVISION 1

Revised Objective

PDO 1: To enable consumers in selected areas to access heating appliances and services producing less PM emissions in Ulaanbaatar.

Revised Rationale

Please see the discussion of the ToC under Objective 1, Original Project.

The following indicator targets were revised, or indicators were added:

Outputs/Intermediate Outcomes:

1. “Persons/ local producers trained in clean stove development, ceramic molding and production (Number)”. The target was reduced from 50 trainees to 28 trainees, and the achievement was 28 trainees. The target was reached.
2. “Number of public buildings in ger area benefited from energy efficiency and retrofitting work”. The target was increased from 12 buildings to 21 buildings, and the achievement was 30 buildings. The target was exceeded.
3. “Number of HOBs replaced by non-coal heating appliances.” The target was increased from one HOB to seven HOB, and the achievement was seven HOBs. The target was reached.
4. “Number of geothermal heat pump systems installed at school/kindergartens”. This indicator was introduced at Restructuring 6, with the target of two systems. The achievement was one system. The target



was 50 percent reached (partially achieved). The ICR explained that this activity was “the first-of-its-kind in Mongolia, and it was difficult to identify suitable sites” for it (ICR, page 40).

5. “Number of air quality monitoring stations supplied to government agencies of air quality.” This indicator was introduced at Restructuring 6, with the target of three systems. The achievement at closure was three systems, the target was reached.

6. “Additional capacity of clean heating appliances provided to targeted households under Component D (Megawatt).” (baseline: zero, target: 1.36 MW). The achievement at closure was 1.36 MW; the target was reached. This target was scaled down at Restructuring 6 (please see details under Original Project, PDO outcome 2).

7. “Estimated GHG emission reduction under Components A, B, and D (tones/year).” (baseline: 153,965 tones/year, target: 165,005 tons/year). This indicator was introduced at Restructuring 6 of December 2021 (replacing the indicator measuring GHG emission reduction under Component D only). The achievement at closure was 204,883 tons/year; the target was exceeded.

PDO outcomes:

1. “Additional number of households provided with access to clean heating appliances” (ETS heaters, Component D). The target was reduced from 5,000 households to 340 households at Restructuring 6 (please see details under Original Project, PDO outcome 2). The achievement at closure was 283 households. The target was 83 percent achieved (substantially achieved).

2. “Number of buildings completed energy efficiency renovation or provided with access to clean heating services”. This indicator was introduced at Restructuring 6, with the target of 31 buildings. The achievement was 57 buildings. The target was exceeded.

Rating. The Revision 1 Project mostly exceeded, reached, or substantially achieved its intended Objective 1 results, and its efficacy rating is Substantial, with minor shortcomings. Three of the four PDO targets were exceeded (on households with Project-installed heating appliances, buildings with completed energy efficient renovation, and the reported better quality of heating), and one was substantially reached (on additional households provided with access to clean heating appliances (ETS heaters, Component D)).

Revised Rating

Substantial

OBJECTIVE 2

Objective

PDO 2: To further develop selected medium-term PM abatement measures in Ulaanbaatar in coordination with development partners.

Rationale

Please see the discussion of the ToC under Objective 1, Original Project.



The efficacy under Objective 2, Original Project, was assessed using the following indicators:

Outputs/Intermediate Outcomes:

1. "City greening preparatory study prepared (Yes/No)." The target was reached.
2. "City greening pilot implemented (Yes/No)." The target was reached.
3. "Power plant emissions control feasibility study prepared (Yes/No)." The target was reached.
4. "Housing policy study prepared (Yes/No)." The target was reached.
5. "District heating preparatory study prepared (Yes/No)." The target was reached.
6. "Monitoring and analysis equipment supplied, cumulative # of bid packages." (baseline: zero, target: three packages). The achievement at closure was nine packages; the target was exceeded.
7. "Effective project management and reporting established (# of project progress reports per year)." (baseline: zero, target: two reports). The achievement at closure was two reports; the target was reached.
8. "Number of persons trained in air quality monitoring, analysis and management; cumulative." (baseline: zero, target: 15 people). The achievement at closure was 56 people; the target was significantly exceeded.
9. "Quarterly report on coordination activities prepared by the municipality." (baseline: zero, target: four reports per year). The achievement at closure was four reports; the target was reached.
10. "Consultants for supporting coordination hired." (baseline: zero, target: two consultants). The achievement at closure was two consultants; the target was reached.
11. "Communications plan for collecting air quality program information across donors and agencies, satisfactory to the PMU, is prepared by the municipality, # of annual plans." (baseline: zero, target: one plan annually). The achievement at closure was three plans; the target was partially reached.
12. "Share of communications targets (e.g., meetings with agencies and donors, information collected) in approved communications plan achieved by the municipality." (baseline: zero, target: 100 percent). The achievement at closure was 100 percent; the target was reached.

PDO outcomes:

1. "Approval by relevant counterparts of principal recommendations and action plans developed by the Project for selected medium term abatement measures." (baseline: zero, target: four approved action plans). The achievement at closure was four action plans; the target was reached. The ICR commented that significant milestones were achieved by the Project, including the development and approval of five standards, six recommendations, and completion of four feasibility studies; also, new standards were developed for energy saving heaters and geothermal systems, and vital recommendations aimed at reducing volatile dust in UB and strategies to enhance the city's green facilities were issued (ICR, page 20). The development of the Affordable Housing Strategy under the Project played a foundational role in shaping subsequent projects focused on housing. Also, the Project built a comprehensive framework on affordable



housing, enabling strategic planning. Furthermore, the feasibility study to improve centralized heating in UB provided a foundation for the World Bank's *Ulaanbaatar Heating Sector Improvement Project*, which aimed to improve district heating efficiency (ICR, page 21).

2. "Inter-agency and donor coordination framework for air pollution abatement measures developed and functioning." (baseline: one, target: six years). The achievement at closure was eight years; the target was exceeded. The ICR commented that the achievement of this result reflected effective collaboration across government agencies, donors, and development partners. The coordination platform, established by the Project, facilitated discussions and prioritization of actions, supported continuous assessment of air quality, and helped to identify policy and institutional capacity gaps, as well as investment needs. (ICR, page 21)

Rating. While the Original Project achieved, exceeded, or substantially reached all its intended Objective 2 results, most of the Objective 2 indicators were either at the output or intermediate results level. This includes the PDO indicators measuring the approval of action plans (as opposed to their implementation) and the number of years of the donor coordination framework being functional). Therefore, the Objective 2 efficacy rating under Original Project is Substantial.

Rating
Substantial

OBJECTIVE 2 REVISION 1

Revised Objective

PDO 2: To further develop selected medium-term PM abatement measures in Ulaanbaatar in coordination with development partners.

Revised Rationale

Please see the discussion of the ToC under Objective 1, Original Project.

The following indicators were added:

Outputs/Intermediate Outcomes:

1. "Additional city greening facility built (Number)." (baseline: zero, target: two facilities). The achievement at closure was one facility; the target was 50 percent achieved (partially reached). The ICR commented that the construction of the second greening facility was cancelled in 2023, due to delays in approval process and insufficient time for completing the task before the closing date (ICR, page 42).

2. "Number of precast concrete apartment buildings insulated." (baseline: zero, target: eight buildings). The achievement at closure was 27 buildings; the target was significantly exceeded. The ICR commented that the overachievement was due to the reallocation of unused budget from other activities (ICR, page 43).

PDO outcomes:

There were no revisions of the PDO indicators.



Rating. The Revision 1 Project achieved, exceeded, or substantially reached all but one result under Objective 2, Revised Project, and its efficacy rating is Substantial. The target that was only partially reached was on greening facilities built.

Revised Rating
Substantial

OVERALL EFFICACY

Rationale

For the Original Project, the rating for efficacy is Substantial, with moderate shortcomings. The results on access to heating appliances and services producing less PM emissions (Objective 1) were partially achieved, and those on the development of medium-term PM abatement measures in coordination with development partners (Objective 2) were substantially reached. Importantly, the Project exceeded the target for the PDO indicator measuring the number of households with installed Project-supported heating appliances, as well as all related (Component A) IRI targets. However, the target for the PDO indicator measuring the additional number of households receiving access to clean heating appliances (ETSs under Component D) was only six percent reached, and the related IRI targets were not achieved either.

Overall Efficacy Rating

Substantial

OVERALL EFFICACY REVISION 1

Overall Efficacy Revision 1 Rationale

For the Revised Project, the rating for efficacy is Substantial. All targets on access to heating appliances and services producing less PM emissions (Objective 1) were exceeded, reached, or substantially achieved. Under Objective 2 (PM abatement measures), the Revised Project achieved, exceeded, or substantially reached all but one target (on greening facilities built), which was partially reached.

Overall Efficacy Revision 1 Rating

Substantial

5. Efficiency

a. Economic Analysis:



At appraisal: economic analysis for the Project was not conducted. Instead, the PAD referred to the economic costs (to health) from PM pollution in UB, based on the Bank's analytical work, as well as to the PM emission reduction potential of clean stoves, and described the logic of the Project interventions, thus justifying clean stoves' subsidization (PAD, pages 12-13).

At AF (Restructuring 5 of December 31, 2019) : economic analysis was conducted for the ETS heaters and for buildings' insulation. The Economic Internal Rate of Return (EIRR) was 37.5 percent for the ETS heaters, and 7.3 percent for buildings' insulation.

At closure: a detailed economic analysis was carried out, separately for the clean stoves program, the ETS heaters, and the buildings' insulation program. The Economic Internal Rate of Return (EIRR) was as follows: (i) 115.0 percent for the clean stoves program; (ii) 10.0 percent for the ETS heaters; and (iii) 6.5 percent for the insulation program. The discount rate was six percent. The benefits included heating cost savings, health benefits from avoided PM pollution, and global environmental benefits from avoided GHG emissions. *Note:* The significant difference between the EIRRs for the ETS heaters at AF (37.5 percent) and at closure (10.0 percent) is explained by the following. As noted in Section 3 (Original Project, Objective 1), the 2019 national technical standards limited the capacity of the ETS heaters, negatively affecting the Project, as the smaller heaters were insufficient for many of the Project beneficiaries, and one-quarter of them needed a second unit, resulting in a reduced EIRR.

Since all EIRRs at AF and at closure were above the opportunity cost of capital (discount rate), the Project was economically efficient. However, the EIRR estimate for the ETS heaters at closure was significantly lower than at AF.

b. Administrative Efficiency:

The Project was supervised efficiently, and there were no issues with the M&E implementation, financial management, procurement, and safeguards' implementation. There were no cost overruns, but the Project had some cost savings, in which cases the team was able to efficiently reallocate them to new or scaled-up activities.

However, the Project was significantly delayed and closed 78 months beyond the originally planned date; and while several activities were added (funded by the AFs), other activities were scaled down. The reasons for the delays and the scale-down were mainly external (outside of Project control). The external factors included a change in Government strategy toward the clean stoves program, subsidization of refined coal and electricity bills, and a failure of the UB electric utility to install meters and collect ETS payments (see more details in section 8 "Assessment of Bank Performance" of this review).

On balance, considering the economic viability of the Project and the efficient use of funds, but also taking into account significant implementation delays, partially caused by factors within Project control, and a low ex-post EIRR for the ETS heaters, Project's efficiency is rated as Modest.

Efficiency Rating

Modest



a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

| | Rate Available? | Point value (%) | *Coverage/Scope (%) |
|--------------|-----------------|-----------------|---|
| Appraisal | | 0 | 0 <input type="checkbox"/> Not Applicable |
| ICR Estimate | ✓ | 6.50 | 0 <input checked="" type="checkbox"/> Not Applicable |

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

| | Original Project: | Revised Project: |
|--------------------------------|--|-------------------------|
| Relevance of objectives | Substantial | |
| Efficacy | Substantial with moderate shortcomings | Substantial |
| Efficiency | Modest | |
| Outcome | Moderately Satisfactory | Moderately Satisfactory |
| Outcome value | 4 | 4 |
| Amount disbursed, US\$ million | 17.63 | 8.2 |
| Disbursement percentage | 68.25% | 31.75% |
| Weight value | 2.73 | 1.27 |
| Total weight | 4.00 | |
| Overall outcome rating | Moderately Satisfactory | |

The overall Project outcome rating is Moderately Satisfactory.

a. Outcome Rating

Moderately Satisfactory

7. Risk to Development Outcome

Government ownership. During the life of the Project, it was negatively affected by several Government decision, including: (i) a strategic shift in the Government approach to addressing urban pollution (removal of subsidies for clean stoves once the program achieved market scale, thus making them unaffordable for many targeted households); (ii) subsidization of utility bills and an increase in coal subsidy in December 2020 (creating incentives for a continued use of energy inefficient heaters and coal stoves); and (iii) the ban on raw coal and the introduction of refined coal briquettes in 2019 (which shortened the lifespan of clean stoves due to a high caloric value of the briquettes). Project sustainability depends on Government commitment to pursue PM abatement measures and create policy and regulatory incentives for switching to clean heating



and cooking appliances. Specifically, subsidization of fossil fuels and electricity tariffs creates risks for Project sustainability.

Financial. The ETS component of the Project was built on the assumption that the nighttime tariffs, made available for the UB's ger areas in November 2017, would stay in place. However, these tariffs require significant subsidization, which might be discontinued, as it creates fiscal pressure. If this subsidy is terminated, the household budgets will suffer, possibly leading to a reduced usage of ETS heaters, thereby creating another risk to Project sustainability.

8. Assessment of Bank Performance

a. Quality-at-Entry

The Project's design reflected core sector needs, outlined in the Government and World Bank strategies, and was based on the Bank's analytical work on clean stoves and clean heating appliances, and on lessons from the previous air pollution reduction efforts in the country. The ICR reported that the Project objectives were realistic, and the design was relatively simple, straightforward, and technically sound. Adequate procurement, financing, budgeting, M&E, and financial management (FM) mechanisms were in place. Key risks were correctly assessed in the PAD, and suitable mitigation measures were identified. (ICR, page 29).

Quality-at-Entry Rating

Satisfactory

b. Quality of supervision

The ICR reported that the Bank team provided close supervision throughout Project implementation, with frequent missions and reporting, as well as a proactive and collaborative approach to support the PMU. The Project conducted 23 Missions, and 22 ISRs were filed. There were instances of cost savings, and the team successfully reallocated the savings to new or scaled-up activities, improving Project's effectiveness and disbursement. (ICR, page 29)

However, the Project was significantly delayed (by 78 months in total), and the extension of the closing date had to be approved five times. While this was partially due to the Additional Financing, there were also shortcomings in implementation management.

The ICR explained delays mainly by factors outside of the Project's control. Specifically, the Project was negatively affected by three Government actions (ICR, page 25):

- First, in 2015, there was a strategic shift in addressing urban pollution: the subsidized model was replaced by a commercial one, ceasing the provision of subsidies for clean stoves once the program achieved market scale, thus making clean stoves unaffordable for many households.



- Second, the December 13, 2020, Government decision to cover utility bills for a wide range of entities and all households until July 1, 2021, led to an increased use of the high-electricity-consuming heaters and the termination of the Project contracts for ETS heaters. Additionally, the Government increased a refined coal subsidy, leading to an increased usage of traditional coal stoves and creating disincentives to use clean stoves.
- Following the approval of the AF Procurement Plan, the Ulaanbaatar Electricity Distribution Network (UBEDN) was to sign two contracts: for the supply and installation of multi-tariff meters, distribution boxes, and grounding for households; and for the collection of ETS monthly installments. However, the contracts were not signed (the explanation was an excessive workload). Consequently, the ETS fee collection fell on the PMU, and the electricity work was outsourced to a contractor. This resulted in delays.

The Project was also affected by COVID-19: during the lockdowns, Project activities had to be fully suspended, leading to delays, including in the production and delivery of the ETS heaters, leading to the shortcomings in the implementation of Component D (ICR, page 25). On balance, considering the sound Project design, efficient management of the Project funds, and an adequate handling of the disruptive external circumstances during supervision, but also taking into consideration significant delays, the overall Bank Performance rating is Moderately Satisfactory.

Quality of Supervision Rating

Moderately Satisfactory

Overall Bank Performance Rating

Moderately Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

The RF reflected the logic of Project interventions in the PAD, was sufficiently linked to the PDO and the ToC, and was comprehensive yet manageable. The PDO indicators were at the outcome level and reflected most of the expected Project outcomes. The intermediate indicators were linked to the PDO indicators, providing more details. The indicators measured both objective results and beneficiary satisfaction, were mostly quantitative, and all of them were time-bound and attributable to the Project.

The ICR reported that the quality of the RF was adequate, however, there was a gap in the M&E design: while the PDO was focused on enabling access to cleaner heating appliances (mainly to reduce PM pollution) and on developing PM abatement measures, the RF did not include an indicator to measure PM pollution reduction, due to the attribution issues. (ICR, pages 26-27) The team subsequently included an indicator on GHG emission reduction.



b. M&E Implementation

The ICR reported that M&E implementation was conducted adequately. The PMU was responsible for data collection, monitoring, and analysis. This was a strategic decision, considering that the PMU had an established internal monitoring and control system. Although there was no PM indicator in the RF, the PMU collected PM measurements from the air quality authorities and used these data in its annual Project progress reports. (ICR, page 27)

The RF was adjusted at three restructurings, in order to add indicators for measuring progress with the implementation of new activities. However, there were almost no changes to the original indicators (only one indicator was dropped and one modified), supporting the ability of the RF to track originally intended results throughout Project implementation.

The ICR noted that many of the targets were significantly exceeded, indicating that they were set up with an insufficient ambition. In the hindsight, several targets should have been increased at restructurings. (ICR, page 27)

c. M&E Utilization

The ICR reported that the task team meticulously documented the supervision and implementation of the Project, effectively utilizing Aide Memoires and ISRs. The M&E was instrumental in highlighting critical issues, thereby facilitating the engagement of the stakeholders, and soliciting support from the Bank management and Government authorities when facing challenges. (ICR, page 27)

Based on the above, the M&E Quality is rated Substantial.

M&E Quality Rating

Substantial

10. Other Issues

a. Safeguards

Environmental and Social Safeguards. At appraisal, the Project was classified as Environmental Category B (Partial Assessment) and triggered the Environmental and Social Assessment (OP/BP 4.01), in relation to Component A. An Environmental Management Plan (EMP) was prepared and disclosed. The second safeguards policy - Physical Cultural Resources (OP 4.11) – was added at Restructuring 1 of November 2014, due to a selection of a site of historical significance under Sub-component B1. At the AF (Restructuring 5 of December 2019), the OP/BP 4.11 was dropped, as it was no longer triggered, while for the activities under Component D, the ESMP was updated and disclosed. The related mitigation measures were implemented. A Grievance Redress Mechanism (GRM) was established, but no public grievances were received. (ICR, page 28) The overall environmental and social compliance was rated Satisfactory during Project implementation and at closure.



b. Fiduciary Compliance

Financial management (FM). The ICR reported that regular FM reviews were conducted by the World Bank to ensure that the FM arrangements were adequate. The Project FM complied with Bank requirements, and the FM performance was rated Satisfactory throughout the implementation period. (ICR, page 28) The ICR did not provide information regarding the timeliness of project external audits and whether the external auditors’ opinions were qualified.

Procurement. The ICR reported that the PMU was responsible for procurement, contract signing, and implementation of the activities. Procurement complied with the World Bank requirements. The World Bank’s Systematic Tracking of Exchanges in Procurement (STEP) was utilized to prepare, clear, and update Procurement Plans and conduct all procurement transactions. A Project Procurement Strategy for Development (PPSD) was created for both the Original Project and the AF. The Procurement rating was consistently Satisfactory throughout Project implementation. (ICR, page 26)

c. Unintended impacts (Positive or Negative)

There were no unintended impacts (positive or negative).

d. Other

11. Ratings

| Ratings | ICR | IEG | Reason for Disagreements/Comment |
|------------------|--------------|-------------------------|----------------------------------|
| Outcome | Satisfactory | Moderately Satisfactory | Efficiency is rated modest. |
| Bank Performance | Satisfactory | Moderately Satisfactory | Shortcomings at supervision. |
| Quality of M&E | Substantial | Substantial | |
| Quality of ICR | --- | Substantial | |

12. Lessons

The following lessons were derived from the ICR (ICR, pages 30-31):

1. Government commitment and consistent support are critical when project’s sustainability depends on policy and regulatory environment. In the reviewed Project, the stove program encountered challenges, as households found the stoves too costly without subsidization (including through tariffs). Separately, in 2019, the Government prohibited the usage of raw coal in UB and introduced refined coal briquettes, which were not compatible with the clean stoves developed by



the Project, and which had high caloric value, thus shortening the lifespan of the stoves. The lack of ongoing consistent policy and regulatory support for the program created risks to the sustainability of the clean stove component of the Project and therefore to the Project's long-term objective of PM emissions reduction.

2. When projects introduce new and innovative technologies, a thorough market analysis, in addition to technical analysis, during project preparation is critical for a successful project implementation. The introduction of the ETS heaters under Component D suffered due to a lack of adequate a-priori market analysis: the Project aimed to provide access to the heater for 5000 households, but this target had to be reduced to 340. This happened because the following discoveries were made during implementation: (i) the network system had to be upgraded to accommodate ETS heaters; and (ii) 89 percent of households meeting the technical criteria could not afford ETS heaters. If a proper market analysis were conducted prior to implementation, these factors could have been incorporated into Project design.

3. Setting insufficiently ambitious RF targets can reduce the usefulness of the M&E system. The reviewed Project significantly exceeded several RF targets, signaling that they were set too low. Since the Project underwent several restructurings, there was a missed opportunity to increase these targets. The overachievement across multiple indicators suggests a need for more rigorous and adequate target setting in future projects to pitch them at the correct level.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

The ICR provides sufficient technical details and evidence to support the analysis and the ratings; the analysis clearly links the evidence to the findings; and the presentation has internal consistency. Both efficacy and efficiency analyses are logical and well structured. The presentation of the facts is candid and analytical, including the description of the risks and lessons learned. The lessons are based on evidence and are useful for future operations. However, there were a few unclaritys in the presentation of Project costs, including the missing data in the Annex 3 table "Project Cost by Component" (ICR, page 51) and the inconsistencies between costs quoted in the Component description and in Annex 3.

Overall, the ICR quality is rated as Substantial.

a. Quality of ICR Rating

Substantial

