ADB

Completion Report

Project Number: 48029-001
Technical Assistance Number: 8776
May 2017

Mongolia: Coal to Cleaner Fuel Conversion for Heating in Ger District and Power Generation

Asian Development Bank

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<table>
<tr><td colspan="3">TA Number, Country, and Name:
TA 8776-MON: Coal to Cleaner Fuel Conversion for Heating in Ger District and Power Generation</td><td colspan="2">Amount Approved: $350,000
Revised Amount: Not applicable</td></tr>
<tr><td colspan="2">Executing Agency: Ministry of Mining and Energy</td><td>Source of Funding: Technical Assistance Special Fund-V</td><td>Amount Undisbursed: $52,991.50</td><td>Amount Utilized: $297,008.50</td></tr>
<tr><td>TA Approval Date:
4 Dec 2014</td><td>TA Signing Date:
24 Feb 2015</td><td>Fielding of First Consultant:
7 August 2015</td><td colspan="2">TA Completion Date
Original: 29 Feb 2016 Actual: 31 Oct 2016
Account Closing Date
Original: 31 May 2016 Actual: 31 Dec 2016</td></tr>
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Description

The policy and advisory technical assistance (TA) was designed to promote the production and use of cleaner fuel from a coal-to-liquid (CTL) process, capitalizing on abundant domestic coal resources for heating and power generation while reducing air pollution and dependence on imports of petroleum products.

While Mongolia is rich in coal supply, it faces challenges on energy security, and air pollution as it depends almost entirely on domestic coal production and imported oil for its energy supply. Mongolia seeks to explore alternative fuel solutions to (i) decrease dependence on oil imports and thereby improve energy security, (ii) reduce air and soil pollution in Ulaanbaatar caused by coal combustion for heating and cooking in *ger* District, and (iii) install regulating capacity such as gas-based power plants in the power system for absorbing renewable energy-based power.

Expected Impact, Outcome, and Outputs

The impact of the TA was improved air quality and energy security in Mongolia due to cleaner fuel supply from CTL. The outcome was an enabling environment for CTL established by 2016. The outputs of the TA consisted of (i) technical and economic feasibility of CTL established, (ii) policy and regulatory environment assessed, (iii) CTL implementation plan developed, and (iv) TA findings and recommendations disseminated.

Delivery of Inputs and Conduct of Activities

The executing agency was the Ministry of Mining and Energy and the implementing agency was the Mineral Resources Authority of Mongolia. The executing and implementing agencies provided logistical support and data, their performance is satisfactory. The consulting team, comprising four international experts and five national experts, was engaged in accordance with Asian Development Bank's (ADB's) Guidelines on the Use of Consultants (2013, as amended from time to time). The TA provided total inputs of 7.62 person-months international and 16.73 person-months national, compared to 6 person-months international and 15 person-months national, as originally planned. The minor deviation is mainly due to the translation of the final report and preparation for the study tour in South Africa. The team work displayed among the international and local experts, open and regular communications between ADB and the consulting team, a well-planned schedule of activities, properly utilized experts' resources, and an established system paved the way for the timely delivery of the required outputs by the consulting firm. The overall performance rating of the firm is satisfactory. ADB provided guidance to the consulting firm and the government, feedback on the reports, and attended missions (inception, review, and final workshop missions). The counterpart staff in the resident mission assisted in linking the consulting firm with the concerned agencies to obtain the required data to complete the final report. ADB performance is rated satisfactory.

The TA was extended to plan the study tour which was supposed to be held in South Africa, a non-ADB member country—Secunda Synfuels Facility of Sasol, the only commercial-scale, coal-based synthetic fuels manufacturing facility in the world. So much effort has been put into organizing the visit to the highly restricted facility for the Mongolian delegates. But due to delays in establishing the new appointees for the executing and implementing agencies, after the elections held in mid of 2016, the study tour was eventually cancelled, and the TA was closed.

Evaluation of Outputs and Achievement of Outcome

The data collected from available and reliable sources such as the government agencies; multilateral development institutions; consultant's own data; international best practices; lessons learned from experiences of other countries; comparison, adaptability, maturity and commercial readiness of technologies; and through direct interviews were the bases for drawing assumptions and conclusions for the TA. The expected TA outputs were accomplished and outcome achieved.

1. Techno-economic feasibility of CTL established. Various technologies for CTL fuel conversion were

considered and the most effective and most appropriate technologies identified: (i) indirect CTL facility producing diesel,[1] naphtha,[2] and dimethyl ether (DME);[3,4] (ii) entrained flow gasifier for converting coal to syngas—it works well with a broad range of coal types and produces gas that is low in hydrocarbons and tars suitable for Fischer-Tropsch (FT) synthesis; (iii) syngas to liquid conversion utilizing cobalt-based FT reactor; and (iv) syngas conversion to DME, which was identified as the clean fuel to be utilized in the *ger* district households in consideration of sustainability, affordability, and ease in distribution.

2. **Policy and regulatory environment assessed.** Establishment of new laws and regulations to strengthen the existing policies were recommended to support the changes in the production of domestic petroleum products and production and utilization of clean gas fuels. The proposed reforms include, among other things (i) the transfer and distribution of clean gas fuel in *ger* households, (ii) defining petroleum production, (iii) safeguarding domestic trade and sale and producers of local petroleum product from international competition, (iv) safety regulations for gas fuel, (v) upgrade and development of the workforce in the petroleum sector, (vi) tax incentives or exemptions, (vii) attractive investment schemes, and (viii) government structure/authority for the petroleum sector. Government support and involvement were highly recommended to ensure successful implementation of the reforms.
3. **CTL implementation plan developed.** A step-by-step implementation plan for a phased plant was developed. Project definition covering business planning, financing, and feasibility studies, including (i) defining government support, legal and investment environments necessary to establish CTL; (ii) establishing government implementing bodies, applying public-private partnership, if needed; (iii) studying available technologies and defining CTL plant, defining detailed technical parameters and conducting feasibility studies and design work; (iv) studying constructability concepts to allow for challenges with building in Mongolia; (v) conducting financial analysis to check the financial viability of the project under current and projected economic climates; and (vi) conducting the necessary financing negotiations to reach agreements. Phase 1 plant to operate at a capacity of 170,000 tons per year (tpy) to produce (i) DME as a clean fuel gas, and (ii) the required liquid fuels using smaller-scale FT synthesis unit minimizing total investment cost; and obtain financing when the project definition phase determines that the CTL plant is technically and financially feasible. Phase 2 to operate at a capacity of 1,220,160 tpy to produce petroleum products that will reduce dependence from imports through the implementation of a larger FT synthesis unit, along with additional DME unit for addressing increased demand for clean fuel in *ger* districts.
4. **TA findings and recommendations disseminated.** The executing and implementing agencies and other stakeholders appreciated and welcomed the findings and recommendation of the TA which were presented during the final workshop.

Overall Assessment and Rating

Almost all the activities planned for the TA were accomplished except for the study tour. Overall the TA is rated as successful.

Major Lessons

Developing a CTL plant facility requires comprehensive preparation, planning, and implementation. It involves a huge amount of investments, and strong support from the private sector and the government is necessary. The government provides among other things the regulatory and policy reforms, and financial aid; while the private sector provides the technical knowledge for its operations and maintenance. Other stakeholders include licensors (technology), distributors (equipment), universities (skills upgrade), etc. The roles of the government, private sector, and other stakeholders should be clearly defined at the beginning of its development.

Recommendations and Follow-Up Actions

The government should encourage exploratory work of its untapped domestic energy resources like coal-bed methane, hydrogen production from curtailed wind and solar and see its potential as a sustainable alternative source of energy to supply the country's increasing demand, where ADB may provide support through TA. The other areas that may be considered for TA support relative to this study include: (i) policy and regulatory reforms; (ii) tax incentives, subsidies, or exemptions; (iii) workforce skills upgrade and knowledge enhancement; and (iv) identifying potential sources of financing to support CTL implementation and development. The government will implement the recommendations on policy and regulatory reforms relative to energy security improvements. ADB may also consider exploring financing a loan through public-private partnership arrangement.

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[1] Diesel will be the primary product supplying the energy needs of the industries.

[2] Naphtha a by-product of producing diesel through FT approach and to be exported to the People's Republic of China as there is no petrochemical market for this product in Mongolia.

[3] DME to provide a clean burning fuel for the *ger* districts.

[4] The indirect CTL technology is commercially developed and ready with lower associated costs. The world's largest facility successfully operating for more than 50 years is found in South Africa—Sasol Secunda Facility. There are three small-scale facilities operating in Inner Mongolia and Xinjiang in the People's Republic of China.