

TERMS OF REFERENCE FOR CONSULTANTS

1. For the proposed knowledge and support technical assistance (TA) a consulting firm composed of international and national consultants will be recruited to undertake the studies listed under the TA. The consulting firm will engage 9 person-month international inputs and 27 person-month national inputs. The government will provide counterpart support to the consultants, including (i) adequate office space; (ii) bilingual counterpart personnel available to provide assistance in collecting data and coordinating with government agencies, if required; (iii) assistance with visas and other permits required by the consultants to enter and to work; and (iv) access to all data, including documents, reports, accounts, drawings and maps, and permission to enter offices, as appropriate and necessary, to undertake the work. The consulting firm will be engaged in accordance with ADB's Procurement Policy (2017, as amended from time to time) through the quality- and cost-based selection method (90:10), following submission of simplified technical proposals. The assignment will be undertaken over a 19-month period on an intermittent basis (October 2018 to May 2020).

2. A summary of the proposed composition of the TA consulting firm is as follows:

	Item	Expertise or Position	Inputs in person-month
International	1	Distributed heating specialist/Team leader	3
	2	Climate change economist	3
	3	Financial specialist	2
	4	Control system specialist	1
Person-month International Total			9
National	1	Distributed heating specialist/co-team leader	8
	2	Renewable energy specialist	3
	3	Energy system specialist	1
	4	Social development specialist	4
	5	Building energy efficiency specialist	1.5
	6	Building structure specialist	1.5
	7	Gender specialist	1
	8	Environment specialist	3
	9	Financial analyst	3
	10	Business development specialist	1
Person-month National Total			27
Deliverables	Output 1:		
	(i)	Inception report.	
	(ii)	Interim report (including survey raw data).	
	(iii)	Draft final report.	
	(iv)	Final report.	
	Output 2:		
(i)	Overseas training.		
(ii)	Workshops.		

3. **Distributed heating specialist/Team leader** (international, 3 person-months, intermittent). The consultant must have (i) at least a master's degree on energy engineering or relevant fields; (ii) at least 10 years of work experience in distributed heating field, out of which, minimum of 8 years of work experience based on renewable energy integrated distributed heating and with thermal storage applications; (iii) experience from international renewable integrated distributed heating and thermal storage projects; and (iv) excellent written and oral English; and

(v) experience in international cooperation and management. The consultant will be the team leader and will:

- (i) prepare working schedule, coordinate team work, and be responsible for communication with EA and IA, specialists, and ADB, ensure the TA is implemented;
- (ii) conduct site visits, analyze urban plans and evaluate heat demand and energy consumption;
- (iii) introduce international practices, and conduct alternative analysis, and propose technical solution;
- (iv) design climate resilient technical solutions in collaboration with climate change economist, renewable energy specialist, and the co-team leader;
- (v) prepare the TA final report including a pre-feasibility study with control system specialist, energy system specialist, and the co-team leader;
- (vi) organize and administer overseas training; and
- (vii) organize the workshops in collaboration with the co-team leader.

4. **Climate change economist** (international, 3 person-months, intermittent). The consultant must have (i) at least a master's degree in economics or climate science; (ii) at least 4 years of relevant experience in decision analysis; (iii) understanding of decision making under deep uncertainty (DMUU), real option analysis, and scenario analysis; (iv) at least 4 years of relevant experience in climate data analysis and management; (v) at least 4 years of relevant experience in climate change adaptation project and familiarity of climate change adaptation benefits and costs estimate; (vi) strong computer skills, including data analysis with standard statistical packages; and (vii) excellent written and oral English. The consultant will:

- (i) identify risks that might affect performance of proposed technologies along their lifetime;
- (ii) estimate the plausible range of uncertainties related to identified risks;
- (iii) in collaboration with social development specialist, consult with all stakeholders, communicate and explain climate-related risks, and understand their risk tolerance;
- (iv) estimate climate change adaptation costs and benefits;
- (v) assist the team leaders in proposing climate-resilient technical solutions, particularly on the flexibility and robustness of technical designs; and
- (vi) assist the team leaders in drafting reports.

5. **Financial specialist** (international, 2 person-months, intermittent). The consultant must have (i) at least a bachelor's degree in finance or energy economics; (ii) a minimum of 10 years of experience in financial and economic analysis of energy projects; (iii) familiarity of financial instruments for performance guarantee and a minimum of 3 relevant project experience; (iv) understanding of government's debt ceiling and repayment capacity; and (v) excellent written and oral English. In consultation with other consultants, the consultant will:

- (i) conduct a cost-benefit analysis on developed technical design;
- (ii) explore the availability and cost of financial instruments for performance guarantee;
- (iii) identify possible financing sources for proposed technical solutions;
- (iv) assess repayment capacity of the government; and
- (v) assist the team leaders in drafting reports.

6. **Control system specialist** (international, 1 person-month, intermittent). The consultant must have (i) at least a master's degree in control engineering, electronic engineering, mechanical engineering or related fields; (ii) a minimum of 10 years of experience in optimal control theories

for energy storage systems or renewable energy integration; and (iii) excellent written and oral English. The consultant will:

- (i) design the computerized thermal control and operation system of renewable energy-based heating systems as part of the pre-feasibility study; and
- (ii) assist the team leaders in drafting reports.

7. **Distributed heating specialist/co-team leader** (national, 8 person-months, intermittent). The consultant must have (i) at least a master's degree on energy engineering or relevant fields; (ii) at least 6 years of work experience in distributed heating field, out of which, minimum of 4 years of work experience based on renewable energy and with thermal storage applications; and (iii) good written and oral English. The consultant will be the co-team leader and will:

- (i) conduct site visits, analyze urban plans and estimate demand and energy consumption;
- (ii) support international distributed heating specialist, to evaluate suitability of international best practice, and propose technical options;
- (iii) coordinate with relevant agencies;
- (iv) design climate resilient technical solutions in collaboration with climate change economist, renewable energy specialist, and the team leader;
- (v) prepare the TA final report including a pre-feasibility study with control system specialist, energy system specialist, and the team leader; and
- (vi) organize workshops in collaboration with the co-team leader.

8. **Renewable energy specialist** (national, 3 person-months, intermittent). The consultant must have (i) at least a master's degree in renewable energy, energy engineering, or relevant fields; (ii) at least 6 years of work experience in renewable energy for heating, preferably on distributed heating; and (iii) good written and oral English. The consultant will:

- (i) forecast future hydropower generations in collaboration with climate change economist;
- (ii) investigate the diurnal and seasonal pattern of power supply and associated pricing mechanism;
- (iii) identify and estimate the reliability of renewable energy sources;
- (iv) assist the team leaders in designing technical solutions; and
- (v) assist the team leaders in drafting reports.

9. **Energy system specialist** (national, 1 person-month, intermittent). The consultant must have (i) at least a master's degree in energy engineering or relevant fields; (ii) at least 6 years of work experience in energy integration preferably for heating, and (iii) good written and oral English. The consultant will:

- (i) develop integrated distributed heating systems as part of the pre-feasibility study;
- (ii) assess the whole energy system including supply side and heating demand side; and
- (iii) assist the team leaders in drafting reports.

10. **Social development specialist** (national, 4 person-months, intermittent). The consultant must have (i) at least a master's degree in sociology or relevant fields; (ii) at least 5 years of relevant experience in household survey design and analysis; (iii) a minimum of 5 years of experience working on internationally financed projects with land acquisition impact, and in-depth knowledge of current PRC legislation regarding land acquisition; (iv) proven experience in social safeguard due diligence; (v) experience with poverty, social, and gender analysis; (vi) strong computer skills, including data analysis with standard statistical packages; and (vii) excellent written and oral English. In consultation with other consultants, the consultant will:

- (i) design and guide a geo-referenced and gender-focused household survey;
- (ii) analyze the survey results and prepare a final report on household survey;
- (iii) estimate the medium- and long-term population influx due to urbanization;
- (iv) collect basic socio-economic data including poverty rate, demographics of population, and urbanization trend for last 5 years;
- (v) in collaboration with climate change economist, consult with all stakeholders, communicate and explain climate-related risks, and understand their risk tolerance;
- (vi) undertake social safeguard due diligence for proposed technical solutions; and
- (vii) assist team leaders in drafting reports.

11. **Gender specialist** (national, 1 person-month, intermittent). The consultant must have (i) at least a master's degree in social science or relevant fields; (ii) at least 5 years of relevant experience in gender field; and (iii) good written and oral English. The consultant will:

- (i) assist the social development specialist in designing household survey;
- (ii) conduct gender analysis as integral aspect of the household survey;
- (iii) estimate potential beneficiaries with gender-mainstreamed considerations;
- (iv) obtain data on labor market participation rates of women in the energy sector in Barkam; and
- (v) assist the team leader in building a business model that mainstreams the involvement of women in business operation.

12. **Building energy efficiency specialist** (national, 1.5 person-months, intermittent). The consultant must have (i) at least a master's degree in civil engineering, energy engineering, or relevant fields; (ii) at least 5 years of work experience in building energy efficiency assessment; and (iii) good written and oral English. The consultant will:

- (i) assist the social development specialist in designing the household survey;
- (ii) conduct energy audit;
- (iii) analyze measures to improve building energy efficiency;
- (iv) estimate energy saving from improved building energy efficiency;
- (v) estimate expected household heat consumption with improved building energy efficiency consideration; and
- (vi) assist the team leaders in drafting reports.

13. **Building structure specialist** (national, 1.5 person-months, intermittent). The consultant must have (i) at least a bachelor's degree in civil engineering or architecture; (ii) at least 8 years of work experience in building design and structural analysis; and (iii) good written and oral English. The consultant will:

- (i) assist the social development specialist in designing the household survey;
- (ii) assess the impact of installation of heating systems on building structural stability; and
- (iii) assist the team leaders in drafting reports.

14. **Environment specialist** (national, 3 person-months, intermittent). The expert must (i) have a master's degree in environmental science, environmental engineering, environmental management, or in any relevant field; (ii) have at least 8 years of working experience; (iii) have experience in assessing environmental impact in space heating; (iv) have a good understanding in ADB's Safeguard Policy (SPS); and (v) good written and oral English. The consultant will:

- (i) conduct carbon and pollutants mitigation impact assessment; and

- (ii) prepare an environment assessment report in English for a pre-feasibility study for the selected technical solutions including associated facilities meeting ADB's SPS, specifically, Safeguard Requirements (Appendix 1 of SPS) and submit it to ADB.

15. **Financial analyst** (national, 3 person-months, intermittent). The consultant must have (i) at least a bachelor's degree in finance or economics; (ii) a minimum of 6 years of experience in financial analysis of energy projects; (iii) familiarity with domestic debt ceiling and foreign capital policy; and (iv) good written and oral English. Together with international financial specialist, the consultant will:

- (i) conduct a cost-benefit analysis on developed technical design with and without environmental and social concerns;
- (ii) explore the availability and cost of financial instruments for performance guarantee;
- (iii) identify possible financing sources for proposed technical solutions;
- (iv) assess the repayment capacity of the government; and
- (v) assist the team leaders in drafting reports.

16. **Business development specialist** (national, 1 person-month, intermittent). The consultant must have (i) at least a bachelor's degree in business administration, law, or related fields; (ii) a minimum of 6 years of experience in business development or management consulting; (iii) a minimum of 4 cases on heating projects; (iv) experience on PPP, BOT, BOOT, and other business models; and (v) good written and oral English. The consultant will:

- (i) explore existing business models on distributed heating worldwide and summarize pros and cons;
- (ii) develop business models in collaboration with international financial specialist, national financial analyst, and team leaders; and
- (iii) assist the team leaders in drafting reports.

Deliverables

17. The Consultant shall submit the following reports to ADB (in both English and Chinese) and to the government (in Chinese):

- (i) **Inception report.** To be submitted within 1 month of commencement of services. The report will summarize discussions with counterparts and other relevant stakeholders, include a detailed work program, and address any major inconsistencies in the terms of reference.
- (ii) **Interim report.** To be submitted within 6 months of commencement of services. The report will include a survey report, interim results of activities, an updated work program, and address any issues and concerns.
- (iii) **Draft final report.** To be submitted within 14 months of the commencement of services. Upon submission of the draft final report, a final consultation will be held, attended by relevant stakeholders, to obtain feedback on the report.
- (iv) **Final report.** To be submitted within 1 month following receipt of comments from ADB and the government on the draft final report. The final report shall take into consideration comments by ADB and the government. An executive summary (with a maximum length of 10 pages) should be included in the final report.

18. In addition, the Consultant will submit (i) a draft survey questionnaire no later than 15 days after the commencement, and (ii) a final questionnaire no later than 5 days after receiving comments from ADB. The design of survey shall be approved by ADB before being used. The survey raw data will be submitted to ADB upon the completion of the survey. A survey report,

including corrections, calibrations, methodologies in information analysis, and findings, will be submitted as part of the interim report to ADB. The survey will be household-based and georeferenced on (a) current heating methods; (b) consumption and expenses on heating; (c) building types and heating areas; (d) household income; (e) willingness to pay for heating; (f) household composition; (g) time consumption of existing heating methods; (h) options that enhance overall household energy efficiency; and (i) other factors that influence heating consumptions and consumers' behavior on heating.

Milestone Payment Schedule

19. The Consulting firm shall be paid following the approval of the milestones deliverables outlined above in accordance with the following schedule:

Inception Report – 20%

Interim Report (including survey raw data) – 50%

Draft Final Report – 20%

Final Report – 10%