

## JICA Environmental Checklist 4: Geothermal Power Station

Points to Note:

1. Answers should not be limited to only Yes/No, but the rationale of the answer and mitigation measures should also be described in the "Confirmation of Environmental Considerations" column.
2. If you have any questions about terminology, etc., please refer to "Japan International Cooperation Agency Guidelines For Environmental and Social Considerations (January 2022)" (the JICA Guidelines) and "Answers to Frequently Asked Questions about the Japan International Cooperation Agency Guidelines For Environmental and Social Considerations (January 2022)" (FAQ).

| Category                     | Item                                                     | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Yes: Y<br>No: N                               | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------|
| 1. Permits and Consultations | (1) Environmental Assessment and Environmental Permits   | (a) Have EIA reports been already prepared in official process?<br>(b) Are the EIA reports written in the official or widely used language of the host country?<br>(c) Have EIA reports been approved by authorities of the host country government? (If not yet approved, write the expected date of the approval in the "Confirmation of Environmental Considerations" column.)<br>(d) Have EIA reports been approved with any conditions? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?<br>(e) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?<br>(f) Do the EIA reports cover the items described in Appendix 2 of the JICA Guidelines? (The scope and detail of the impact assessment may be adjusted according to the impact of the project.)<br>(g) Do the environmental and social consideration confirmation cover the project's whole scope, cumulative impacts, derivative and secondary impacts, as well as impacts of indivisible projects? | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g) | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g)                                  |
|                              | (2) Explanation and Consultation with Local Stakeholders | (a) Are local stakeholders properly analyzed and identified?<br>(b) Does the project provide appropriate explanations to local stakeholders about the content and impact of the project, and gain their understanding, through the process of ensuring meaningful consultation including information disclosure?<br>(c) For local stakeholder consultations, are records of consultations prepared, including the gender and other attributes of the participants?<br>(d) Have comments from local stakeholders (such as local residents) been reflected to the project design, etc.?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (a)<br>(b)<br>(c)<br>(d)                      | (a)<br>(b)<br>(c)<br>(d)                                                       |
|                              | (3) Examination of Alternatives                          | (a) Is the project/plan's scope of multiple alternatives adequately considered?<br>(b) Are alternatives that are feasible in terms of technical, financial, and environmental and social aspects considered from the view point of environmental and social items and, if necessary, reducing total greenhouse gas emissions?<br>(c) Are comparisons made with the "without project" scenario?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | (a)<br>(b)<br>(c)                             | (a)<br>(b)<br>(c)                                                              |

| Category             | Item                    | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Yes: Y<br>No: N                                      | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|----------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------|
| 2. Pollution Control | (1) Air Quality         | (a) Does hydrogen sulfide (H <sub>2</sub> S) emitted from the project comply with the emission standards of the host country, etc. ? Is there a possibility that the emitted hydrogen sulfide has the impacts on the surrounding areas, including vegetation?<br>(b) Do other air pollutants emitted from the project comply with the emission standards of the host country, etc. ? Are any mitigation measures taken?<br>(c) Do air pollutants emitted from the project cause areas that do not comply with the ambient air quality standards of the host country, etc. ?<br>(d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                            | (a)<br>(b)<br>(c)<br>(d)                             | (a)<br>(b)<br>(c)<br>(d)                                                       |
|                      | (2) Water Quality       | (a) Do effluents including thermal effluents from the power plant comply with the effluent standards of the host country, etc. ?<br>(b) Does the geothermal utilization cause water pollution by toxicants, such as Arsenic (As) and Mercury (Hg) contained in geothermal fluids?<br>(c) Do leachates from the waste disposal sites comply with the effluent standards and ambient water quality standards of the host country, etc. ?<br>(d) Do effluents from well excavation cause water contamination?<br>(e) Does the quality of sanitary wastewater and stormwater comply with the effluent standards of the host country, etc. ?<br>(f) Do effluents from the project cause areas that do not comply with the ambient water quality standards of the host country, etc. ?<br>(g) Are adequate measures considered to prevent drinking water pollution in case of emergency discharge to rivers due to equipment troubles, etc.?<br>(h) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts? | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g)<br>(h) | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g)<br>(h)                           |
|                      | (3) Wastes              | (a) Are wastes generated by the facility operations properly treated and disposed of in accordance with the regulations of the host country?<br>(b) Are wastes generated by the effluents from well-excavation properly treated and disposed of in accordance with the regulations of the host country?<br>(c) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (a)<br>(b)<br>(c)                                    | (a)<br>(b)<br>(c)                                                              |
|                      | (4) Noise and Vibration | (a) Do noise and vibrations from the operation comply with the standards the host country, etc. ?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (a)<br>(b)                                           | (a)<br>(b)                                                                     |

| Category               | Item                       | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Yes: Y<br>No: N                        | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|
| 2. Pollution Control   | (5) Subsidence             | (a) Is there any possibility that the extraction of steam causes subsidence?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (a)<br>(b)                             | (a)<br>(b)                                                                     |
|                        | (6) Odor                   | (a) Are there any odor sources such as H <sub>2</sub> S, and anticipated any effect?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (a)<br>(b)                             | (a)<br>(b)                                                                     |
| 3. Natural Environment | (1) Protected Areas        | (a) Is the project site located in protected areas designated by the country's laws or international treaties/ conventions?<br>(b) Does the project affect the protected areas?<br>(c) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (a)<br>(b)<br>(c)                      | (a)<br>(b)<br>(c)                                                              |
|                        | (2) Biodiversity           | (a) Does the project site encompass primary forests, natural forests in tropical areas, habitats with important ecological value (coral reefs, mangrove wetlands, tidal flats, etc.)?<br>(b) Does the project site encompass habitats of rare species that require protection under domestic legislation, international treaties, etc.?<br>(c) Are there any concerns about the significant impact on biodiversity by the project, with significant conversion or significant degradation of critical habitats or critical forests? If yes, are appropriate measures taken to address the impact on biodiversity?<br>(d) Does the intake and drainage by the project have negative impacts on biodiversity in the surrounding water bodies?<br>(e) If there are any other concerns about significant impacts on biodiversity, are measures taken to reduce the impacts on biodiversity?<br>(f) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts? | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f) | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)                                         |
|                        | (3) Topography and Geology | (a) Does the project cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (a)<br>(b)                             | (a)<br>(b)                                                                     |

| Category              | Item                                  | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Yes: Y<br>No: N                                                           | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|-----------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 4. Social Environment | (1) Resettlement and Land Acquisition | (a) Is land acquisition with involuntary resettlement caused by project implementation? If yes, please describe the scale of land acquisition and resettlement.<br>(b) Are efforts made to minimize the impacts caused by the resettlement? Are there any other land acquisition or loss of livelihoods?<br>(c) Is adequate explanation on compensation and livelihood restoration program given to affected people prior to resettlement?<br>(d) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards, developed based on socioeconomic studies on resettlement?<br>(e) Are the compensations paid prior to the resettlement?<br>(f) Are the compensation policies prepared in document?<br>(g) Does the resettlement plan pay particular attention to vulnerable social groups, such as women, children, elderly peoples, people in poverty, persons with disabilities, refugees, internally displaced persons, and minorities?<br>(h) Are the compensation to be agreed are explained to the project affected persons in writing, and are agreements with the affected people obtained prior to resettlement?<br>(i) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?<br>(j) Are any plans developed to monitor the impacts of resettlement?<br>(k) Is the grievance redress mechanism established? | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g)<br>(h)<br>(i)<br>(j)<br>(k) | (a)<br>(b)<br>(c)<br>(d)<br>(e)<br>(f)<br>(g)<br>(h)<br>(i)<br>(j)<br>(k)      |
|                       | (2) Living and Livelihood             | (a) Does the project adversely affect the living conditions of the inhabitants? Are adequate measures considered to reduce the impacts, if necessary?<br>(b) Does the intake (surface water and groundwater) and drainage by the project have negative impacts on the existing water use?<br>(c) Does the project have a negative impact on ecosystem services (provisioning services and regulating services) and affect health and safety of the community (especially indigenous peoples who depend on the services)?<br>(d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (a)<br>(b)<br>(c)<br>(d)                                                  | (a)<br>(b)<br>(c)<br>(d)                                                       |
|                       | (3) Vulnerable Social Groups          | (a) Is appropriate consideration given to vulnerable social groups, such as women, children, elderly peoples, people in poverty, persons with disabilities, refugees, internally displaced persons, and minorities?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (a)<br>(b)                                                                | (a)<br>(b)                                                                     |

| Category              | Item                                                 | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes: Y<br>No: N                 | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|-----------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------|
| 4. Social Environment | (4) Heritage                                         | (a) Does the project damage any archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the laws of the host country?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (a)<br>(b)                      | (a)<br>(b)                                                                     |
|                       | (5) Landscape                                        | (a) Does the project adversely affect landscapes that require special considerations?<br>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (a)<br>(b)                      | (a)<br>(b)                                                                     |
|                       | (6) Ethnic Minorities and Indigenous Peoples         | (a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?<br>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?<br>(c) Is an indigenous peoples plan prepared and published, if necessary?<br>(d) Do the project make efforts to obtain the Free, Prior, and Informed Consent (FPIC) of the affected indigenous peoples?<br>(e) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (a)<br>(b)<br>(c)<br>(d)<br>(e) | (a)<br>(b)<br>(c)<br>(d)<br>(e)                                                |
|                       | (7) Working Conditions                               | (a) Does the project comply with laws related to occupational health and safety of the host country?<br>(b) Are tangible safety considerations in place for individuals involved in the project, such as installation of safety equipment which prevents industrial accidents, and management of hazardous materials, etc.?<br>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as development of health and safety plans, and conducting safety trainings (including traffic safety and public health) for workers etc.?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (a)<br>(b)<br>(c)               | (a)<br>(b)<br>(c)                                                              |
|                       | (8) Health, Safety and Security of Local Communities | (a) Are there any negative impacts on health/hygiene of the local community, such as disease outbreaks (including HIV and other infectious diseases) due to the influx of workers, etc. associated with the project? Are there any mitigation measures in place for the impacts?<br>(b) Are there any negative impacts on the safety of the local community, such as deterioration of public safety, due to the influx of workers, etc. associated with the project? Are there any mitigation measures in place for the impacts?<br>(c) When security guards are hired for the project or other personnel are deployed to ensure and maintain the security of the project area as well as the persons related to the implementation of the project during the project preparation and implementation, are any appropriate measures taken for such personnel not to use any force to provide security except for preventive and defensive purposes?<br>(d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts? | (a)<br>(b)<br>(c)<br>(d)        | (a)<br>(b)<br>(c)<br>(d)                                                       |

| Category  | Item                                        | Main Check Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes: Y<br>No: N                 | Confirmation of Environmental Considerations<br>(Reasons, Mitigation Measures) |
|-----------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------|
| 5. Others | (1) Monitoring                              | (a) Does the project proponent develop and implement monitoring program for the environmental and social items that are considered to have potential impacts?<br>(b) What are the items, methods and frequencies of the monitoring program?<br>(c) Does the project proponent establish an adequate monitoring framework (organization, personnel, equipment, and budget to sustain the monitoring framework)?<br>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reporting the monitoring results from the project proponent to the regulatory authorities?<br>(e) Is the grievance redress mechanism regarding environmental and social considerations established? | (a)<br>(b)<br>(c)<br>(d)<br>(e) | (a)<br>(b)<br>(c)<br>(d)<br>(e)                                                |
| 6. Note   | (1) Reference to Checklist of Other Sectors | (a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (a)                             | (a)                                                                            |
|           | (2) Note on Using Environmental Checklist   | (a) Where necessary, the impacts to transboundary or global issues should be confirmed (e.g. the project includes factors that may cause problems, such as transboundary waste treatment or global warming).<br>(b) For projects that are expected to generate more than a certain amount of greenhouse gas emissions, is the total amount of the greenhouse gas emissions estimated before the project implementation?                                                                                                                                                                                                                                                                                                                              | (a)<br>(b)                      | (a)<br>(b)                                                                     |