Managing Environmental Risks and Impacts in Geothermal Exploration Projects

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Content

- Phases of Geothermal Development Projects
- Critical Steps of Managing Environmental and Social Risks
- Identifying Impacts and Mitigation Measures
- WB's Geothermal Development Project and the Environmental and Social Management Framework
- Gaps between national and international standards regarding environmental assessment process and content

DEVELOPMENT of GDP

The development of a geothermal projects has four phases;

- Exploration Phase – This phase will establish the location, size and quality of the geothermal reservoir; activities conducted include surface exploration, followed by exploration and confirmation drilling.
- Resource/Field Development Phase – This phase includes the drilling of the wells, which will be used to extract the geothermal resource from the reservoir and confirm its commercial viability for heat/energy generation production; activities conducted are capacity drilling (also called production drilling) and development of steam gathering system.




DEVELOPMENT of GDP

- Power Plant Development Phase – This phase consists of the final design and construction of the power plant that utilizes the geothermal energy.
- Facility Operations Phase – This phase includes the operation and maintenance of the steam gathering systems and the power plant.




Step 1. ENVIRONMENTAL & SOCIAL ASSESSMENT

- Environmental and social risk management is a very critical step for overall risk management.

- Extensive assessment of the impact of the ***proposed project*** and all ***its infrastructure*** and ***associated parts*** on the local area and the catchment area

✓ <u>Environmental Assessment:</u>.

- Physical Environmet (Air, water, soil, …)
- Ecology and Biodivesity
- Landscape
- Cumulative Impact Assessment

✓ <u>Social Assessment:</u>

- Impacts on local residents
- Land Acquisition
- Social and Economical Structure of the Project Area
- Labor Influx

Step 2. STAKEHOLDER ENGAGEMENT & GRIEVANCE

- Early and comprehensive consultation with local residents and all other interested stakeholders (to explain environmental and social impacts)
- Clear and transparent Land Acquisition Process
- Grievance Procedure
- Clear benefits for the local communities

Step 3. MONITORING & MANAGEMENT

- Regular monitoring of all significant environmental and social impacts as identified at project planning/EIA stage and measures to mitigate negative impacts;
- A comprehensive ESMP and a clear management structure to ensure its full compliance.

IDENTIFYING IMPACTS and MITIGATIONS

- Land and Habitat Loss
- Impacts on Water (GW and Surface)
- Proper Disposal of Drill Muds
- Gas Emissions
- Noise
- Occupational Health and Safety
- Social impacts including land acquisition

IMPACTS – LAND & HABITATS

- Land loss
  - ✓ Forestry land
  - ✓ Pasture Land
  - ✓ Agricultural Land (including orchards)
  - ✓ Treasury land
- Habitat loss
  - ✓ Critical Habitats
  - ✓ Natural Habitats
  - ✓ Key Biodiversity Areas (KBA)




MITIGATIONS – LAND & HABITATS

- Site selection including alternative site analysis.
  - Elimination of critical habitat areas.
  - Elimination of legally problematic areas
  - Use of marginal lands




MITIGATIONS – LAND & HABITATS

- ✓ A detailed habitat and biodiversity survey
- ✓ Identification of protected or key biodiversity areas located near the project site. Assessment of risk posed by the project. (e.g. due to accidental discharges of water into local streams; release of steam).
- ✓ Consultation with local authorities and NGOs for any mitigation/compensatory measures especially for the loss of agricultural lands




MITIGATIONS – LAND & HABITATS

- ✓ Protect non-construction areas, avoid work in sensitive areas, restore damaged areas
- ✓ Design of slopes & retaining structures to minimize risk, provide appropriate drainage, soil stabilization/vegetation cover (including access roads opened, etc.)
- ✓ Take/dispose of materials from/at approved sites

IMPACTS – WATER

- Drilling Fluids
  - ✓ generally fresh waters (impacts of water use on other users)
  - ✓ including geothermal water extracted during well testing
- Cleaning Water
  - ✓ water form periodical cleaning - chemicals including strong acids, most commonly hydrochloric acid.
- Domestic Wastewater

MITIGATIONS – WATER

- Utilizing surface water by taking other users into consideration – detailed baseline assessment
- Minimum discharge of testing water, use of ponds (then can be used for emergency/maintenance purposes)
- Informing residents about testing period.
- Avoid/minimize any discharge of geothermal fluids into surface watercourses.
- Domestic wastewater disposal – not expected during exploration phase

IMPACTS – MUD DISPOSAL

- Water mixed with bentonite (a natural clay).
- Drill mud recycled and reused
- Cuttings may be classified as hazardous depending on the concentration and potential for leaching of silica compounds, chlorides, arsenic, mercury, nickel, and other heavy metals.

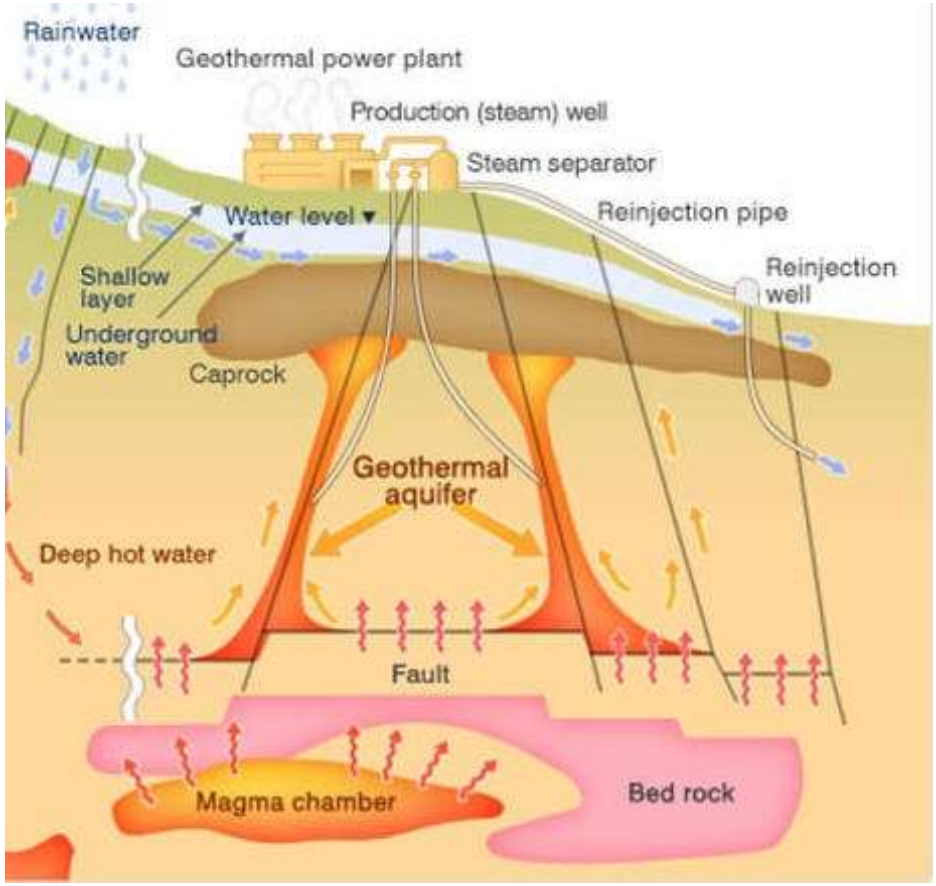
IMPACTS – MUD DISPOSAL

- Prevention of Mud Pit over flow and leakage.
  - Isolation from storm water flow.
  - Leak-proof system design (concrete pond, double liner etc.)
- Chemical analysis of Mud for identification of disposal method.

- Transfer and disposal of mud in accordance to Regulation on Control of Hazardous Wastes, if the mud classified as hazardous.

IMPACTS – GROUNDWATER

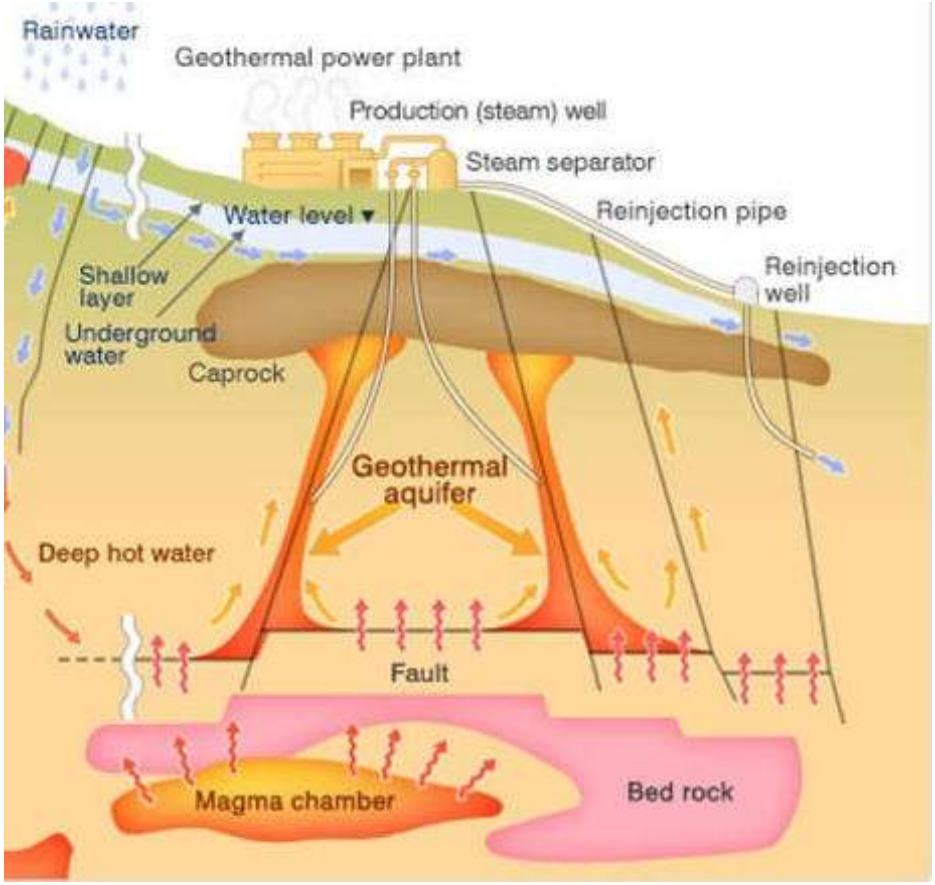
- Casing failures wells may create pathways for geothermal fluids to mix with groundwater at shallow levels.
- If important freshwater aquifers exist above the geothermal reservoirs it is important to monitor ground water composition and temperature.
- Depletion of aquifers and impact on neighboring aquifer systems






MITIGATIONS – GROUNDWATER

- Detailed analysis of aquifer and existing groundwater resources and their use in the area.
- Special protection for wells (double casing, concrete casing etc.)
- Monitoring of ground water around wells.
- Detailed aquifer baseline assessment (considerin cumulative impacts)






IMPACTS – GAS EMISSIONS

- Possible toxic gas emissions (H_2S, Hg, CO, CH_4 etc.)
  - extraction well sites
  - plant-site
  - vents
- High CO_2 emission depending on the source characteristics.
- Dust emission due to site activities, arrangement of drilling rig areas, construction of power generation unit, access roads, traffic etc.

MITIGATIONS – GAS EMISSIONS

- Detailed analysis of source in terms of toxic gases as well as CO_2 content
- On site toxic gas measurements, (i.e. hydrogen sulfide, mercury)
- Safety planning and measures for uncontrolled gas releases
- Appropriate design, training in O&M, safety
- Installation of shutoff valves – well blows
- Control of dust with water suppression
- Timing of works, vehicle speeds
- GHG emission calculations and in case requirement preparation of GHG Management Plan

OTHER IMPACTS

- Well abandonment
  - ✓ At the end of operation of a well or if a well fails to provide thermal groundwater, well should be closed with concrete. This will protect other aquifers and living things from adverse impacts of hazardous gases and other hazardous substances that may originate from well.
- Cultural resources – project siting, use of chance find procedures
- Noise, odor – siting, mufflers, no night time drills, manage H2S emissions (gas separators, closed circuit)
- Occupational Health and Safety – prevent well blow out, PPEs (gloves resostant to heat, etc), fact sheets, trainings, emergency response
- Community Health and Safety – continous information, emergency response
- Land acquisition

Geothermal Development Project (GDP)

- Turkish government's core energy policy priority is to maximize exploitation of domestic primary energy resources and securing sufficient, reliable and affordable energy in an environmentally sustainable manner.

- 1,000 MW of geothermal electricity generation capacity is the target value for the year 2023 (National Renewable Energy Action Plan, 2023)

- In this context, The Geothermal Development Project (GDP) has been developed to support the private sector;
  - to further scale up geothermal development and aims to do so by creating a mechanism to share the resource risk associated to the validation of geothermal resources, and
  - to facilitate financing for the resource development and construction phases of geothermal project development.

TURKISH EIA REQUIREMENTS	WB REQUIREMENTS
1. SCREENING	**1. PROJECT CATEGORIZATION & SCREENING**
Annex – I projects: EIA required, significant potential impacts	*Category – A: significant adverse environmental impacts*
Annex – II projects: PIF required, EIA required decision after evaluation of PIF.	*Category – B: potential impacts on the environment are typically site-specific, reversible in nature*
2. PUBLIC PARTICIPATION MEETING (Annex - I Projects)	*Category – C: minimal or no adverse environmental impacts*
3. SCOPING	**2. SCOPE OF ENVIRONMENTAL ASSESSMENT**
4. EXAMINATION, EVALUATION & APPROVAL OF EIA	**3. PUBLIC CONSULTATION**
5. ANNOUNCEMENT	**4. REVIEW AND APPROVAL OF THE ESIA/ESMP**
6. MONITORING & MANAGEMENT	**5. DISCLOSURE**
	6. IMPLEMENTATION
	a) compliance with measures agreed with WB on the basis of the findings and results of the EA, and
	b) findings of monitoring programs

KEY DIFFERENCES BETWEEN TURKISH EIA REGULATION AND WB REQUIREMENTS

PROJECT CATEGORIZATION	*WB classified the exploration stage of the Project as Category B, and capacity drilling phases as either Category B / B+ depending on the special circumstances of the Project. Some* of the energy production facilities may be categorized as 'A' according to environmental and social risks. Project categorization in WB policies are case by case, no pre-defined lists.
SCOPE OF ENVIRONMENTAL ASSESSMENT	***Cat A (full ESIA including ESMP) and Cat B (partial ESIA or ESMP)*** *All project components (access roads, transmission lines) are evaluated in an integrated approach in WB projects* *Detailed baseline assessment* *Social impacts always included* *Stakeholder Engagement Plan* *Alternative analysis, cumulative impacts, ESMP for all projects which will be used in bidding documents and inserted in contracts* *Under Turkish FW, Annex II documentation does not have most of these elements*
PUBLIC CONSULTATION	*EIA Regulation does not require PC for all categories.* *Only one Public Participation Meeting for Annex – I project.* *WB requires at least 1 meeting for Cat Bs and 2 for Cat As*
DISCLOSURE	EIA Regulation - Only EIA report is disclosed. WB – draft ESIA, final ESIA/ESMP should be disclosed depending of project category.

Process

Component I

- ✓ Preparation of Project Description File in line with EIA Regulation
- ✓ Submission of File to MoEU
- ✓ Collecting official responses and letters from relevant authorities
- ✓ Receiving ‘EIA Not Necessary’ Decision from MoEU
- ✓ Drilling wells and testing period
- ✓ Preparation of geothermal development plan and applying for operation permit




ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

- Project Description
- Identification of Project Standards regarding National Laws and Regulations and WB Environmental, Social and Health and Safety Standards
- Baseline Studies
- Impact Identification, Assessment, Mitigation Measures and Residual Analysis
- Institutional Arrangements
- Environmental and Social Management Plan
- Stakeholder Engagement Plan – including feedback from consultation meeting, Grievance Mechanism

INELIGIBLITY;

- Projects triggering International Waterways OP 7.50.
  - ✓ Eligible watersheds are;

    Susurluk, North Aegean, Gediz, Kuçuk Menderes, Buyuk Menderes, Western Mediterranean, Antalya, Sakarya, Western Black Sea, Yesilirmak, Kizilirmak, Konya Kapali, Eastern Mediterranean, Seyhan, Ceyhan, Eastern Black Sea, Burdur, Afyon, Orta Anadolu, and Van.

- Projects which has impact on any Critical Natural Habitats
  - ✓ Critical Natural Habitats
    - *Legally protected;*
    - *officially proposed for protection; or*
    - *unprotected but of known high conservation value sites.*

- Projects in culturally/archaeologically protected areas

ROLES AND RESPONSIBILITIES

THANK YOU FOR YOUR ATTENTION…