LIFE CYCLE ASSESSMENT OF ENHANCED GEOTHERMAL SYSTEM

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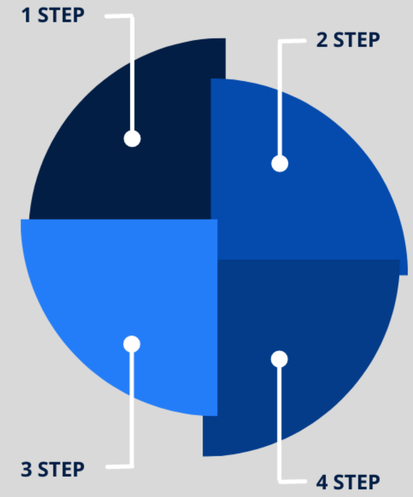
INTRODUCTION

This paper presents a framework for conducting an analysis of life cycle based on an example of EGS power plant. Energy from hot dry rocks is used globally through EGS technology – Enhanced Geothermal System. Unlike conventional hydrogeothermal systems, this technology enables the extraction of energy from dry rocks that do not contain water or contain water in small amounts. This is done by artificially increasing the hydraulic efficiency of a geothermal reservoir and then introducing a working fluid into it. After this process, working fluid is brought either into a power plant or to a combined heat and power plant. A great way to determine the impact of electricity generation on environment and also to establish outside effects on the landscape and the surroundings of power plant, is a method called LCA (Life Cycle Assessment)..

MAIN PHASES OF LIFE CYCLE ASSESSMENT



1 STEP

Deciding on the purpose and scope.

2 STEP

Analysing input and output data.

3 STEP

Evaluating the impact of the system.

4 STEP

Interpretation.

1 STEP

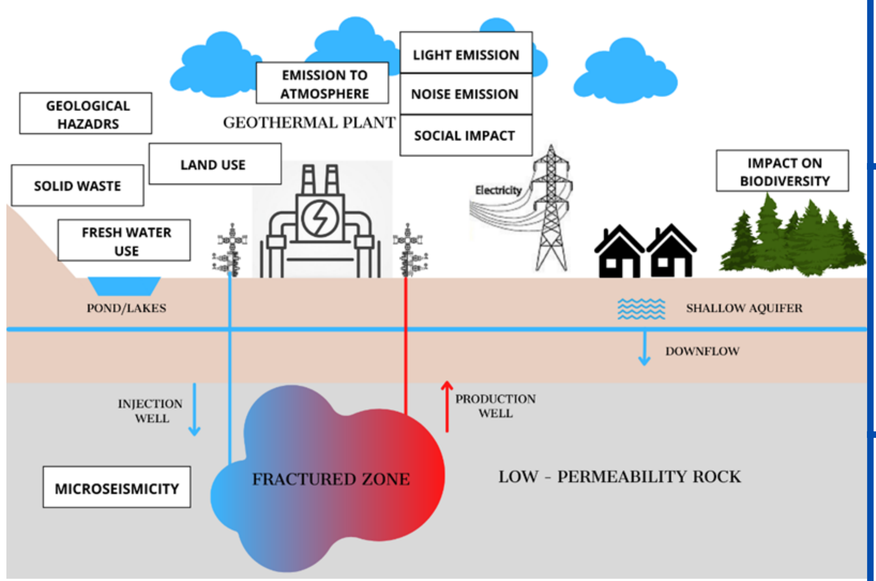
LCA practitioners should clearly define the purpose and intended use of the LCA study, the motivation behind it and the target audience of the study. The scope of the study defines the functional unit, the product system and its boundaries. Data collection is important part of this step. When acquiring data for analysis we have to consider three phases concerning the life cycle of a power plant (construction phase, operational stage and "end of life".

2 STEP

The second step called LCI (Life Cycle Inventory), or "balance analysis", consists in identifying and calculating for specific functional units in the system the elements entering from the environment and the elements leaving from this system to the environment (e.g. CO_2 emissions to air, emissions to water). It includes the analysis of the technological process (existing or designed), the balance of flows of materials, energy and auxiliary materials (inputs), and the balance of manufactured products and discharged waste and emissions (outputs).

3 STEP

In the third step of the LCA analysis, the "Life Cycle Impact Assessment (LCIA)" is carried out. Based on the characterization models, the LCI results can be assigned to the respective categories and the category indicators calculated. The introduction of modelling allows to limit – depending on the method - to one or more numerical results. This modelling consists of assigning individual (environmental load) values to one or more impact categories, depending on the environmental problem posed.



4 STEP

The final stage includes the interpretation of the life cycle assessment, formulation of proposals to guide the implementation of solutions to reduce the environmental impact of the process under consideration.

IMPACT CATEGORIES	CHARACTERIZATION
Climate change	Global warming potential (measure of greenhouse gas emissions - CO_2 and methane)
Acidification	Measure of emissions that cause acidifying effects to the environment
Human toxicity cancer effects	Calculated index that reflects the potential harm of a unit of chemical released into the environment, which potentially result to cancer disease
Human toxicity non-cancer effects	Calculated index that reflects the potential harm of a unit of chemical released into the environment
Ecotoxicity freshwater	Emission inventories witch content hundred of chemicals, then could potentially contaminate aquatic and terrestrial ecosystem
Resource use, minerals and metals	Extraction of fossil fuels resources
Resource use, energy carries	Extraction of material
Ozone depletion	Measure of air emissions that contribute to the depletion of the stratospheric ozone layer
Particulate matter	Measure of particulate matter emissions and precursors to secondary particulates, such as SO_2 and NOx from sources like fossil fuel combustion, wood combustion and dust particles from roads and fields

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