Sustainability assessment protocol for geothermal utilization

www.GSAP.is

Ruth Shortall,

Brynhildur Davíðsdóttir, Guðni Axelsson, Jónas Ketilsson, and Ladislus Rybach

GEORG
GEOTHERMAL RESEARCH GROUP

GSAP

UNIVERSITY OF ICELAND
SCHOOL OF ENGINEERING AND NATURAL SCIENCES
FACULTY OF LIFE AND ENVIRONMENTAL SCIENCES

Context

- Research project funded by the research cluster GEORG
- 3 year project, conducted in 3 countries as well as with an international group of UNGTP fellows
- Focus on sustainable development and geothermal power

Context

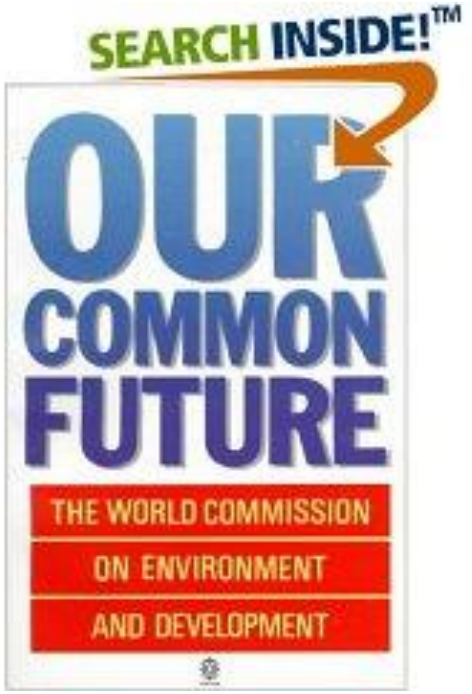
- Sustainable energy development an emerging paradigm.
- Multi-dimensional problem.
- Reduce negative health and environmental impacts; increase access, affordability, energy security and the efficiency of energy use.
- All in the context of alternative energy sources

- **Renewability and sustained yield** of energy resources generally is agreed to be a **necessary** but **not a sufficient** requirement for sustainable energy development.
- New paradigm requires a much broader assessment of energy development

Sustainable development

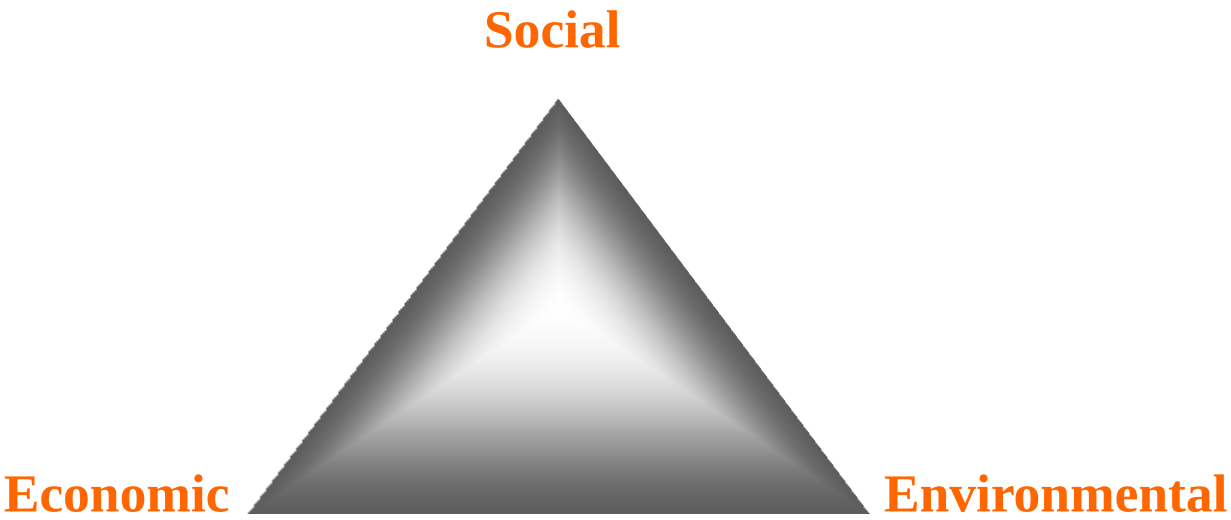
Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
(Brundtland Commission 1987)

Long-run thinking (thinking in generations)



The three dimensions of SD

- The challenge: Balancing economic development with social and environmental objectives
- Public participation and public consultation important according to the Rio declaration from 1992.



Sustainable Energy Development

- Energy is central to three SD dimensions
- The development of sustainable energy systems has “emerged as one of the priority issues in the move towards global sustainability” (Malkina-Pykh et al. 2002).
- Not treated as a centrally important issue until around 2000

Sustainable Energy Development

- Defined as “the provision of adequate energy services at affordable cost in a secure and environmentally benign manner, in conformity with social and economic development needs” (IAEA/IEA 2001)

- “improving access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services and resources, taking into account national specificities and circumstances through various means such as enhanced rural electrification and decentralized energy systems, increased use of renewable energy, cleaner liquid and gaseous fuels and enhanced energy efficiency.” (Johannesburg declaration)

Feature of systems that contribute to SED

- Renewable or perpetual
- Efficiently produced and used
- Economically and financially viable
- Secure and diverse => resilient
- Equitable (Readily accessible, available and affordable)
- Has positive social impacts
- Minimize environmental impacts

Goals and Indicators

- SD goals for energy development describe what the development must fulfill (linked to features).
- Indicators illustrate if energy development is moving us towards sustainability or not. Linked to goals.
- Need expressed from practitioners for protocols to measure if energy developments contribute to SD. E.g. CDM projects.
- Specific energy indicators for sustainable development e.g. by the IAEA and IEA. General and used at a “high” level (national).
- Resource and location specific indicators, such as by the IHA sustainability standard for hydropower.
- No such standard available for geothermal power

Aim of GSAP project

Objective: to develop a Sustainability Assessment Protocol for Geothermal Utilization (GSAP) that will aid policy - and decision-making regarding geothermal energy developments. Will illustrate if the energy development contributes to SED.

The sustainability assessment protocol will consist **of specific sustainability goals, and a set of indicators of sustainable development** tailored especially for geothermal energy development projects.

Sustainability assessment protocol

Scale and Scope: is intended for use at any stage in the geothermal development process from the strategic stage through to the operation stage.

Should enable e.g. local and national energy planning authorities, donors and financial institutions to assess the impact of individual energy developments on sustainable development.

Development process - steps

1. Defining the purpose of the index: to evaluate if geothermal development contributes to sustainable development.
2. Define the sustainability criteria the industry needs to adhere to.
3. Identify sustainability goals from the literature and workshops
4. Identify indicators derived from the literature and workshops
5. Use Delphi process to evaluate goal and indicator suitability (from step 3 and 4) at different regional locations using public participatory instrument (Delphi) (locations differ in terms of geography and development)
6. Repeat process from step 3 at different locations
7. Core set of goals and indicators identified based on results from all locations.

Progress

- Have completed steps 1 through 6 (almost)
- Workshops and Delphi survey conducted in three different countries to gain insight into differences in what is deemed important in SD assessments
  - Iceland (2011 and 2012)
  - New Zealand (2012)
  - Kenya (2013)
- Currently we are in the Kenyan iteration of the development process – will be completed in November 2013
- Also have conducted an addition survey with UNUGTP fellows
- In 2014 protocol will be finalized, a handbook and academic papers completed and possibly a software tool developed.

Workshops

- Conducted in Iceland, New Zealand and Kenya
- Purpose:
  - Draw on local expertise and opinions
  - Broad level of expertise invited.
  - To help design our online Delphi survey
  - Bring in regional issues

Structure of Today's World Café

TIME	EVENT
8.00 am	Introductory presentation
8.30 am	**Round 1**.: What are the most important environmental/social/economic issues that must be kept in mind and managed in geothermal developments? **Round 2:** What are the most important environmental/social/economic issues that must be kept in mind and managed in geothermal developments? *Draw and write on boards during each round; Put post-its on a board during/after each round, should capture main issues; Short presentation from each group*
10.00 am	Tea break
10.30 am	**Round 3:** What are the most important environmental/social/economic issues that must be kept in mind and managed in geothermal developments? *Draw and write on boards; Put post-its on a board during/after each round; ; Put post-its on a board during/after each round, should capture main issues; Short presentation from each group*
11.00 am	Collection / **Presentation of results**
11.10 am	Group discussion; What is missing? What is most important? …..
12.00 pm	Lunch + Q&A
1.00 – 2:00 pm	Presentation of Delphi Technique + Q&A

Delphi Technique - overview

- Uses a highly structured and formalized type of communication to extract unbiased opinions and sometimes consensus among a group of experts.
- Used to get input for policy, decision, and goal setting, when opinion is required from a disparate audience with a wide divergence of opinion.

Used when:

- Participants are geographically distant
- Participants too numerous for face-to-face exchange
- Frequent meetings too costly or time consuming
- Serious disagreements exist between participants

Delphi survey

Aim of GSAP Delphi

1. To define and refine the list of critical geothermal sustainability goals and indicators
2. To seek consensus on those critical geothermal sustainability goals and indicators.

Delphi technique – how it works

Participants invited to online questionnaire via email. Three rounds

ROUND 1 – Goals created, comments on and rating of existing indicators, new indicators suggested

->Feedback from facilitators

ROUND 2 – Rating of goals and indicators, comments

->Feedback from facilitators

ROUND 3 – Rating of goals and indicators, comments

->”Consensus” reached

The entire process is anonymous

Why Delphi

Highly structured and formalized type of communication

Aims to extract unbiased opinions and sometimes consensus from a group of experts.

Ability to include participants in a wide variety of location.

Avoids conflicts of face-to-face group scenarios

Minimises “band-wagon” effects

Drawbacks:

Stakeholders still have “influence” via their comments

Consensus will never be “100%” – output is still an opinion

Requires facilitation while interpreting results

Insights from Icelandic Delphi

Highest rated goals

- For each geothermal area and each mode of production there exists a certain maximum level of production, E0, so that with production below E0 it is possible to sustain steady energy production from the system for at least 100-300 years. If the level of production exceeds E0 it is not possible to sustain steady production from the system for so long. Geothermal production that is less than or equal to E0 is defined as sustainable production but production exceeding E0 is not sustainable.
- A geothermal resource should be managed in such a way as to avoid, remedy or mitigate adverse environmental and health effects.

Highest rated indicators

1. Air quality
2. Water quality
3. Resource lifetime

Lowest scoring

1. Impact on local income
2. R&D expenditures
3. Earning ratio

All health and resettlement related indicators removed

Insights from UNU Delphi

Highest rated goals

- A geothermal resource should be managed in such a way as to avoid, remedy or mitigate adverse environmental and health effects.
- The power companies should be responsible toward the community and the effect of the utilization of the geothermal resource shall be as positive for the community as possible and yield positive social and cultural impacts.

Highest rated indicators

1. Air quality
2. Water quality
3. Local job creation

Lowest scoring

1. Satisfied workers
2. R&D expenditures
3. Resettlement

Insights from Kenya Workshop

Important issues to include (e.g. often mentioned):

- Social benefits from project must be secured
- Public participation essential in planning process
- Air quality and land degradation important
- Resettlement issues must be accounted for
- Must benefit ancillary commercial activity
- Impact on culture must be considered
- Job creation and transfer of skills essential
- National economic impact important

Comparative analysis

- Results from each region are compared and the goals and the indicators that are common to all will constitute a core set of goals and indicators
- The remainder will constitute a supplementary set that is applicable in specific settings.
- The final product is a comprehensive framework that can be used to evaluate if specific developments (depending on development stage) are expected to, or are contributing to SD.
- The handbook will contain detailed descriptions of what issues auditors will need to verify are being addressed (the goals), and the indicators will provide measurable benchmarks.

Conclusion

- Sustainable use of geothermal energy resources is vital in enabling SD.
- The goals and indicators developed in this project are intended to give a detailed, holistic view of the sustainability of geothermal energy developments.
- The handbook and software will turn an academic project into a practical application.

Thank you for listening

UNIVERSITY OF ICELAND
SCHOOL OF ENGINEERING AND NATURAL SCIENCES
FACULTY OF LIFE AND ENVIRONMENTAL SCIENCES