

Risk Management Plan D1.2



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Technical References

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^[1] Dissemination level: PU = Public, SEN = Sensitive, R-UE/EU-R = EU classified, C-UE/EU-C = EU classified, S-UE/EU-S – EU classified

^[2] Nature of the deliverable: deliverable: R = Document, report; DEM – Demonstrator, pilot, prototype; DEC – Websites, patent, filings, videos etc; DATA – data sets, microdata, etc; DMP – Data Management Plan; ETHICS; SECURITY; OTHER

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List of Abbreviations

CA	Consortium Agreement
D	Deliverable
EGS	Enhanced Geothermal Systems
GA	Grant Agreement
HSE	Health, Safety and Environment
IP	Intellectual Property
LCA	Life Cycle Assessment
LCOE	Levelized cost of electricity
PC	Project Coordinator
PMP	Project Management Plan
RMP	Risk Management Plan
SET Plan	Strategic Energy Technology Plan
TRL	Technology Readiness Level
WP	Work Package
WPL	Work Package Leader



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Executive Summary

This Risk Management Plan (RMP) aims to identify the potential risks in the project at an early stage. Prevention and mitigation measures will be planned to address the risks. A risk management procedure has been established and will be followed to handle the risks properly. This document will be updated periodically during the lifetime of the project.

The Risk Management Plan builds on the critical risks analysis performed during the proposal period and Grant Agreement preparation. The plan reinforces risk management procedures established in the Grant Agreement and outlines responsibilities, prevention, and mitigation measures.

1. Introduction

1.1 HOCLOOP project overview

Geothermal energy has a large potential as a clean renewable energy source. The conventional technology is mainly based on heat extraction from hot permeable aquifers. Such aquifers are hard to find, limit the applications and imply high cost and risks.

Responding to this challenge, the main objective of the HOCLOOP project (“or A circular by design environmentally friendly geothermal energy solution based on a Horizontal Closed LOOP”) is to verify a novel geothermal closed loop solution for the extraction of heat from deep or shallow formation rocks. The solution is environmentally friendly and expected to improve the cost-efficiency for geothermal developments.

HOCLOOP will also enable exploiting geothermal energy sources in new regions with- or without good hydrothermal reservoirs. Examples are low-permeability reservoirs, Hot Dry Rock and other kinds of reservoirs, such as those with high content of non-condensable gas. However, also in regions where there are hydrothermal reservoirs, the proposed system reduces the environmental impact and can prove to be preferred. The solution is expected to significantly increase the deployment of geothermal resources for trigeneration with reduced environmental impact and economic attractiveness compared to conventional geothermal plants, avoiding several issues of Enhanced Geothermal Systems (EGS). The target design is a geothermal heat exchanger that can deliver stable and cost-efficient energy for a time span of at least 50 years serving a surface district heating/cooling and power generation unit. The solution is foreseen to be integrated with other renewables to improve the reliability of the power supply and grid stability, and to be applicable to any geological structural condition and district heating.

HOCLOOP is based on the use of an innovative horizontal closed loop solution for the extraction of heat from deep or shallow formation rocks. The solution is based on new drilling technology and solves the challenges of conventional construction of geothermal wells. The solution will improve the power production due to extended reach horizontal drilling with a large hole size. Further improvement is expected to be achieved using alternative circulation fluids to water, such as CO₂ based fluids. It is expected that the solution can reduce the LCOE compared to the conventional solution and meet the SET plan targets. The project will develop the tools to enable the proposed geothermal solution and demonstrate the technology in a full-scale test operation to TRL5. The work will cover the development and validation of models for the heat flow and investigate the possibility for improving the electricity production by using alternative fluids to water. The work will also cover the investigation of potential EU pilot sites, environmental assessment, and the social acceptance of the proposed technological solution. It is expected that the solution will enable exploitation of geothermal energy sources in new regions, including the ones where hydrothermal reservoirs are absent or do not present the adequate hydraulic properties to enable the deployment of conventional



geothermal solutions. The solution is foreseen to be integrated with other renewables to improve the reliability of the power supply and grid stability, and to be applicable to a variety of geological conditions. It is also expected to solve the main issues of geothermal energy related to emissions, seismicity, and environmental aspects.

1.2 Aims and objectives

This Risk Management Plan aims to be a guiding document for proper and effective risk handling. A risk management procedure has been established and will be followed. Potential risks have been identified, prevention and mitigation measures are planned and shall be executed when necessary.

1.3 Relations to other activities in the project

The Risk Management Plan is relevant to all the activities in the project. All partners are responsible for identifying the risks continuously and preparing prevention and mitigation measures accordingly, to reduce the negative impact of the risks to the project.

2. Risk management

2.1 Introduction

Risk is any event that can negatively impact the project, compromising its goals and/or quality of results.

Risk management is essential to minimize the prospect of failure due to unexpected events with possible negative outcomes on the project's objectives and economy. Unexpected events may be both internal and external and arise for various reasons involving participants, technology, planned or unforeseen activities, pandemic, resources etc. Risk management is a continuous process throughout the lifetime of the project and involves identifying, analyzing, controlling, reporting and handling the potential risks that may occur, at the earliest possible moment.

This document contains a detailed description of the factors that have been identified as a potential risk for the realization of HOCLOOP's project activities. It also includes estimated impact of the risks and procedures for identifying and mitigating them.

2.2 Risk management procedure

The risk management procedure is based on the provisions of the CA¹ and GA², as well as Chapter 2. *Project Management Plan (PMP)* in D1.1 HOCLOOP deliverable *Project and data management plan*.

Following those provisions, by the Coordinator and all involved parties, serves as an action plan to avoid the risks or minimize the impact of the risks that may occur. Well executed Project Management Plan is the ultimate mitigation action.

Moreover, to ensure proper handling of risks/deviations, the HOCLOOP consortium will follow the decision process procedures outlined in section 2.4 of D1.1, where both decision making and conflict resolution process are described. The unforeseen risks, challenges and new opportunities identified

¹ Consortium Agreement: 101083558 – HOCLOOP – HORIZON-CL5-2021-D3-03

² Grant Agreement: 101083558 – HOCLOOP – HORIZON-CL5-2021-D3-03



along the implementation, will be communicated, and managed following the structure presented in this section. Figure 1. summarizes the provisions of this section.

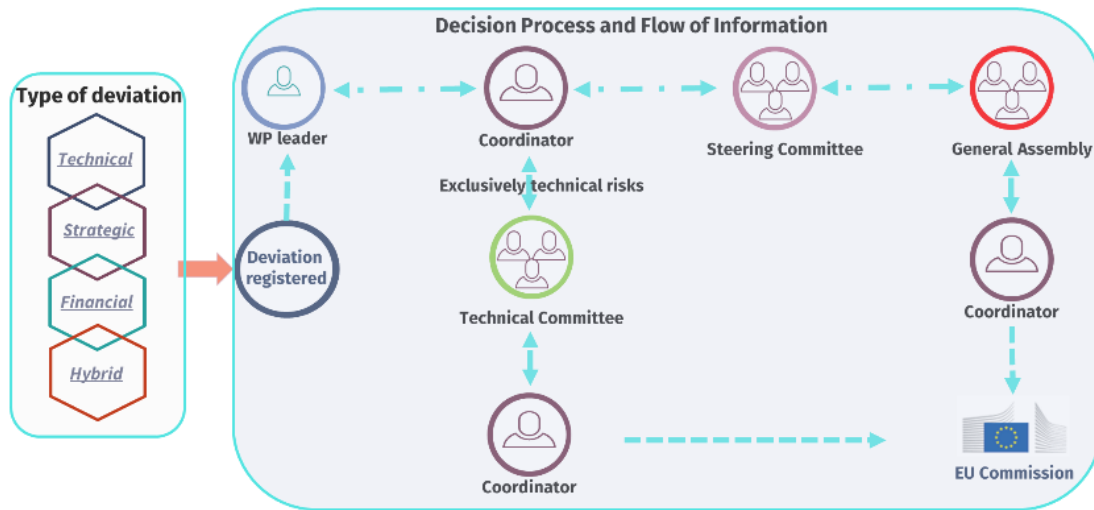


Figure 1. Decision chain in case of deviation.

2.3 Roles and responsibilities

2.3.1. Risk identification

Each partner has the responsibility of continuous risk identification. The analysis can and should be continuously performed by individual partners, Task and WP groups, as well as the General Assembly. If a risk is identified by any member of the consortium, it will immediately be reported to the WP Leader. If necessary – the WPLs must escalate the case.

Risk management is a part of WP1, Coordination and management, where IFE is the lead partner. The task ensures the proper handling and prediction of risks, estimation of their impacts and definition of prevention and mitigation measures. In practice, PC has the overall responsibility to continuously monitor risk assessment within the WPs, update the risk register with new risks and early warning indicators.

In addition, Work Package Leaders have a crucial role in risk management procedure, as they have the responsibility to monitor the risks within their work packages and take appropriate action to eliminate the risk or minimize impact the risk may have on the project’s objectives.

2.3.2. HSE and safe job analysis

Each person participating in the project is obliged to familiarize themselves with and follow the HSE regulations at the location where the work is performed. In case there is an immediate danger threatening the health or life of the individuals at the location, each person is obliged to take immediate actions.

2.4 Risk assessment

Each risk needs to be thoroughly evaluated in means of likelihood of the risk to occur and its impact if the risk materializes. A commonly applied method is the usage of a risk matrix to evaluate the overall risk. Likelihood and impact are individually evaluated by a qualitative assessment in three levels, Low/Medium/High for likelihood and for impact. The combination of likelihood and impact provides a measure of the degree of overall risk; low, medium, high, or critical. The risk matrix is shown in Figure 2 and the overall risk is the product of the likelihood times the impact.



The risk shall be assessed at the project management level it is identified at, but no lower than WPL level. In practice, risks identified at the Task level will be assessed at the WP level by the WPL and Task contributors. Risk identified at the General Assembly level will be assessed by the General Assembly in forum.

PROBABILITY	HIGH	3 MEDIUM	6 HIGH	9 CRITICAL
	MEDIUM	2 LOW	4 MEDIUM	6 HIGH
	LOW	1 LOW	2 LOW	3 MEDIUM
		LOW	MEDIUM	HIGH
		IMPACT		

Figure 2. Risk matrix

2.5 Risk management tool

The risk register is the key document for risk management of HOCLOOP, see Table 1. The register contains the potential risks identified for the consortium at the proposal stage and at the early stage of the project. It will be continuously updated throughout the project’s lifetime, both with new risks identified and as risks are assessed and managed. The risk register contains a thorough description of each risk with details of the identified risk, which work package that may be affecting, who is responsible for the work package, likelihood, impact, overall risk and proposed prevention and mitigation measures.

It will be stored and made available to all the project partners through the HOCLOOP Project folder in SharePoint.



Table 1. HOCLOOP Risk register.

No.	Description	Work package	Responsible (WP Leaders)	Probability (Low, Medium, High)	Impact (Low, Medium, High)	Overall risk	Proposed prevention and mitigation measures
1	Key partner leaves the consortium.	1	IFE	L	M	2 LOW	Management Board either distributes the vacant tasks to the most appropriate participant(s) or decides to stop the concerned activity.
2	Individual partners not performing the assigned tasks on time or WP leaders not coordinating activities effectively. Conflicts arising between partners over division of labor.	All WPs	IFE	L	M	2 LOW	The management team is experienced and will implement a robust, well designed project management structure with regular meetings and monitoring to identify. It will solve problems quickly by consensus. A clear detailed work plan and CA will specify roles/responsibilities. Work package leaders are experienced in collaborative working. Proactive risk reviewing will be done.
3	Conflict on exploitation of results (publications, IP)	1	IFE	L	M	2 LOW	Anticipation in consortium agreement.
4	Delay or lack of input data from WP2 for model development and comparison.	3	UNIFI	L	L	1 LOW	Clearly communicate required data and their form and time of need with responsible partner(s). Rely on experience in the consortium and previous work to develop the models.
5	Delay in realization of experimental test rig.	3	UNIFI	L	M	2 LOW	Proper planning is envisioned. Furthermore, if required specific employment of people with the right competence to speed up the process.



6	Delayed input from WP2, 3 and 4 for LCA and socio-economic assessments.	7	VAASA	L	M	2 LOW	WP leaders will have ad hoc meetings to unlock the information flow. The regular conference calls of the will minimize communication risks.
7	Workshop testing reveals weaknesses that require re-design and testing.	5	REELWELL	L	M	2 LOW	Some buffer time is already included in the schedule for such events. If severe problems are experienced, the specification values may need to be reconsidered to avoid delay of the full- scale test operation.
8	Long delivery time for pipes to be used in the full-scale test due to high market activity, disruptions, pandemic etc.	6	REELWELL	L	M	2 LOW	Use of pipes with non-optimum dimensions and performance could be considered acceptable if such situations occur, to prevent excessive delays.
9	Restricted access to qualified personnel for the development and equipment testing	5, 6	REELWELL, IFE	L	M	2 LOW	Require proper planning, and if required employ people with the right competence in time.
10	Ullrigg not available for the test due to breakdown, fire or other reasons.	6	NORCE	L	M	2 LOW	A back-up rig site would be the X-rig outside Stavanger, that can provide an alternative well for the full-scale test.
11	Development costs increase beyond current budget, due to equipment failure or other unforeseen reasons.	5, 6	REELWELL, IFE	L	M	2 LOW	If problems to reach TRL5 for the tools, it would be considered to reduce the operation envelope for the solution as mitigation.



3. CONCLUSIONS

The Risk Management Plans, together with Project Management Plan, serve as a practical guide supplementing the provisions of the Grant Agreement and the Consortium Agreement. These are “go to documents” to find guidelines on day-to-day cooperation within the consortium, as well as guidelines on immediate action plan in case of conflict, deviation or unforeseen risk.

The document will be updated during the project’s lifetime based on the experience gained.

4. CHANGE LOG

Date	Description

