

PUSH-IT

Piloting Underground Seasonal Heat Storage In geothermal reservoirs

**D4.2 Updated dissemination, exploitation and communication plan
PUSH-IT website and SM channels**



Funded by
the European Union

Grant agreement number	101096566		
Project title	Piloting Underground Storage of Heat In geoThermal reservoirs		
Project acronym	PUSH-IT		
Start date	01-01-2023	DURATION	48 months
End date	31-12-2026		
Work Package No. and Title	WP4 Dissemination, Exploitation and communication		
Deliverable number	D4.2		
Deliverable title	Updated dissemination, exploitation and communication plan, PUSH-IT website and SM channels		
Actual date of delivery	11-04-2025		
Nature	R	DISSEMINATION LEVEL	Public
Deliverable Leader	AARD		
Author	Tebbe van Oort, Serge Santoo		
Co-authors and contributors	Julian van Loo & Danielle van Duin		

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Document history

Version	Description (Section, page number)	Author	Role (Organisation short name)
V0.1	First draft	Tebbe van Oort	AARD
V0.1a	Review	Polycentric	Consortium partners
V0.2	Second draft Processed of feedback received from reviewers / partners	Tebbe van Oort	AARD
V0.2a	Review	Serge Santoo	AARD
V0.3	Draft final Processed of feedback received from reviewers / partners	Tebbe van Oort	AARD
V1.0	Final version	Tebbe van Oort	AARD

Quality control

Author	Organisation short name	Role	Date
Tebbe van Oort	AARD	Work Package Leader	24-01-2025
Tebbe van Oort & Serge Santoo	AARD	Deliverable Leader	17-02-2025
Consortium partners	Consortium partners	Reviewer 1	19-02-2025
Martin Bloemendal	TUD	Scientific Project Coordinator	11-04-2025
Danitsja van Heusden	TUD	Project Coordinator	11-04-2025

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List of Abbreviations

ATES	Aquifer Thermal Energy Storage
BMC	Business Model Canvas
BMEM	Business Model Environment Map
BTES	Borehole Thermal Energy Storage
DAP	Delft Aardwarmte Project
DH	District Heating
EC	European Commission
EU	European Union
GHG	Greenhouse Gas
GRE	Glass fiber re-enforced epoxy
HT	High Temperature
HT-UTES	High-Temperature Underground Thermal Energy Storage
IP	Intellectual Property
KER	Key Exploitable Result
LCOE	Levelized Cost of Energy
MRL	Market Readiness Level
MTES	Mine Thermal Energy Storage
MOOC	Massive Open Online Course
TRL	Technology Readiness Level
SL	Site Leader
SMCA	Spatial Multi-Criteria analysis
TL	Task Leader
TRL	Technology Readiness Level
UTES	Underground Thermal Energy Storage
VPC	Value Proposition Canvas
WP	Work Package
WPL	Work Package Leader

Executive Summary

The PUSH-IT project, funded by the Horizon Europe Programme of the European Commission, aims to contribute to the transition towards a net-zero greenhouse gas (GHG) economy in Europe by demonstrating the full-scale application of high temperature heat storage in geothermal reservoirs using three different technologies across six different sites. The project seeks to reduce environmental impact and improve performance and robustness through the development and demonstration of enabling technologies and engagement with key stakeholders. As PUSH-IT embarks on this four-year project, it is important to consider the potential for the project results to be exploited for wider societal and economic benefits.

This deliverable, “Deliverable D4.1 Detailed dissemination, exploitation and communication plan” is a critical tool for ensuring the success of the PUSH-IT project. This document outlines the dissemination and communication strategy that will be deployed to pursue the maximum impact of the project results. It also serves as a guideline to the consortium for dissemination, exploitation and communication efforts throughout the project. In this plan, identification of the preliminary list of exploitable results is being described and an outline of the project governance procedures for knowledge management and intellectual property rights is being provided. The PUSH-IT project also presents a comprehensive exploitation plan to ensure the successful commercialization of the project outcomes. Through this plan, the PUSH-IT project aims to make the results obtained in the demonstration sites available to parties in the supply chain and potential users, ensuring that the project contribute towards the long-term objectives of the EU.

The PUSH-IT dissemination, exploitation and communication plan is a living document and will be updated as required throughout the implementation of the project. Maintenance and distribution of the plan for the whole duration of the project will be the responsibility of the WP4 Lead.

1. Introduction

1.1 The PUSH-IT project

PUSH-IT is a project funded by the Horizon Europe Programme of the European Commission, the goal of which is to have a net-zero greenhouse gas (GHG) economy by 2050¹, with 55% reduction on 1990 levels by 2030². At present, heating and cooling represent around 50% of the final energy demand in Europe and are mainly supplied by fossil fuel derived energy. It is therefore essential to decarbonise heating and cooling to achieve EU ambitions.

The PUSH-IT project will demonstrate the full-scale application of high temperature heat storage (up to 90°C) in geothermal reservoirs using 3 different technologies, aquifers, boreholes and mines, across 6 different sites. The 3 technologies addressed in PUSH-IT are relevant for different geological conditions, which are widely available in Europe. PUSH-IT will develop, deploy and test our technologies for a variety of configurations of heat sources, heat storage technologies, geological conditions, distribution systems, stakeholder populations and market and legal conditions. Hence, PUSH-IT provides a unique scope on demonstration, integration and advances for seasonal heat storage. These results will enhance the utilisation of sustainable energy and create a more balanced system for sharing benefits and burdens tied to sustainable heat generation, storage and distribution activities.

PUSH-IT aims to reduce environmental impact, levelized cost of energy (LCOE) and risks and improves performance and robustness via development and demonstration of several enabling technologies, i.e., newly developed monitoring and water quality control, novel drilling and completion and novel control systems. Societal engagement with these developments is a key element and achieved via citizen engagement, analysis of perceptions and levels of acceptance of heat storage technologies, and investigation of governance, policies and business models that engage citizens in decision-making around urban heating systems including storage.

The consortium of the PUSH-IT project combines heat suppliers, well-drillers, public planning offices and academic partners. Through our transdisciplinary collaboration, PUSH-IT will realise operational projects and use these to generate both general transferrable principles and context-specific practices of relevance to sites across Europe and beyond. All activities will be monitored and reported, yielding a valuable comprehensive dataset on the technical and social real-world performance.

1.2 Objectives for dissemination, exploitation and communication

Dissemination, exploitation and communication are a critical and integral part of PUSH-IT and play a key role in maximizing the impact of the project results, engaging stakeholders, showcasing project value, meeting project requirements, and promoting science communication and public engagement. Moreover, dissemination, exploitation and communication create foundations for technical advancements in future research as well as demonstrating where the regulatory framework might be improved. An outcome of dissemination, exploitation and communication can also be that opportunities are created for lessons learned when unanticipated issues arise. These might be communication issues/failures which should be treated as learning points for future work. In PUSH-IT, fast-track market upscaling is one of the key goals. Here, dissemination, communication and exploitation are playing a role as well.

¹ EC, 2022. 2050 long-term strategy on climate strategies & targets.

² EC, 2022. 2030 climate & energy framework.

Dissemination, exploitation and communication each have their specific objectives in light of the overarching goal of the PUSH-IT project.

This first version of the dissemination, communication and exploitation plan will lay the foundation of the approach for PUSH-IT in such a way that the project is optimally structured and aligned for successful dissemination of the results. A second version of the plan will be created halfway through the project in M24.

This deliverable consists of four parts. Chapter 1, this chapter, introduces PUSH-IT and its objectives. Chapter 2 describes the dissemination strategy, approach and activities. Chapter 3 is focused on the consortium's approach to further exploitation of the results of PUSH-IT. This chapter also contains the approach towards intellectual property. Chapter 4, finally, describes the communication strategy, approach and activities. This deliverable is a updated version of the earlier submitted DEC-plan, therefore parts of the text will be the same with only minor updates to it. Additionally, this plan will not cover all advances within the project. Only meaningful advances that have influenced the plan itself.

1.2.1 Dissemination objectives

The key objectives of dissemination in PUSH-IT remain:

- Provide public information on scientific results, through the project website, a newsletter and on social networks, with a strong emphasis on success stories to address potential concerns of stakeholders and public on underground activities.
- Disseminate research results via peer-reviewed publications, national and international conferences (in-person and online events). The results of the project are published in several articles in scientific journals as well as in various scientific conference presentations and papers.
- Create a webinar / vocational training series on main project findings.
- Organise a summer school that integrates technical, societal and system integration issues.
- Organise a final project symposium at demo site TU Delft.
- Communication about dissemination activities will be done in English

1.2.2 Exploitation objectives

Exploitation of Key Exploitable Results (KER) is a critical and integral part of PUSH-IT and plays a key role in maximizing the impact of the project results.

The main objective of the exploitation plan for the PUSH-IT project is to exploit and utilize lessons learned within the project to achieve the EU's energy transition objectives. The preliminary indicated KERs related to technical installations, optimised control systems, monitoring of environmental impact and technical performance, as well the pro-active public engagement approach, will keep playing an important role in achieving this objective. However, their status as KER might change throughout the project, as it may become clear that the results from actual field testing indicate that the results are not exploitable and do not benefit the wider industry or specific project. This of course remains a valuable lesson for the industry and policy makers as well.

However, successful results will be used to develop innovative solutions to increase the efficiency and sustainability of the geothermal energy sector, contributing to the EU's overall goals of reducing greenhouse gas emissions and achieving carbon neutrality.

All stakeholders in the geothermal energy supply chain, including heat network companies, drilling companies, and geothermal operators, have access to the KERs. Consortium

partners will distribute these results, and their potential for further exploitation will be assessed through potential mapping. This will identify which of the initial KERs and potential other, newly identified, results could be exploited and assessed for their potential for further development.

To ensure the success of the exploitation plan, business models and plans will be developed for each eligible exploitable result. This will mostly be done on a local level by the different sites, as well as the companies providing key technologies for the different sites. The business plan will outline the commercialization strategy, including the target market, a short potential marketing strategy, and financial projections. The business model will provide a framework for commercial partners to develop the product or service further, considering factors such as IP rights, distribution channels, and revenue streams.

1.2.3 Communication objectives

For communication specifically the described goal is to

- Ensure that PUSH-IT results are widely available to stakeholders and integrated in industry workflows.
- Transfer of scientific and technical project results to all relevant parties, such as system planners, heat network operators, approval authorities and the scientific community.
- Inform potentially other interested internal and external stakeholders of progress and outcomes and achievements of the project.
- Establish adoption of the results of the project by main stakeholders.
- Contribute to information and dissemination activities to increase the visibility and synergies between Horizon Europe supported actions (CINEA).
- Communication will be done in English; the project understands that there are many different countries involved in this project and we want all countries to have equal access to the information. Local project specific information might be communicated in the local language but will not be communicated on the project wide channels.

A range of multimedia content will be produced and published on the project website as well as on dedicated social media platforms.

1.3 Deliverables and Milestones

Below the milestones and deliverables are listed in two tables (Table 1 and Table 2). Milestone 10 has been extended from month 26 to month 32. To allow for a shoot onsite during the General Assembly in Bochum.

Table 1: Work Package 4 Deliverables

Deliverable No	Deliverable Name	Lead beneficiary	Due Date (month)
D4.1	Detailed dissemination, exploitation and communication plan, PUSH-IT website and SM channels	AARD	6
D4.2	Updated dissemination, exploitation and communication plan, PUSH-IT website and SM channels	AARD	24
D4.3	GIS web-app for potential mapping	AARD	46

Deliverable No	Deliverable Name	Lead beneficiary	Due Date (month)
D4.4	Webinar series/vocational training	AARD	46
D4.5	Key Exploitable Results business plan and road maps	AARD	46

Table 2: Work Package 4 Milestones

Milestone No	Deliverable Name	Lead beneficiary	Due Date (month)
9	Project website launch	AARD	9
10	Demo/follower site videos	UNIGE	26 à 32
11	Public stakeholder demo site workshops	AARD	35
12	Summer school	AARD	40
13	Final symposium	AARD	48

2. Dissemination plan

2.1 Approach

The primary goal of the dissemination strategy is to extend the specific groups who benefit from and find value in the project's findings, and to then determine the most effective ways to communicate with them. The strategy is to amplify the impact of the project outcomes by engaging with influential target audiences. It outlines the dissemination approach utilized and the tools used to publicize the project's accomplishments. To ensure effectiveness, dissemination efforts have been planned throughout the project's entire timeline rather than solely at the dissemination of its final results.

The dissemination activities have a strong relationship with communication activities. Hence, this plan interlinks with the PUSH-IT communication plan.

2.2 Target audience

An stakeholder analysis was performed to identify the most relevant target groups and determine the most effective means of implementing dissemination activities for PUSH-IT. As the project progressed, an extended stakeholder analysis was conducted, and the dissemination plan is updated with this document.

During the initial phase of the project six primary target groups had been identified:

1. Scientific community.
2. Academia.
3. District heat network operators, geothermal storage site operators including specialised engineering and software companies.
4. Investors.
5. Policy makers, municipalities (local, regional, national, EU-level).
6. licensing authorities (mining and water authorities, nature conservation authority)
7. General & local public / citizens.

This list was further extended with follow up stakeholder analysis:

8. Local energy corporation
9. Local fire departments

2.3 Activities

The dissemination plan targets several audiences, and the means and objectives for these target groups vary slightly, while keeping as main objective to advocate for the urgent need to provide cleaner and more efficient district heating systems by implementing underground storage solutions.

For dissemination PUSH-IT developed communication materials:

- Dedicated website to engage stakeholders and share updates.
- Project identity, including logos & colour scheme.
- Factsheet & Infographics series and short explanation video.
- Site videos and more site videos are still being developed
- LinkedIn page as well as a YouTube channel for the publication of videos, updates and stories about the project.
- Media kit for journalists and policymakers.
- Roll-up banners, brochures and other material. And if applicable design for local use.

The dissemination activities per target group is detailed in Table 3.

Table 3: Dissemination activities for each target group of audience

Target group	Objective	Means & activities
Scientific community	Disseminate the scientific results and output of the PUSH-IT project on advances made on the critical bottlenecks and scientific barriers for heat storage systems in geothermal reservoirs	Initial target: 20-25 peer reviewed open-access publications and 30 presentations at sector-relevant international events. Currently, the project is on track to meet this target. Keeping in mind that some of the results will only be available after the end date of the project. Meaning that PUSH IT will continue to produce publications even after the project is officially finished.
Academia	Advance scientific understanding of the technical and social challenges and approaches associated with implementing heat storage in geothermal reservoirs across different contexts	Summer/Winter schools and block-courses, workshops open to students in the academic institutions participating PUSH-IT consortium. Currently, the first preparations for the summer school are being made and a curriculum is being developed.
District heat network operators, geothermal storage site operators including specialised engineering and software companies	Raise awareness among district heating network operators and geothermal site developers of practical solutions (relating to technical and societal challenges) relating to heat storage in geothermal reservoirs systems developments	Factsheets & infographics about industrial application, deployment, economic potential and societal benefits, clustering with other related projects to be shared at trade fairs such as GeoTherm or GRC, the EGC and WGC as well as national geothermal events organisations such as Geothermie Nederland, and EGEN in Europe. The first results are actively being communicated at geothermal events by the people involved at the project. Factsheets & infographics currently only provide a more general overview of the project and the potential benefit but will become more elaborate as the project progresses.
Investors	Raise awareness of the economic feasibility and opportunities of heat storage in geothermal reservoirs, solutions and related short-term, mid-term and long-term risks for the sector, despite relatively high investment costs for the implementation	High-level guidelines on the storage of heat in the subsurface, addressing the relevant steps and obstacles to be shared at relevant conferences and symposia. LCOE model has been made and together with SMCA this will provide guidelines for potential investors into which areas are most promising when it comes to UTES.
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	Raise the interest and awareness of heat storage systems in geothermal reservoirs as a viable solution for enhancing energy independence and decarbonisation and decentralise the heating costs	High-level final conference; suggestions for updated regulations, addressing regulatory bottlenecks. The final conference is planned at the end of the project and first steps are taken to organise the conference.
General & local public / citizens	Raise the interest and awareness of for heat storage systems in geothermal reservoirs as a solution for enhancing energy independence, climate change mitigation. Increase community and public understanding and support of such projects	Pro-active, two-way communication through information exchange events, social media and website updates, and webinars. This is currently ongoing and will proceed until the end of the project. Updates on the website and social media channels are done periodically to keep the audience engaged. But also on an ad-hoc basis as interesting events take place throughout the project's live.

The following media, conferences and events were selected to be used as platform for dissemination activities. This list is final and can be updated along the way as part of the communication activities.

Scientific journals

The results of the project are published in several papers in scientific journals, such as Energy and Environmental Science, Renewable and Sustainable Energy Review, Renewable Energy, Energy Research and Social Science, Energy Policy, Geothermics, Solid Earth, EGU Sphere, Energies, Geosciences, etc. Although this plan lists a number of journals scientists are free to use journals of their choice.

Conferences and geothermal trade fairs

Also, the results of the project are disseminated in various scientific conference presentation, such as GeoTHERM Expo & Congress, the European Geothermal Congress, the World Geothermal Congress, the European Geoscience Union, European Geothermal Workshop, Earth System Governance, International Association for Society and Natural Resources, and International Conferences on Energy Research & Social Science, Earth System Governance Conference, Royal Geographical Society Conference. Although this plan lists a number of conferences this is not an exhaustive list and other conferences that are of interest to the project might also be attended.

2.4 Work Package specific related dissemination activities

2.4.1 WP1 Sites

The PUSH-IT project will, for the first time, demonstrate high temperature geothermal heat storage for seasonal balancing and for multi-source multi-user application. PUSH-IT concentrates all project activities on pilot sites. WP1 will address specific/local technical and societal issues and make the step to translate our findings into generic solutions that can be applied to heat storage systems across Europe. Full scale implementation of heat storage in geothermal reservoirs will be demonstrated at 3 demo-sites:

1. Delft: Aquifer thermal energy storage (ATES);
2. Darmstadt: Borehole thermal energy storage (BTES);
3. Bochum: Mine thermal energy storage (MTES).

Next to these key demo-sites, 3 'follower' locations will be involved:

1. Berlin: Aquifer thermal energy storage (ATES);
2. Litoměřice: Borehole thermal energy storage (BTES);
3. United Downs: Mine thermal energy storage (MTES).

The state of development of dissemination action is so far heterogeneously developed for the different demo-sites. Hereafter, for each demo-site and follower site, the activities are detailed according to current state of development.

The follower sites also have dissemination activities, they largely are similar to the demo sites. Such as inviting school classes to visit sites and attending conferences.

2.4.1.1. Delft

The Delft site dissemination activities will be articulated around the various stakeholders present on site and in the area. Table 4 presents the various activities planned for the different groups of stakeholders and audience, with associated media use, and expected outcomes.

Table 4: Dissemination activities planned for the Delft demo site

Target group	Activity type	Media use	Expected outcome(s)
Scientific community	<ul style="list-style-type: none"> Scientific publications Scientific congresses participation 	<ul style="list-style-type: none"> Scientific journals listed previously. Notification of journal publication on social networks, LinkedIn, ResearchGate, twitter, among other 	Lay out the scientific basis for design, implementation and performance of HT-ATES systems.
Academia	<ul style="list-style-type: none"> Summer school for advanced master students, and for PhD candidates Integration of heat storage in geothermal reservoirs technologies for Bachelor and Master students of TU Delft: MSc SET program, as well as various MOOCS 	<ul style="list-style-type: none"> Email lists MOOCS Social networks, LinkedIn, Instagram (institute accounts have large reach) Local symposia. E.g., regular Delft Aardwarmte Project (DAP) symposium, Urban Energy Institute symposium, All Energy Day. Other special events 	Raise interest and awareness for students and young professionals, encouraging a portion to enter the multi-disciplinary work market needed for heat storage implementation.
District heat network operators, geothermal storage site operators including specialised engineering and software companies	<ul style="list-style-type: none"> Demo-site visit organisation, including workshop part to raise awareness on ATES technology implementation in Delft, but also other heat storage in geothermal reservoirs technologies developed in PUSH-IT to the stakeholders Colloquiums and clustering events online on storage technologies, implemented in other projects in Delft area 	<ul style="list-style-type: none"> Publication as paper forms, and also available online of the Factsheets & infographics about industrial application, deployment, economic potential and societal benefits, clustering with other related projects. This factsheet will provide an overview of the amount of heat stored, deterred CO² emissions, sizes and volume. Economic potential is harder to qualify and information provided will be more general in nature. Dedicated website for the Delft site: subsurface urban energy lab, including the HT-ATES, but also 	Raise awareness and showcase advantages of heat storage in geothermal reservoirs solutions and optimisation tools and workflows developed in PUSH-IT for district heating grid management

Target group	Activity type	Media use	Expected outcome(s)
	(sharing knowledge events)	Geothermal well, Heat pump centre, DHN all used for heat supply of campus and Delft as well as research and education	
Investors	Demo site visits, and network activation and clustering to provide open science project and raise the technological development	<ul style="list-style-type: none"> • Publication online of High-level guidelines on the storage of heat in the subsurface, addressing the relevant steps and obstacles • Roadmap scheme on know-how and knowledge gained from PUSH-IT demo-sites • Provide guidelines for ways of fundings (governmental finance plans, etc.) 	<ul style="list-style-type: none"> • Awareness of heat storage potential (economic and environmental), decreasing uncertainties and unknowns. • Highlighting potential bottlenecks and how to overcome them. • Decrease unknowns and the therefore reluctance to invest.
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	<ul style="list-style-type: none"> • Participation into clustering and network events involving policy makers, locally and at the federal level • Open the possibility for site visit on demand, and co-organise with policy makers large public events (see section below) 	<ul style="list-style-type: none"> • High-level final conference; suggestions for updated regulations, addressing regulatory bottlenecks • Social media publication of such events, to raise interests of other similar stakeholders 	<ul style="list-style-type: none"> • Increase awareness of benefits of heat storage systems. • Awareness of demonstrated performance of heat storage, and its integration into wider heating systems. • Available data on environmental and energetic performance. • Increased accessibility of operating systems to enable improved technical understanding of the HT-ATES system and showcase the implementation of such system at the university campus scale, proving possibility to roll-out to urban environments applicable to large portions of the energy demand.
General & local public / citizens	<ul style="list-style-type: none"> • Open-air scientific public events, with demo site visits, pedagogical presentation • Information panels on PUSH-IT project and on demo-site visits 	<ul style="list-style-type: none"> • Social media • Local and national newspapers and other local press • Co-presentation with local political and association networks to widen audience 	<ul style="list-style-type: none"> • Awareness of safe operation and potential (economic and environmental) benefits. • Availability of working sites to demonstrate performance. • Improved social understanding and support of such projects

Target group	Activity type	Media use	Expected outcome(s)
		<ul style="list-style-type: none"> Massive Open Online Courses (MOOCs) 	

1.6.1.2. Darmstadt

Darmstadt site dissemination activities will be articulated around the various stakeholders present on site and in the area. Table 5 presents the various activities planned for the different groups of stakeholders and audience, with associated media use, and expected outcomes.

Table 5: Dissemination activities planned for the TU Darmstadt Lichtwiese Campus demo-site

Target group	Activity type	Media use	Expected outcome(s)
Scientific community	<ul style="list-style-type: none"> Scientific publications Scientific conference participation 	<ul style="list-style-type: none"> Scientific journals, listed previously Notification of journal publication on social networks, linked in, ResearchGate, twitter, among other 	Spread knowledge out of the scientific excellence and multi-disciplinarity, and direct-use potential of scientific productions issued from the PUSH-IT implementation on Darmstadt site
Academia	<ul style="list-style-type: none"> Summer school for advanced MSc students, and for PhD candidates Integration of heat storage in geothermal reservoirs technologies module for Bachelor and Master students of TU Darmstadt 	<ul style="list-style-type: none"> Email lists Social networks, LinkedIn, Instagram Information page on the TU DA institute home page 	<ul style="list-style-type: none"> Raise interest, awareness Train young professionals in the field of heat storage to overcome the skills issue in the labour market Address skilled, competent junior experts, able to work in a multi-disciplinary environment
District heat network operators, geothermal storage site operators including specialised engineering and software companies	<ul style="list-style-type: none"> Demo-site visit organisation, including workshop part to raise awareness on BTES technology implementation in Darmstadt, but also other heat storage in geothermal reservoirs 	Publication as paper forms, and also available online of the Factsheets & infographics about industrial application, deployment, economic potential and societal benefits, clustering with other related projects	Raise awareness and show case advantages of heat storage in geothermal reservoirs solutions and optimisation tools and workflows developed in PUSH-IT for district heating grid management

Target group	Activity type	Media use	Expected outcome(s)
	<p>technologies developed in PUSH-IT to the stakeholders</p> <ul style="list-style-type: none"> • Colloquium and clustering events online on storage technologies, implemented in other projects in Darmstadt area (sharing knowledge events) 		
Investors	Demo site visits, and network activation and clustering to provide open science project and raise the technological development	<ul style="list-style-type: none"> • Publication online of High-level guidelines on the storage of heat in the subsurface, addressing the relevant steps and obstacles • Best-practice code on know-how and knowledge gained from Darmstadt PUSH-IT demo-site • Provide guidelines for ways of fundings (governmental finance plans, etc.) 	By sharing the success story and detailing what potential bottlenecks and how to overcome them, decrease the fear of investments
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	<ul style="list-style-type: none"> • Participation in clustering and network events involving policy makers, locally and at the federal level • Open the possibility for site visit on demand, and co-organise with policy makers large public events (see section below) 	<ul style="list-style-type: none"> • High-level final conference; suggestions for updated regulations, addressing regulatory bottlenecks • Social media publication of such events, to raise interests of other similar stakeholders • Participation in networking style conferences e.g., like Berliner Energietage and activities therein 	Increase the accessibility of technical understanding of the BTES system and show case the implementation of such system at the university campus scale, proving that it is possible to roll it out massively
General & local public / citizens	<ul style="list-style-type: none"> • Open-air scientific public events, with demo site visits, pedagogical presentation, community liaison groups. 	<ul style="list-style-type: none"> • Social media • Newspaper local press • Co-use of the local political and association networks to actively integrate them into the dissemination 	Inform locals of project updates in timely manner, address potential concerns about heat storage in geothermal reservoirs systems, create open dialogue with communities, increase local knowledge about project and technology

Target group	Activity type	Media use	Expected outcome(s)
	<ul style="list-style-type: none"> Information panels on PUSH-IT project and on demo-site visits 		

2.4.1.2. Bochum

The dissemination activities for the Bochum site will be articulated around the various stakeholders present on site and in the area. Table 6 presents the various activities planned for the different groups of stakeholders and audience, with associated media use, and expected outcomes.

Table 6: Dissemination activities planned for the Bochum MTES demo site

Target group	Activity type	Media use	Expected outcome(s)
Scientific community	<ul style="list-style-type: none"> Scientific publications Scientific congresses participation 	<ul style="list-style-type: none"> Scientific journals, listed previously Notification of journal publication on social networks, linked in, ResearchGate, twitter, among other Webinar (for example mine-water-symposium) 	Spread knowledge out of the scientific excellence and multi-disciplinarity, and direct-use potential of scientific productions issued from the PUSH-IT implementation on Bochum site
Academia	Integration of heat storage in geothermal reservoirs technologies module for Bachelor and Master students of Ruhr-University / RWTH Aachen University / BTU Cottbus-Senftenberg	<ul style="list-style-type: none"> Lectures (Chair of Geothermal Systems) (YouTube)-Video-Explanation of the MTES principles (t.b.d.) 	Raise interest, awareness and retain young professionals to help overcome the skills issue in the labour market where there is a need for skilled, competent juniors, able to work in a multi-disciplinary environment
District heat network operators, geothermal storage site operators including specialised engineering and software companies	<ul style="list-style-type: none"> Demo-site visit organisation, including workshop part to raise awareness on MTES technology implementation in Bochum Colloquium and clustering events online/On site projects in Bochum 	Publication as paper forms, and also available online of the Factsheets & infographics about industrial application, deployment, economic potential and societal benefits, clustering with other related projects	Raise interest and awareness, train young professionals to overcome the skills issue in the labour market address skilled, competent junior experts, able to work in a multi-disciplinary environment

Target group	Activity type	Media use	Expected outcome(s)
	together with Energy Providers (Stadtwerke)		
Investors	Demo site visits, and network activation and clustering to provide open science project and raise the technological development	<ul style="list-style-type: none"> • Publication online of High-level guidelines on the storage of heat in the subsurface, addressing the relevant steps and obstacles • Best-practice code on know-how and knowledge gained from Bochum PUSH-IT demo-site • Provide guidelines for ways of fundings (governmental finance plans, etc.) 	By sharing the success story and detailing what potential bottlenecks and how to overcome them, decrease the fear of investments
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	<ul style="list-style-type: none"> • Inviting (local) politicians, parties and NGOs to our site to explain the technology • Integrate the MTES technology to “Kommunale Wärmeplanung” 	<ul style="list-style-type: none"> • High-level final conference; suggestions for updated regulations, addressing regulatory bottlenecks • Social media publication of such events, to raise interests of other similar stakeholders • Participation in networking style conferences e.g., like “Stadtwerke.Nutzen.Geothermie” (event offered by Fraunhofer for energy supplier) 	Increase the accessibility of technical understanding of the MTES system and show case the implementation of such system at the university campus scale, proving that it is possible to roll it out massively
General & local public / citizens	<ul style="list-style-type: none"> • In the frame of Institutional open days • Information panels on PUSH-IT project and on demo-site visits 	<ul style="list-style-type: none"> • Social media • Newspaper local press • Co-use of the local political and association networks to actively integrate them into the dissemination • “Geothermal window” at the wells 	Inform locals of project updates in timely manner, address potential concerns about heat storage in geothermal reservoirs systems, create open dialogue with communities, increase local knowledge about project and technology

2.4.1.3. Berlin

For the follower site of Berlin, Table 7 details the intended dissemination actions.

Table 7: Dissemination activities planned for Berlin Adlershof follower site

Target group	Activity type	Media use	Expected outcome(s)
Scientific community	<ul style="list-style-type: none"> Scientific publications Scientific congresses participation 	Scientific journals and conference presentations	<ul style="list-style-type: none"> Lay out the scientific basis for design, implementation and performance of HT-ATES systems and PUSH-IT implementation on Berlin ATES site. Adopting methods developed in other projects (e.g., Very-High-Temperature Heat Aquifer Storage, project in the DACH region Project in Germany)
Academia	ATES lecture at TU Berlin including modelling workshop for master students	<ul style="list-style-type: none"> University Lecture Seminars 	<ul style="list-style-type: none"> Raise interest, awareness and retain young professionals to feed the work market Address skilled, competent junior experts, able to work in a multi-disciplinary environment
Academia/scientific community	Organisation of workshops with experts and stakeholders from research, industry, politics and authorities to discuss underground thermal storage and its integration into DH systems.	Guidelines and criteria catalogue for HT ATES applications	Identify and reduce obstacles regarding legal aspects, technical and financial risks
District heat network operators, geothermal storage site operators including specialised engineering and software companies	Demo-site visit	<ul style="list-style-type: none"> Participation in networking style conferences e.g., like Berliner Energietage and activities therein Site visits offered for conferences (DGK 2024); associations, and other research projects 	Raise awareness
Investors	Demo-site visit and the organisation of workshops with experts and stakeholders from , industry and politics to discuss		Identify and reduce obstacles regarding legal aspects, technical and financial risks

Target group	Activity type	Media use	Expected outcome(s)
	underground thermal storage and its integration into DH systems.		
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	Publications and the organisation of workshops and with experts and stakeholders from politics and authorities to discuss underground thermal storage and its integration into DH systems	Social media	Identify and reduce obstacles regarding legal aspects, technical and financial risks
General & local public / citizens	<ul style="list-style-type: none"> Open-air scientific public events, with demo-site visits, Information panels on project site 	<ul style="list-style-type: none"> Social medias Paper local press Use of the association networks to actively integrate them into the dissemination 	Inform locals of project updates in timely manner, address potential concerns about heat storage in geothermal reservoirs systems, create open dialogue with communities, increase local knowledge about project and technology

2.4.1.4. Litoměřice

For the follower site of Litoměřice, Table 8 details the intended dissemination actions.

Table 8: Dissemination activities planned for Litoměřice follower site

Target group	Activity type	Media use	Expected outcome(s)
Scientific community	<ul style="list-style-type: none"> Presentation on the national/international conference/seminar 	<ul style="list-style-type: none"> Personal power point presentation 	<ul style="list-style-type: none"> PowerPoint presentation
Academia	<ul style="list-style-type: none"> Presentation during classes for MSc/PhD students at Charles University 	<ul style="list-style-type: none"> Personal power point presentation Information on UKR website 	<ul style="list-style-type: none"> PowerPoint presentation Increased knowledge of the students on UTES/BTES systems
District heat network operators, geothermal storage site operators including specialised engineering and software companies	Invitation of the DH systems operator to the Litoměřice demo site to showcase drilling technologies and development of the pilot wells	<ul style="list-style-type: none"> Personal meeting incl. presentation Information on the meeting published on RINGEN web site 	<ul style="list-style-type: none"> Photos, power point presentation Established network Increased knowledge of the DH systems operator on UTES/BTES systems and their use for heating & cooling

Target group	Activity type	Media use	Expected outcome(s)
Investors	DH systems operator and municipality is the potential investor		
Policy makers, Licensing authorities, municipalities (local, regional, national, EU-level)	Invitation of the city councillors to the Litoměřice demo site to showcase drilling technologies and development of the pilot wells	<ul style="list-style-type: none"> • Personal meeting • Workshop with public officials (water management, environmental protection etc.) 	<ul style="list-style-type: none"> • Photos & list of attendance • Better understanding of the BTES/UTES systems and their current legal framework and permitting procedures + feedback for the PUSH-IT project implementation
General & local public / citizens	<ul style="list-style-type: none"> • Information panels on PUSH-IT project and on demo-site visits • Invitation of the local and regional media to showcase drilling technologies and development of the pilot wells and PUSH-IT project presentation 	<ul style="list-style-type: none"> • Website CGS/ • Newsletter of CGS/ Ministry of the Environment/ Charles University • Social media • Local & regional media (press, radio, TV) • Litoměřice website 	<ul style="list-style-type: none"> • Exhibition stand at the largest outdoor popular science event in the Czech Republic "Věda Fest" • Two-day outdoor popular science event Geological Day with the Czech Geological Survey • Articles and interviews in the local & regional media • Press release on the Litoměřice website

2.4.1.5. United Downs

The advances on the development of the United Downs site are still at an early stage, and the main aim of PUSH-IT there is to investigate accesses to the mines and perform feasibility studies, to be disseminated through the following means:

- Information on the GEL website.
- PUSH-IT content shared on GEL's social media.
- Updates on GEL's work on the project shared on GEL's social media.
- Information panel in GEL's visitor room highlighting the project and explaining the concept of MTES.
 - Also information about the mines, such as maps, can be found here
- Publication of information/FAQ sheets.
- Engagement in the Mine Water Energy Expert Group, and with the BGS and the Coal Authority.
- Engagement with locals

2.4.2 WP2 Societal Engagement

There has been a good collaboration between WP4 and WP2 in the first part of the project. This includes monthly meetings and strategy discussions, as there is some overlap between the objectives of WP2 and WP4. These meetings have made a good contribution to the overall coordination between the efforts of the 2 work packages. And allowed for synergies to be exploited, for example with the development of the power interest matrix and the development of communication materials.

In the first phase of the project WP2 has worked with project partners to identify local community members and policymakers to target for information dissemination, creating networks of local stakeholders across the six sites. This included households in the local community but also local organisations with established social networks.

Across all phases of the project, WP2's dissemination strategy is focused on local community members that might be impacted through their proximity to the demonstration and/or follower sites. This includes households in the local community, but also local organisations with established social networks. In the initial phase of the project, WP2 has recorded evidence of all previous approaches to dissemination of information to local communities across the different project types, while also determining what types of dissemination have been most effective in each location. After determining this, WP2 used a variety of the dissemination types which have been deemed appropriate across these locations (e.g., social media, community meetings, workshops, newsletters, etc.), ensuring that dissemination strategies also incorporate space for community members to feedback information to the project team.

In focusing on local community members and policymakers, WP2 includes in the information that will be disseminated, findings from the work package on the regulatory and economic barriers and opportunities to implementing geothermal energy.

In the final phase of the project, findings associated with economic, political, and social research conducted within this work package will be disseminated through a variety of activities, targeting policymakers, community members, industry, academics and the general public. These activities will take place through a variety of avenues, such as conferences, academic journals, project reports, webinars, and community events.

2.4.3 WP3 Enabling Technologies

The WP3 objective is to reduce CO₂ emissions and costs by developing, applying, and evaluating technologies for heat storage in geothermal reservoirs systems. Most of these technologies can only be assessed after the systems are up and running, other technologies will be applied tested during the construction phase. The dissemination in WP4 will mainly aim for broadcasting the results and outcomes of the project and the benefits of developing and applying CO₂ reducing technologies and will adapt specific dissemination activities for the main tasks of WP3.

2.4.3.1. Task 3.1 Enhanced well drilling and completion activities

The main expected outcomes of drilling activities will be disseminated mainly by encouraging local events, and by showing the roll-out potential from the demo-sites to the follower sites, with a binding development and shared of gained experience with the communities implied in the follower sites and tackling also broader audience topic and thematic such as the well integrity (cross-projects activities planned).

Specifically, the content of the dissemination is tailored to each targeted group, with the following development:

The scientific community is targeted through scientific publications and participation in scientific congresses. The media used is primarily scientific journals. The expected outcome is to notify the publication of research findings through social networks, LinkedIn, ResearchGate, Twitter, YouTube and other platforms. Additionally, the aim is to lay out the scientific basis of underlying technologies and showcase the technology developments that can be applied to ensure high-temperature (HT) geothermal storage systems can be designed, implemented, and integrated using a smart control system.

The dissemination activities for academia include organizing a summer school for advanced MSc students and PhD candidates. A key part of this will be conducting dissemination and teaching sessions of the tool in the modelling courses offered during the summer school. Lectures and site visits will be organized to raise awareness of the technological application and developments specifically in the context of HT-geothermal storage.

The implementation of the system itself and showing the workings can be a great showcase and dissemination activity in itself. The target group of district heating network operators, geothermal storage site operators, and drilling contractors will be invited to demo sites to showcase tested technology results. Presentations will be made at exhibitions and professional organizations. Verbal communication during site visits will be used as a means of dissemination. Additionally, information will be published on the PUSH-IT webpage, including factsheets, posters, and social media. There is also a possibility of utilizing patents for evaluating technology, extending portfolios, and showcasing new service/products.

The dissemination activities for investors are expected to be primarily through the site plan rather than focusing on individual technologies.

Policy makers, licensing authorities, and municipalities will be engaged through the demonstration of new drilling and completion technologies at the demo-sites, in Delft and also in other sites. Scientific publications will also be utilized to disseminate relevant information. The media used will include scientific journals and the PUSH-IT website. Site visits and contributions to meetings and working groups will further provide opportunities for dissemination. The expected outcome is to contribute to the underlying knowledge required for the improvement of drilling operations and legislation concerning smart control technologies.

2.4.3.2. Task 3.2 Smart district heating network control

The goal of this task is the dissemination is to broadcast and advertise the tailor-made control objective and collaboration between control and co-simulation approaches, both empirical and numerical. Specifically, the relative dissemination activities are dependant for each targeted group.

WP3 propose to engage the scientific community through an activity focused on publishing scientific papers and active participation in prestigious scientific congresses. Some of these activities have already taken place and more are planned in the future. The communication channels primarily consist of open-access peer-reviewed scientific journals and conference proceedings. Our objective is to contribute valuably to the ongoing research on smart control algorithms for DH (District Heating) networks, thereby advancing the field and fostering collaboration within the scientific community.

For the second target which is academia, additionally from academic classic dissemination through papers and conference, the PUSH-IT project wants to launch an engaging initiative specifically targeting advanced master students and PhD candidates. The proposed initiative includes a summer school program designed to cater to their needs. As part of the program, dissemination, and teaching sessions on control strategies, and how to use the control tool will be conducted within the modelling courses. Additionally, lectures and workshops will be given to raise awareness among students and PhD candidates about the importance of smart

control. It is the aim of the project to have real life examples up and running during the summer school. The objective is to provide them with knowledge and understanding in this field, encouraging their interest and active involvement in research and innovation.

The third target, district heat network operators and geothermal storage site operators, will be invited to a demonstration site showcasing the results of the smart DH network controller. The invitation includes workshops and site visits as part of the engagement. The purpose of this dissemination strategy is here is to raise awareness among network operators about the potential benefits of smart control and aims to demonstrate how the implementation of smart control can optimize operations and enhance the efficiency of district heat networks.

The objective of this dissemination plan is to also raise investor awareness of the potential and benefits of smart control technologies, fostering technological development and enhancing investment efficiency. Proposed activities include demo site visits, network activation and clustering, informative workshops, and site visits to operational projects. Communication channels will involve a project website, social media platforms, direct communication through emails and newsletters, and collaborations with industry associations. By implementing this plan, the PUSH-IT project aims to raise awareness, foster collaboration, and drive investments in smart control technologies, unlocking their full potential for sustainable development and improved efficiency across sectors.

Another target of this plan is to disseminate awareness among policy makers, licensing authorities, and municipalities regarding the importance of smart control in decision-making processes and policy development. To achieve this, it proposes contributing to exhibitions, panel discussions, and conferences specifically targeting decision makers. Through presentations and exhibition booths, it will actively engage decision makers and provide them with information about the benefits and necessity of smart control. Additionally, the PUSH-IT will collaborate with sector organizations to maximize our reach and impact. By effectively disseminating the advantages of smart control technologies and emphasizing their role in policy development, it aims to create understanding among decision makers and promote the adoption of smart control in various sectors.

Finally, our dissemination plan for the smart control activities also targets the general public, with following content and means, e.g. through open-air scientific public events, including demo site visits and pedagogical presentations. Information panels about the PUSH-IT project and demo-site visits are displayed. The plan also involves utilizing social media, press releases, and an advertising campaign in the city to reach a wider audience and effectively communicate the advantages of smart control technologies.

2.4.3.3. Task 3.3 Water quality and environmental impact control

Task 3.3 on water quality and environmental impact control aims to deliver guidelines to research and if applicable deal with various issues related to water quality, and recommendations for facilitating regulatory and political evolutions. For this, several dissemination actions are planned towards different audiences.

The BRGM (leading the task and co-supervising a PhD student with GFZ), GFZ and KWR have targeted three publications and participations to conferences and scientific congresses. The journals selected for submission target the scientific community of heat storage systems in geothermal reservoirs, as well as geochemistry/ microbiology community, to raise the awareness on the water quality and environmental impact for the heat storage systems in geothermal reservoirs community, and to raise interest and applicability of geochemistry- trans disciplinary in fundamental academic community.

The main deliverable of the task has a broader audience, proposing a framework to deal with water quality issues in heat storage systems. Decision making support (e.g. decision trees) will be elaborated. General recommendations for future sites will be formulated. This

deliverable will target all stakeholders of future sites. It will be delivered at the end of the project (M46).

Findings tied to environmental impacts will be fed into the dissemination strategies described above in WP2, so they are communicated globally and locally (site-specific results all along the project and more general results at M46).

2.4.3.4. Task 3.4 focuses on the system performance assessment and optimization.

Installation and monitoring the heat storage system is done in the previous tasks, the role of task 3.4 is to assess from these datasets and workflow the performance of the system and attempt to optimise it to its best. In this task, several dissemination activities relative to the specific sub-tasks, as well as cross-tasks activities are planned to promote the PUSH-IT outcomes.

For this the following audiences are targeted on the specific high technical ends related to the sub-tasks with Reservoir assessment with High Pressure Production Trap and Enhanced Geothermal Response Test methodologies and publications.

Scientific dissemination also goes through publicly available datasets of the demo sites test phases (both sub surface and district heating grid datasets), when possible (example of Darmstadt which is currently running field tests).

The co-simulation subtask (3.4.2) has a considerable potential for dissemination, as this task will provide a toolbox and hand-on solution. Both the scientific community, as well as district heating network managers to have a numerical estimation and potential optimisation platform for the modular adaptation of heat storage in geothermal reservoirs systems into the district heating grid, with large possibilities of scenarios and time frequency analyses from seasonal optimisation to long terms scenarios model simulations, which can help policy makers in their multicriteria based decision making processes.

2.5 Timeline

The dissemination strategy considers the project to consist of the following three main parts, coupling priorities to each of these phases:

During the initial 8-month period of the project, efforts were focused on developing a project branding strategy and identifying opportunities for dissemination. A project website was created and a graphical identity and stationery was created which includes a project logo and templates for various project documents such as presentations and newsletters. The logo and templates have additionally received an update in the second year of the project. Giving the template and logo are more professional feel and look. Additionally, liaising opportunities with other relevant Horizon Europe geothermal projects were identified and possible clustering activities are currently being discussed. For example, dissemination and communication activities planned together with EU projects Interstores, Treasure and Uses4heat.

1. From months 9 to 36, the project has entered the targeted dissemination phase, utilizing various tools to reach stakeholders and audiences. Virtual methods such as social media and website updates have been employed, along with printed materials such as infographics and project brochures. Live meetings, including expert workshops and conferences, are also being utilized to promote the project objectives and explain the work plan timeline and activities taking place within the consortium's WPs. To build trust with stakeholders, transparency is a key focus, including sharing methodologies used and showing intermediate and preliminary results. Additionally, video updates are produced to achieve this goal.

2. From Month 37-48 the project enters its final stage. It will focus on finalizing activities, analysing, and presenting final results, and disseminating the final outcomes and recommendations to stakeholders. Planning for any potential follow-up activities or next steps based on the project's results will also be considered next to activities that have already taken place in the past.

Important dissemination milestones throughout the project are shown in Table 9.

Table 9: Milestone listing for the dissemination activities

Milestones no.	Milestone Title	Due date [M]	Means of verification
M4.1.	Technical progress - Newsletters at M9, M18, M27, M36, M45]	9	Newsletters
M4.1.	Technical progress - Newsletters at, M18	18	Newsletters
M4.1.	Technical progress - Newsletters at, M27	27	Newsletters
M4.1.	Technical progress - Newsletters at, M36	36	Newsletters
M4.1.	Technical progress - Newsletters at, M45	45	Newsletters
M4.2.	Demo/follower site video's	36	Video's
M4.4.	Public stakeholder Demo site workshops	36	Minutes of meeting
M4.6.	PUSH-IT Summer school	40	Minutes of meeting
M4.7.	PUSH-IT final Symposium	48	Minutes of meeting

3. Exploitation plan

3.1 Vision and Goals

To reach EU long-term objectives, the results obtained in the demonstration and follower sites will be made available to parties in the supply chain e.g., heat network companies, drilling companies and geothermal operators. PUSH-IT will do this by executing the exploitation plan. The exploitation plan can be on a partner's individual level but also potential for synergies have been explored. At the end of the project the marketable results will be taken up by the commercial partners for further development as product or service.

3.2 Introduction

There is a growing importance of renewable energy and seasonal energy storage. The technologies developed within PUSH-IT contribute to the wider need for seasonal energy storage. Within PUSH IT there are three different Underground Thermal Energy Storage (UTES) technologies that are being developed, Mine Thermal Energy Storage (MTES), Aquifer Thermal Energy Storage (ATES) and Borehole Thermal Energy Storage (BTES), along with a number of supporting technologies. These three technologies can contribute to seasonal energy storage in different ways and are often bound to certain geographical features. All technologies are developed to allow storage at high temperatures. All sites have commercial partnerships for the development of the different storage technologies. This allows commercial parties to acquire firsthand knowledge of the different technologies without the considerable risks of developing UTES or the supporting technologies solely.

3.3 Target Sectors and Stakeholders

Successful further exploitation of the results of PUSH-IT requires a clear and thorough determination of the target sectors and stakeholders. PUSH-IT initially determined the following sectors and stakeholders for the purpose of exploitation:

- Scientific community;
- Academia;
- District heat network operators, geothermal storage site operators including specialised engineering and software companies: they will be the direct users of PUSH-IT's results;
- Investors;
- Licensing authorities, municipalities, and citizens.

Although these list of stakeholders and target sectors still apply, during the trajectory of PUSH-IT and the development of the different technologies it has become clear that the three technologies are suitable for a number of different application. Depending on the application the target sector may vary. Below an overview of the technologies will be given along with their unique characteristics, from these characteristics, KERs already emerge. Because of the differences in characteristics a more precise list of stakeholders for each technology was created by each site. These lists or currently not static and are evolving throughout the project.

3.4 Technology Overview

3.4.1 Mine Thermal Energy Storage (MTES)

MTES uses abandoned mines filled with mine water to store excess thermal energy. MTES technology therefore has the prerequisites of abandoned mine shafts. Abandoned mine shafts are often already flooded with mine water, the storage capacity of a MTES is largely dependent

on the size of the abandoned mines and the connectivity between the mine shafts. Larger systems will be able to provide peak loads for district heating networks in winter. Or are able to provide heating for campuses or city districts in winter with the storage excess heat generated in the summer.

3.4.2 Aquifer Thermal Energy Storage (ATES)

ATES systems use natural aquifers for thermal energy storage. ATES systems vary in size and capacity depending on the subsurface as well as the number of wells drilled. ATES systems are best suited for storing excess thermal energy generation in summer. Examples include excess heat from geothermal wells, gas or coal fired power plants and in the future might also include excess heat from hydrogen production.

ATES system can have a large capacity but are also scalable by drilling extra wells, increasing the output (and input) capacity. Due to the volume with ATES systems they are best suited for large-scale applications like heating districts, horticulture and industrial plants.

ATES systems can be created anywhere were there are natural aquifers and a source of excess heat.

3.4.3 Borehole Thermal Energy Storage (BTES)

BTES systems use boreholes for energy storage. These systems are the most versatile among the technologies described. However, they also provide the least amount of storage capacity. For BTES existing boreholes can be used or new boreholes can be created. BTES systems are in general not bound to any geographical features and can be utilized in any area that has an excess amount of thermal energy in the summer.

BTES systems are most suitable for smaller and medium scale systems. Examples include, small industrial facilities, large offices, residential blocks. An advantage of the technology is that the storage capacity of the system is more predictable than the other technologies. Additionally, the costs are also predictable however may vary due to differences in drilling costs.

3.5 Business Models and Market Analysis

PUSH-IT will develop business models for each of the eligible Key Exploitable Results, KERs. Some of these KERs are already developed as a business proposition by a partner of the PUSH-IT consortium and will therefore also be further developed in that partner's own organisation. Other KERs, developed during PUSH-IT's work, will be carefully assessed on the market potential. Based on the market potential of a KER a business model will be developed. The proposed business models will include three key elements: value proposition, configuration of value creation and revenue/financial model. All industrial partners will contribute to the development of PUSH-IT main exploitable solutions and will be involved in the process that determines whether the solutions offered by each of the technologies create a positive business case. This will be done as part of the work of the normal work for each of the proposed technologies, as the aim is that the three demo sites will have commercially viable systems running by the end of the PUSH IT project. For some projects a comprehensive Business Case is already available. For example, Delft has an integrated business case with the Delft geothermal site showing the financial viability of the project. By 2026, the solutions will have been tested at Technology Readiness Level (TRL) 7 in the 3 demo-sites. At this point, an accurate assessment can be made whether the technologies based on their underlying KERs deliver a positive value proposition and business case.

To perform the business model and market analysis, PUSH-IT provides a number of tools that are commonly used in the innovation management field: the Business Model Environment Map (BMEM), the Value Proposition Canvas (VPC) and the Business Model Canvas (BMC). These tools can be used to determine the exploitability of the different technologies however we realize that more suitable models might be applicable in certain cases.

3.5.1 Business Model Environment Map

The Business Model Environment Map (BMEM) helps in identifying new opportunities for innovation. It helps to look at an existing business model through a series of lenses: Key Trends, Market Forces, Macro-economic forces, and Industry forces. By addressing these forces, potential new propositions can be determined and developed further.

During the implementation of the technologies, these forces can be mapped and updated when major changes will occur with significant potential impact to the business model of a KER. For example: when regulatory trends towards underground heat storage will change in favour of these solutions, this will create a major positive impact on projects delivering these solutions. It is important for technologies employed with PUSH-IT to keep track of these forces when assessing the real-world potential of PUSH-IT KERs.

Business Environment Map: Definition and Usage

A business environment map is a strategic tool used to visualize external factors that can influence a company's operations, performance, and decision-making. It helps businesses identify opportunities, threats, and trends that may affect their industry. The map typically consists of different layers representing economic, political, social, technological, environmental, and legal factors (often referred to as the PESTEL framework). Some versions also include competitors, suppliers, customers, and industry trends.

How to Use a Business Environment Map:

1. **Identify Key Factors:** Start by listing relevant external factors under each category (e.g., economic trends, regulatory changes, emerging technologies).
2. **Analyse Their Impact:** Evaluate how each factor could positively or negatively influence your business. For example, a new regulation may increase operational costs, while technological advancements might improve efficiency.
3. **Prioritize Factors:** Not all factors have the same level of impact. Determine which ones are most critical to your business and require immediate attention.
4. **Monitor Changes:** The business environment is dynamic, so regularly update the map to reflect new developments and shifts in trends.
5. **Develop Strategies:** Use the insights from the map to formulate strategies that capitalize on opportunities and mitigate risks. This can inform decision-making in areas like market expansion, risk management, and competitive positioning.

A well-maintained business environment map enhances strategic planning and helps businesses stay agile in a rapidly changing landscape.

3.5.2 Value Proposition Canvas

When a KER is assessed and ready for further exploitation the team working on that KER will enter the next phase: the creation of the initial Value Proposition for that KER and the validation of existing assumptions surrounding the initial Value Proposition for that specific KER.

The VPC can help in determining the specific value that can be derived from the KERs and for which target audience this value is most important in order to create adoption. PUSH IT partners can use this model to establish the potential of the KER.

Value Proposition Canvas: Definition and Usage

A Value Proposition Canvas is a strategic tool used to design and analyse the value a product or service offers to customers. It helps businesses align their offerings with customer needs by breaking down key elements into two main sections: the Customer Profile and the Value Proposition.

How to Use a Value Proposition Canvas:

1. **Define the Customer Profile:** Identify customer segments and outline their jobs (tasks they want to accomplish), pains (challenges and frustrations), and gains (desired benefits and outcomes).
2. **Map the Value Proposition:** Determine how your product or service addresses customer needs by listing pain relievers (how your solution alleviates customer problems), gain creators (how it enhances benefits), and product/service features that deliver value.
3. **Identify Fit:** Ensure a strong alignment between what the customer needs and what your product or service offers. Adjust and refine your value proposition as needed to create a better match.
4. **Test and Validate:** Gather customer feedback, analyse market response, and iterate on the value proposition to enhance its effectiveness.
5. **Use for Strategy Development:** Leverage insights from the canvas to refine marketing messages, improve product development, and optimize business models.

A well-structured Value Proposition Canvas enables businesses to create compelling offerings that resonate with customers, leading to greater market success.

In a standard innovation process these mapping points are assumptions which need to be validated with the intended target customer. It needs to be determined if, when and how this will be done in the context of the PUSH-IT project. Within PUSH-IT the consumer can also be part of the consortium and is actively working to develop the technology, with the aim to make use of a KER. However, consumers can also be outside the consortium and more effort will be needed to establish whether the value proposition is valid.

3.5.3 Business Model Canvas

After completing the VPC the initial business model of the KERs can be established. The Business Model Canvas (BMC) will help in visualising the potential business models and in determining the next steps towards successful exploitation of a KER.

Business Model Canvas: Definition and Usage

A Business Model Canvas is a strategic tool that provides a structured way to analyse, design, and refine a business model. It consists of nine key building blocks that outline how a company creates, delivers, and captures value.

To use the BMC effectively, teams working on a KERs will use the value proposition that came out of the VPC session. Next, teams will fill out the canvas with information in the nine sections. These sections include customer segments; value proposition; channels, customer

relationships, revenue streams, key resources, key activities, key partnerships, and cost structure.

Once the canvas is filled out, the KERs responsible teams will look for connections between the different sections. Focus will be on how the initial value proposition connects with the established customer segments and how the key resources support the key activities.

How to Use a Business Model Canvas:

1. **Customer Segments:** Identify the different groups of people or organizations your business serves.
2. **Value Proposition:** Define the unique value your products or services provide to customers.
3. **Channels:** Determine how your business delivers value to customers (e.g., online, physical stores, partnerships).
4. **Customer Relationships:** Describe the type of relationship you establish with each customer segment.
5. **Revenue Streams:** Identify the ways your business generates income from each customer segment.
6. **Key Resources:** List the critical assets required to operate your business successfully.
7. **Key Activities:** Outline the essential actions your business must take to deliver value.
8. **Key Partnerships:** Identify external companies or suppliers that help your business function effectively.
9. **Cost Structure:** Determine the primary costs associated with operating your business.

Implementation Steps:

1. **Fill Out Each Section:** Use sticky notes or a digital tool to complete each building block.
2. **Analyse and Adjust:** Evaluate whether the components align with your business goals and adjust as necessary.
3. **Test and Validate:** Gather feedback from customers and stakeholders to refine the model.
4. **Iterate and Improve:** Continuously update the canvas to adapt to market changes and business growth.

Next focus is on the testing of the assumptions by talking to customers, partners, and other stakeholders. Feedback will then be used to refine the business model and make it more effective.

Also, PUSH-IT partners need to be aware of the fact that the BMC is a living document that should be updated and refined as the business evolves. It can be used to track changes and make strategic decisions about the future of the business.

Also as part of the PUSH IT program, two tool are being developed the levelized cost of energy (LCOE) reduction tool as part of work package two and the Spatial Multi-Criteria analysis (SMCA) tool as part of work package 4. These tools in itself might provide KERs of the HT-UTES technologies. A short description is given below.

3.5.4 LCOE reduction tool

A developed open-source tool to assess and optimise LCOE reduction and costs of carbon emission reduction. The tool can capture the system dynamics of heat supply, storage operational performance, techno-economic parameters, and uncertainty of future heat demand. Quantitative risk assessment on the business case will be carried out to provide the probability distribution of LCOE.

3.5.5 Geographical Information System web-app for potential mapping (SMCA tool)

The delivery of a PUSH-IT WEB- Geographical Information System platform to visualize and interrogate a set of grid maps displaying the favourability of implementation for the different heat storage in geothermal reservoir technologies analysed at different scales (national to the individual site implemented in PUSH-IT).

3.6 Key Exploitable Results

PUSH-IT has determined an indicative list of Key Exploitable Results (KER), based on current interactions within the PUSH IT consortium and industry partners.

3.6.1 High Temperature Underground Thermal Energy Storage KERs

Seasonal energy storage

The main advantage of the HT-UTES solutions is that it allows the storage of excess heat production in summer. The summer period is often characterized by low heat demand, meaning that heat producing facilities are often ideal or operating below their design capacity. HT-UTES systems have the capacity to store large amounts of thermal energy at high temperatures and efficiency. HT-UTES therefore allows facilities to operate throughout the summer, lowering costs and in some cases facilities can be designed at lower operating capacities.

Drop-in solution for back-up and peak demand

The width-in PUSH IT developed UTES systems can be used as drop-in solution for replacing fossil fuelled peak and back-up plants. The UTES systems can be utilized in a similar manner to a gas fired power plants. Gas fired power plants or currently often used in a back-up/peak role in district heating. The UTES systems developed here can operate alongside a renewable source and function as solution for peak demand as well as back-up source, depending on the size and capacity of the system. Other (underground)storage technologies lack this capability, as they have only limited volume or lack the required temperature (>90°C).

Small footprint

UTES systems have a small footprint compared to other storage technologies. As the UTES is mostly realised underground it does not require large tanks that require significant space to as well as insulation and safety measures. Therefore they can be placed in urban areas with limited availability of space and close to the heat demand.

3.6.2 Supporting technologies KERs

Before the start of the project a number of supporting technologies KERs have been identified. This list has does far not been expended but might be throughout the rest of the project. Especially when these technologies are starting to be used in practice.

Drilling: GRE casing

Glass fiber re-enforced epoxy (GRE) is a composite material, newly applied for cheap completion of HT-wells. These products and methods will be developed to a demonstration level.

Drilling: Expanded diameter gravel wells

This technology has been recently demonstrated for low temperature storage allowing wells to be installed with a diameter of over 2m in the geothermal reservoir. This will reduce the number of wells needed in such systems and reduce the injection pressure required, thus reducing both capital and operational expenditure.

Integration: Machine learning based DH control system

The smart DH network controller is able to adjust the heat demand of the network using demand response so that the heat demand is tailored to the real-time conditions of the geothermal reservoir and the heat producing installations. Furthermore, the smart DH network controller will be able to minimize the supply and return temperature of the network, and as such minimizing the heat losses in the network and maximizing the capacity of the capital cost intensive geothermal wells by increasing the difference between extraction and injection temperature.

Integration: Develop algorithms for coordinated management of multiple heat sources

These algorithms actively control the temperature profile of the storage system, thus providing a flexible online storage capacity adjustment. It actively controls the heat flow infeed temperature to the DH system, increasing the network operation flexibility by admitting different return temperatures.

Integration: Co-simulation

PUSH-IT will optimise integration in heat systems via co-simulation and machine learning (currently more well known under the term Narrow Artificial Intelligence) based control for demand side management to optimise heat utilisation, reduce supply and return temperatures in the network, and maximise network flexibility to reduce GHG emissions. Digital twins will be developed and applied to optimise the design of parameters, operation, and integration into heating systems for each site. It will compose and validate a toolbox that can be used to predict subsurface dynamics, system performance and economically optimise integration of geothermal energy storage in local heat distribution networks and power infrastructures.

Monitoring: ATEs and MTES

The multi-disciplinary and glass fiber based geomechanically and thermal monitoring of open systems reservoir provides a cost-efficient and 4D monitoring of energy storage, to ensure its performance and sustainability.

Monitoring: Enhanced Geothermal Response Test and glass fiber monitoring for BTES

Well test for closed loop systems to characterise the reservoir behaviour in terms of geothermal storage potential. Here the standardised procedure for monitoring installation, test, and evaluation will be applied for BTES demo-sites.

Testing: Push-pull HT performance test

The test procedure will be further developed for HT-ATEs/MTES into a standard test procedure and will be applied at project demo sites.

During PUSH-IT all the above KERs will be assessed on their potential which is depending on the result of their usage in the project itself.

3.7 Planning and Milestones

Phased approach

The PUSH-IT exploitation plan consists of the following phases:

Phase 1 (2023 – 2024)

- Potential mapping: The initial potentially KER will be reviewed other results will be identified and their potential for further exploitation will be assessed. – KER list has been edited and expanded based on experiences within PUSH IT.

Phase 2 (2024 – 2025)

- Market analysis: To identify the feasibility of the KERs listed in this section and other project results, a market analysis has to be conducted. This market analysis will be conducted in 2025 and will leverage the first results of the LCOE tool and the SMCA tool.

Additionally, PUSH-IT will use the following methods to analyse the attractiveness and target users of exploitable results:

- Market mapping (BMEM, VPC): market mapping will match potential customers for exploitable results. Early strategies for customer development will be considered.
- Strengths, Weaknesses, Opportunities and Threats analysis (BMEM): a SWOT analysis will be conducted to identify strengths, weaknesses, opportunities, and threats of all potentially KERs.
- And most importantly PUSH IT make a business case analysis for three different UTES technologies, in order to determine whether UTES offer a viable solution for energy storage and is able to lower the LCOE of customers.

Phase 3 (2025 - 2026)

- Using the BMC for each of the three different technologies a short business plan will be written, containing possible applications, the strength and weakness of each technology, viable markets and a business case.

3.8 Intellectual Property Management

3.8.1 Management and Commercialization of IP

The intellectual property (IP) generated during the PUSH-IT project is an important asset for the consortium partners, and it is essential that it is managed and commercialized effectively. The broad agreement within the consortium partners is that parties that develop technologies own their IP, and the exploitation of the technology are done within the consortium. The following procedures will be followed to manage and commercialize the IP generated during the project:

Identification of IP: Each partner is responsible for identifying the IP generated within their respective WPs. The project coordinator will compile a comprehensive list of all identified IP, which will be maintained throughout the project.

Ownership of IP: The partner or partners who generate the IP will own the IP. This ownership will be established in the consortium agreement and confirmed in the respective partner's contribution agreement.

Protection of IP: The protection of the IP will be ensured by obtaining the necessary patents, copyrights, and other legal protections. The consortium partners will decide which IP will be protected and the means by which it will be protected. All partners will work together to ensure that the IP is protected effectively.

Exploitation of IP: The exploitation of the IP will be done within the consortium. The consortium partners will determine which IP will be exploited, and how it will be exploited. The exploitation of the IP will be governed by the consortium agreement and confirmed in the respective partner's contribution agreement.

Licensing of IP: If a partner decides not to exploit their IP, they can choose to license it to another partner within the consortium or to a third party. The licensing agreement will be governed by the consortium agreement and confirmed in the respective partner's contribution agreement.

Commercialization of IP: The commercialization of the IP will be done by the consortium partners. The consortium partners will determine which IP will be commercialized and how it will be commercialized. The commercialization of the IP will be governed by the consortium agreement and confirmed in the respective partner's contribution agreement.

Monitoring of IP: The project coordinator will be responsible for monitoring the IP generated during the project. The IP will be monitored to ensure that it is protected, exploited, licensed, and commercialized in accordance with the consortium agreement and the respective partner's contribution agreement.

3.8.2 Confidentiality and Trade Secret Guidelines

The PUSH-IT consortium recognizes the importance of confidential information and trade secrets in the development and commercialization of the project's intellectual property. The consortium partners agree to establish guidelines for the management and sharing of such information to ensure its protection and to prevent unauthorized use or disclosure.

Identification of Confidential Information and Trade Secrets: The consortium partners will identify any confidential information or trade secrets developed or used in the project. Confidential information is defined as any information that is not generally known or easily accessible to the public, and which has commercial value. Trade secrets are defined as confidential information that gives a competitive advantage to the owner.

Ownership of Confidential Information and Trade Secrets: The ownership of confidential information and trade secrets developed in the project will be determined by the agreements between the consortium partners. The partners who develop the confidential information or trade secrets will own them, unless otherwise agreed upon in writing.

Protection of Confidential Information and Trade Secrets: The consortium partners will take reasonable measures to protect the confidentiality and secrecy of the information, including:

- Limiting access to confidential information and trade secrets to those with a need to know.
- Marking all documents containing confidential information and trade secrets with a notice that the information is confidential.
- Storing all documents containing confidential information and trade secrets in a secure location.
- Implementing physical and technical security measures to prevent unauthorized access to the information.

Sharing of Confidential Information and Trade Secrets: The consortium partners will share confidential information and trade secrets only on a need-to-know basis, and only with those who have signed a non-disclosure agreement. The non-disclosure agreement will include provisions for the protection of the information, including limitations on use and disclosure, and obligations to return or destroy the information upon request. In cases where the consortium partners wish to share confidential information or trade secrets with third parties,

they will obtain written consent from the owner(s) of the information and will ensure that the third-party signs a non-disclosure agreement.

Enforcement of Confidentiality and Trade Secret Guidelines: The consortium partners will enforce the confidentiality and trade secret guidelines through appropriate legal means, including injunctive relief, damages, and/or termination of the agreement. Any breaches of the guidelines will be investigated promptly, and the consortium partners will take all necessary steps to mitigate the damage caused by the breach.

4. Communication plan

4.1 Introduction

As described in Chapter 1 the goal of communication is to ensure that PUSH-IT results are widely available to stakeholders and integrated in industry workflows. The communication strategy aims to:

1. engage stakeholders and members of the public and provide knowledge in an accessible manner, and
2. address the challenge of increasing the use of geothermal energy in Europe and beyond.

To successfully reach these goals as a consortium, communication objectives, key communication principles and process guidelines have been established. The communication strategy has been divided into three phases: awareness, engagement and activation. The objectives for communication have been determined per phase. The next chapters will describe the strategy in more detail.

4.2 General approach & organisation

The communication strategy is based on three main principles described below. To ensure a smooth implementation of the strategy, guidelines for the communication process have been made. These guidelines describe how the coordination and execution of the communication strategy is organised in the PUSH-IT consortium.

4.2.1 Communication principles

Technology driven, people oriented

- Focus on future societal impact: technology for the benefit of people, society & planet. Although PUSH-IT is focused on new heat storage technologies, it aims to communicate the impact on people, society, and planet. How could or will they benefit from these technologies? How does technology solve their issues? How could these technologies be of benefit? PUSH-IT is technology driven and people oriented.

Feasible, viable, tangible

- Real questions, real concepts, real results, real people. PUSH-IT does not merely want to communicate ambitions, plans or ideas - it wants to be as concrete as it can. The PUSH-IT project wants to address the actual scientific and societal questions. Convey feasible and viable concept. Show real and tangible results, both scientifically and in terms of building and realisation of the site. And tell about the actual needs and wants of the people involved: users, stakeholders, project team members.

Central coordination, local execution

- Centralised communication strategy, local focus, and execution. PUSH-IT amplifies the local content of the local sites. By providing a communication framework with strategic content, it conveys a uniform message of PUSH-IT's goals. The specific local content makes every PUSH-IT message relevant to the local stakeholder-community, because it has a strong focus on the local context and practise. And via the European PUSH-IT communication network, this can in itself inspire other local stakeholder-communities.

4.2.2 Communication process guidelines

Central coordination, local execution

- Centralised communication strategy, local focus and execution.

The central communications team provides the strategic framework and strategically relevant content calendar. Local communication teams are able to provide a local add-on to the generic PUSH-IT content and communicate this through their own local channels and to their own local stakeholder network.

Collaboration through co-creation

- Local focus amplified via overall communications team and vice versa.

Together with the local communication teams it focuses on organising and executing the overall content calendar. Since the local teams have a good understanding of the progress within their own project, they can provide for the needed local content. Having the overview of all the project sites, the central communication team is able to put all these elements together.

Alignment with project development

- Milestones in Research & Development project development are met by communication milestones.

Communication always follows the project development progress. The progress and contents of the WPs is leading for the communication process and content.

4.2.3 Global – local approach

During the project, communication activities will be in line with these principles and process guideline. Much of the above is based on the situation that PUSH-IT, although a project with a multi-country scale and approach, consists of a local project dimension with its own local particularities. The PUSH-IT project can govern and structure much of the central communication activities and keep these aligned with the core project. However, the local sites will also have to communicate to their own stakeholders on their own project's behalf. This cannot be governed from a central team. That is why PUSH-IT has chosen for a global – local approach which is illustrated in Figure 1.



Figure 1: Framework for global and communication local approach

The ‘scale’ determines at what level a topic is relevant and which stakeholders would be interested in these topics. The **top row represents the global scale**, which includes content relevant for the entire PUSH-IT project and its partners, external stakeholders such as policy makers, the public, and industry professionals. This global scale content is coordinated and disseminated by the PUSH-IT communication team; content is provided by the WP and site communication leads. The **bottom row represents the local scale**, which included content relevant only to the local context of a specific site, such as implications of the PUSH-IT project on the local community and developments at the site. The local scale content is aimed at local stakeholders and disseminated and created by the site communication leads, using the overall project communication strategy as guidelines.

The ‘topics’ consider global, project-wide topics (such as safety, social impacts, sustainability, technological developments, project results) and local topics (local results). Global topics include the project goals and themes and are mainly steered by the communication team via the strategic content calendar. Local topics follow from the site developments.

Each box in the diagram of Figure 1 specifies the content owner and the type of content that belongs in that box.

4.2.4 Communication organisation design

Coordinating communications for a large consortium with multiple work packages and site locations requires a thorough structure. Hence, the following setup with corresponding task division was established and communicated with the entire PUSH-IT consortium (Figure 2).

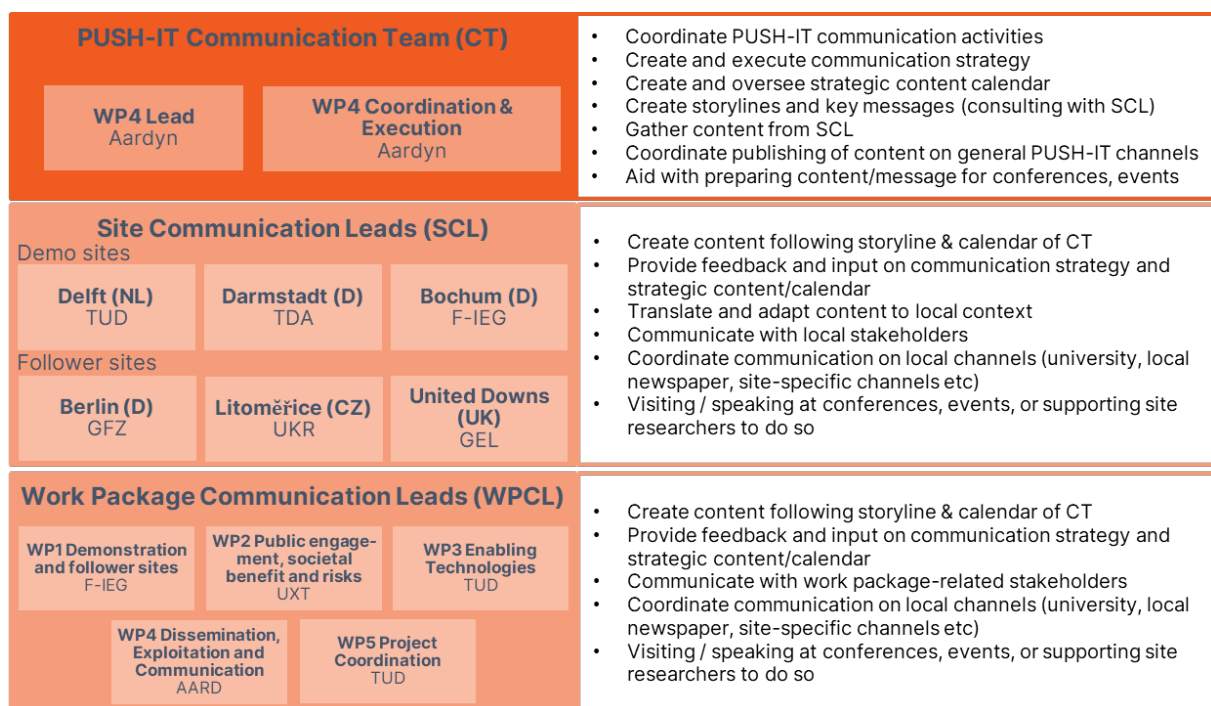


Figure 2: Communication organisation and division of responsibilities

4.2.5 Meetings and consultations

We have established a structured process for meetings and consultations to ensure effective coordination of communication activities, timely content sharing, and alignment across all project teams:

Quarterly communication coordination meetings

These meetings, held once every three months, bring together the communication team and the site and WP leads:

- Communication team and WP/site leads share updates, developments and upcoming activities.
- Coordinating upcoming communication activities.
- Identifying strategic content opportunities and events.

During steering committee meetings:

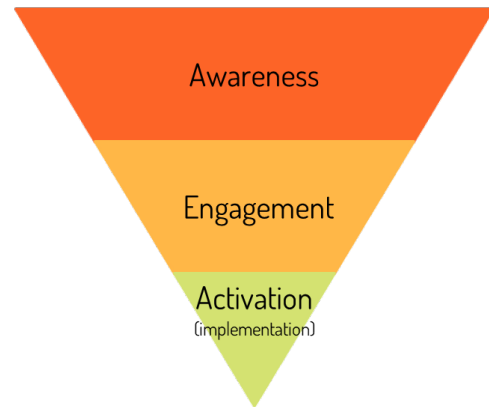
- Discuss what topics are to be communicated externally.

Ongoing communication

On a regular basis, or as necessary, the following processes will ensure a smooth and proactive flow of communication:

- Communication team sends updates on upcoming content that is needed from communication leads.
- Communication team sends requests for content to communication leads.
- Communication leads proactively send feedback, updates, and content to communication team.
- Communication leads send site/WP plans & developments to the communication team for the content and event calendar.

All requests will be made in a timely manner to ensure enough time for responses and ensure the quality of the communication.



4.3 Overall communication strategy

Communication follows the project development progress. The progress and contents of the work packages is leading for the communication process and content. In the WPs, there is a focus on the development of both TRLs and MRLs (Market readiness levels).

The communication related activities follow a phased approach. The phases and their high-level activities are:

Phase 0: Creating the push-it communication foundation (year 1)

Map stakeholder network per site, create PUSH-IT communication way of working, incorporate site plans in communication planning, involve Advisory Board, prepare social media channels.

Phase 1: Awareness (year 1)

The aim of the first communication phase is to raise awareness on the issues that PUSH-IT aims to address and on the importance of the project in solving these issues. Activities include

Website launch, create and execute proactive external communication calendar (including interviews, press releases, LinkedIn posts), event calendar, stakeholder sessions where relevant, progress updates, create and share videos.

Phase 2: Engagement (year 2, 3 and 4)

The aim of the second communication phase is to engage key stakeholders in the research and solutions that PUSH-IT is developing, to make these stakeholders interested and engaged in the project results. Activities include Maintain and execute pro-active external communication calendar (including interviews, press releases, LinkedIn posts), events, stakeholder sessions where relevant, progress updates, update communication plan, create and share videos.

Phase 3: Activation (year 3 & 4)

The aim of the third communication phase is to activate key stakeholders in adopting the results of the PUSH-IT project. Activities include maintain (social) media calendar, press releases, events, stakeholder sessions where relevant, progress updates, create and share videos.

Project close (year 4)

Follow-up steps and closing report.

The plotting of these phases in a timeline result in the view shown in Figure 3. The objectives and activities of different communication phases are described in more detail in the next section.

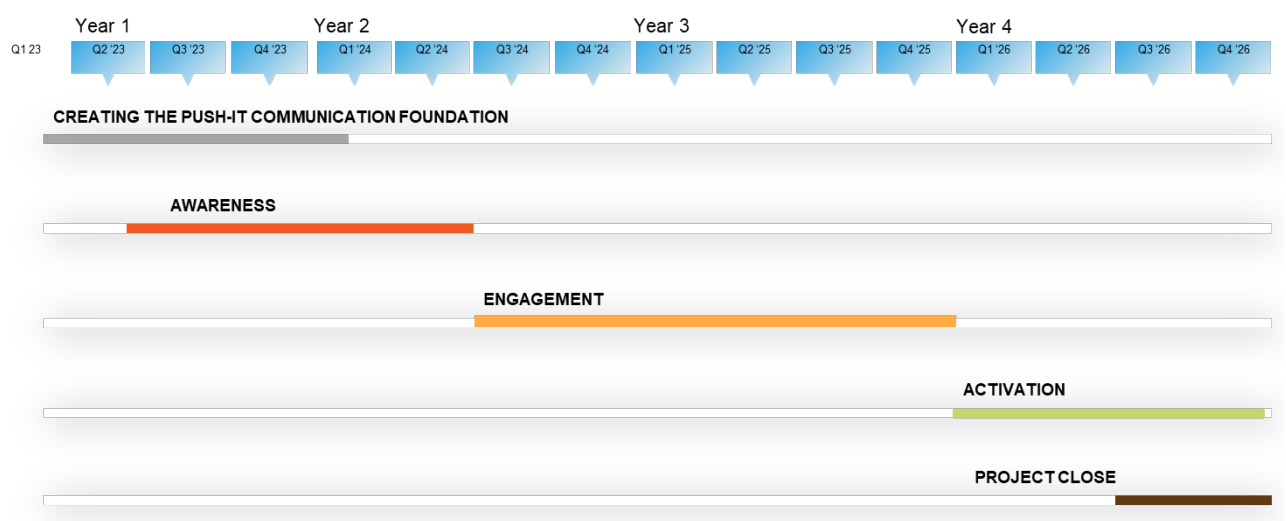


Figure 3: Timeline of communication strategy phases.

4.4 Objectives and activities per phase

Each phase of the communication strategy has a specific focus, which comes with distinct communication objectives and activities.

4.4.1 Strategy Phase 1: Awareness (M6-18)

Main goal awareness phase:

To inform our target audience about the existence, importance, benefits, and potential applications of the solutions that PUSH-IT is developing. The aim is to ensure that stakeholders understand what high-temperature heat storage is and why it is important.

In the awareness phase we define three main objectives:

1. Establish and maintain pro-active public relations & public affairs: update focus storylines and share key messages with media and stakeholders.

Activities

- Align & update focus storylines with PUSH-IT purpose & activities.
- Create and execute pro-active external communication calendar (including interviews, press releases, LinkedIn posts).
- Strengthen relations with key stakeholders, including media.
- Create and manage stakeholder network.
- In collaboration with other WP's create a pro-active approach on priority items.
- Align with PUSH-IT focus storylines.
- Build relations with key stakeholders.
- Initiate roundtables/events & speaking opportunities.

2. Create and implement an active & integrated social media management strategy.

Activities

- Quarterly news stand-up to feed media calendar.
- Update progress overview & share with consortium communication partners and wider media network.
- Preparing statements and Q&As on major progress points.
- Initiate pro-active approach on linked issues (e.g. geothermal energy, district heating networks, energy storage and societal engagement in energy transition).

3. Create a strong foundation for public relations & public affairs activities.

Activities

- Implement PUSH-IT communication way of working (structures & processes).
- Monitor media & stakeholders.
- Update external communication channels.
- Build PUSH-IT internal communications network.

4.4.2 Strategy Phase 2: Engagement (M18-36)

Main goal engagement phase:

To understand stakeholders' needs, drivers, and barriers in adopting and supporting high-temperature heat storage solutions. By fostering strong relationships and two-way communication, we can raise awareness of the technology and its benefits, improve communication effectiveness, and better prepare stakeholders for successful implementation.

In the engagement phase we define three main objectives:

1. Maintain a proactive public relations & public affair: Increase stakeholder engagement and build strong relationships.

Activities

- Reevaluate stakeholders and identify key stakeholders per site and find out their needs, barriers and perspectives regarding the project.
- Each sites strengthens or initiates relations with key stakeholders.
- Establish channels for two-way communication (such as workshops, surveys, and feedback sessions) to engage stakeholders in dialogue about the project's progress, challenges, and impact.

- In collaboration with Work Package 2.
- Use the networks and channels of consortium partners reaching wider and specific audiences.
- Organize stakeholder workshops at each of the three demo project sites to facilitate knowledge sharing and collaboration on a local level.

2. Stakeholder-centric communication and active social media management.

Activities

- Maintain proactive external communication calendar (e.g. interviews, press releases, LinkedIn posts, newsletter).
- Update progress overview & share with consortium communication partners and wider media network.
- Shift communication focus towards collecting & addressing stakeholder needs and interests.
- Sites should tailor their communication and outreach activities to resonate with different stakeholder groups.
- Create a strong foundation for public relations & public affairs activities.

3. Establish an active network within the heat (storage) ecosystem.

Activities

- Develop and maintain an active network of stakeholders within the heat (storage) sector in each country involved in the project.
- Participate in industry events and conferences to expand the project's reach and visibility within the sector.
- Initiate events & speaking opportunities for consortium partners (e.g. conference, congress, forums).
- Collaborate with industry partners and associations to leverage their networks and resources for mutual benefit.

4.4.3 Strategy Phase 3: Activation (M36-48)

Main goal activation phase:

The main goal is to convert interest and engagement in PUSH-IT's deliverables into tangible actions, such as the adoption of high-temperature heat storage solutions, policy support, or investment in further research and development. This stage focuses on moving from interest to implementation.

Objectives and Activities

1. Facilitating adoption and real-world application

Enable stakeholders to take concrete steps towards integrating high-temperature heat storage into their operations, fostering both local and sector-wide implementation.

Activities

- Implementation workshops and training sessions: Host specialized workshops for stakeholders focused on operational and technical aspects of UTES. A summer school on underground heat storage will be organised near the end of the project.
- Knowledge platform: Further develop the website where stakeholders can access tools and resources for implementation

2. Policy and regulatory advancement:

Engage policymakers to establish supportive frameworks and incentives that encourage the adoption and scalability of high-temperature heat storage.

Activities

- Policy Roundtables: Host discussions with policymakers and industry experts to align on regulatory needs, culminating in the publication of white papers with actionable recommendations.
- Policy / position papers for Stakeholders: Create policy or position paper helps municipalities and energy planners advocate for policy support.

3. Catalysing research and development investments:

Inspire investment in the ongoing development of high-temperature heat storage, particularly to address evolving needs and enhance long-term viability.

Activities

- Investor engagement program: Organize informational sessions for potential investors focused on the financial and environmental returns of high-temperature heat storage technology.

Table 10: Overview of main goals and activities per phase of the communication strategy.

Phase	Goal	Activities
Phase 1: Awareness	Inform the target audience about the existence, importance, and benefits of high-temperature heat storage and the solutions PUSH-IT is developing.	<ul style="list-style-type: none"> - Create a proactive external communication calendar (interviews, press releases, social media) - Strengthen relationships with key stakeholders - Establish and manage a stakeholder network - Organize roundtables and events - Monitor media and stakeholders
Phase 2: Engagement	Understand stakeholder needs and barriers regarding high-temperature heat storage and strengthen two-way communication.	<ul style="list-style-type: none"> - Evaluate and identify stakeholders per project site - Establish two-way communication channels (workshops, feedback sessions) - Organize site-specific workshops - Tailor communication for different stakeholder groups - Participate in industry events and conferences
Phase 3: Activation	Convert interest into tangible actions, such as adopting heat storage, policy support, or investment in further R&D.	<ul style="list-style-type: none"> - Implementation support packages - knowledge platform - Policy roundtables and white papers - Investor engagement program - Establish a long-term knowledge consortium - Annual stakeholder summit

4.5 Message house and key messages

Communication within PUSH-IT is based on a centrally driven message house structure. This framework is used to develop and articulate key messages for PUSH-IT. This way, it provides a structured approach to ensure consistent and effective messaging.

Table 11 shows the proposed description of PUSH-IT's purpose, goal, and three focus storylines with key messages and topics. These focus storylines will be further expanded and refined in the first phase of the communication approach as described in the next section.

Table 11: Proposed focus storylines for the PUSH-IT communication strategy.

Purpose	Contribute to a net-zero European economy and society in 2050.		
Goal	Successfully demonstrate the full-scale application of high-temperature underground heat storage in aquifers, boreholes and mines in six locations in Europe to overcome the seasonal mismatch between heat demand and heat generation from sustainable sources.		
Solutions	Underground heat storage is the missing link for future sustainable district heating networks.	Underground heat storage will be a safe, reliable and affordable method to support the use of sustainable heat.	Underground heat storage can be socially, economically and institutionally embedded.
Key messages	<p>Embed heat storage in heat networks to overcome the seasonal mismatch and increase reliability.</p> <p>With smart control and better operational strategies, UTES will reduce costs and emissions and increase efficiency.</p>	<p>Technological development of heat storage and enabling technologies increase performance and efficiency.</p> <p>This will speed up realisation of heat storage and improve performance, monitoring, smooth operation and safety.</p>	<p>We need to create a more favourable environment to enable wider adoption of underground heat storage.</p> <p>Through viable business models, improved societal engagement, and identifying drivers in policy, regulations & governance.</p>
Topics	<p>Storage techniques and their applicability in different locations.</p> <p>Better integration of energy sources and storage techniques in heat networks.</p> <p>Solving seasonal mismatch and making sustainable heat sources and networks more economically viable.</p> <p>Smart control and monitoring reduces</p>	<p>Robustness and reliability of the system.</p> <p>Impacts of underground heat storage.</p> <p>Supporting technologies and methods for faster and safe realisation, improved performance and decreased costs.</p> <p>Safe and high-quality water through solutions that address corrosion, scaling,</p>	<p>Increased public understanding of the need, solutions and societal benefits.</p> <p>Improved societal engagement during development and exploitation.</p> <p>Economic viability, business models and drivers for market upscaling.</p> <p>Regulatory approaches, governance and policies for</p>

	costs, heat loss and emissions.	geochemical and microbiological changes.	underground heat storage.
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4.6 Target Audience

Overall, PUSH-IT has four main target groups:

1. Industry professionals

This group includes district heat network operators, geothermal site operators, energy companies, specialised engineering and software companies and other professionals involved in the technical and operational aspects of heat systems. These stakeholders are essential for the technical implementation and integration of PUSH-IT's solutions. They are mainly interested in the technological feasibility, efficiency gains, and cost-effectiveness of the project.

2. Scientific stakeholders

These are researchers, academic institutions, and scientists working on topics similar to those addressed by the PUSH-IT project, such as energy storage, sustainable heating, or renewable energy integration. Collaboration with scientific stakeholders is key to advancing knowledge, sharing research outcomes, and fostering innovation.

3. Governmental stakeholders

This group includes policy makers, regulators, licensing authorities and other government officials responsible for shaping the energy transition. Their engagement is critical for creating an enabling environment for the adoption of new energy solutions like high-temperature heat storage. They are interested in understanding how the project aligns with broader energy transition goals, environmental sustainability, and economic growth.

4. Public stakeholders

This group consists of citizens and local residents who are either interested in or affected by the PUSH-IT project. Engaging with these individuals is crucial for gaining public support. Their concerns might centre around local environmental impacts, changes in their neighbourhood, or opportunities for community benefits.

4.7 Stakeholder analysis

4.7.1 Goals for stakeholder analysis

The aim is to:

- Establish communication and dissemination strategies customized for each stakeholder.
- Align strategies with the power, interests, and needs of stakeholders.
- Identify the most suitable messages and means to reach each target audience effectively.

4.7.2 Why conduct a stakeholder analysis?

Conducting a thorough stakeholder analysis is crucial for establishing trust, gaining the social license to operate, and ensuring the legitimacy of our activities. By understanding the perceptions, stakes, needs, and potential barriers of stakeholders, we can implement more effective engagement strategies.

The key reasons for conducting stakeholder analysis are to:

- Develop more appropriate communication and engagement strategies, leading to more effective engagement.
- Engage stakeholders more deeply, ensuring that solutions are aligned with their needs and that the project has a greater impact.

- Achieve wider dissemination of project results, leading to broader adoption of thermal energy storage technologies.
- Improve the overall image and support for thermal energy storage.
- Address potential issues and concerns proactively, reducing project risks.
- Foster positive relationships and build trust, thereby enhancing our reputation.
- Prevent delays and public resistance, securing the social license to operate.
- Work towards fair and inclusive procedures in which multiple perspectives are represented, contributing to a just energy transition.

4.7.3 Overview of stakeholder analysis steps

The stakeholder analysis consists of three main steps, which are implemented in an iterative fashion. For example, new stakeholders might come into focus over the course of the project, or new issues might emerge. The stakeholder analysis will be updated accordingly. Each step of the stakeholder analysis will be emphasised at a particular timespan during the project, indicated at each step.

Step 1: stakeholder identification and local analysis (M6-M24 | 2023-2024)

In the first phase, a local stakeholder analysis was conducted at all project sites. The primary goal is to establish an understanding of all the stakeholders at the local level, which will set the stage for engagement in the following phases.

Step 2: stakeholder workshops and events (M18-M36 | 2024-2025)

This phase will focus on organising targeted workshops that involve multiple stakeholder groups from the pilot sites. These workshops aim to explore the needs, concerns, and priorities of stakeholders. Additionally, participation in industry events and conferences will be a key component of this phase. The goal is to gain deeper insights into key stakeholder needs and concerns while establishing an active stakeholder network.

Step 3: broader stakeholder engagement and activation (M32-M48 | 2025-2026)

The final phase will culminate multiple events, including a final symposium and a summer school aimed at a wider audience. This phase will also involve participation in industry events and conferences, along with one-on-one meetings with specific stakeholders. The objective is to ensure active participation in the implementation phase, which is critical for achieving successful outcomes.

Step 1: stakeholder identification and local analysis

To reach the appropriate stakeholders and increase the effectiveness of communication efforts, a stakeholder analysis is needed. For each of the three demo and three follower sites, a stakeholder analysis was made by the local project teams to determine the needs, interests and barriers of the key players for each site. This stakeholder analysis was used by the sites to determine a suitable local communication strategy.

Since multiple WPs in PUSH-IT include performing a stakeholder analysis, and each site has to address their specific stakeholders for successful communication and dissemination, close coordination between each WP and the sites was key. This is why the analysis was done in collaboration, coordinated by the Communication Team. Special attention was given to collaborating with WP2 (Societal Engagement) to align the stakeholder mapping efforts.

A systemic approach to selecting stakeholders was used, meaning that actors from technological, economic, ecological, social and policy domains of innovation were considered.

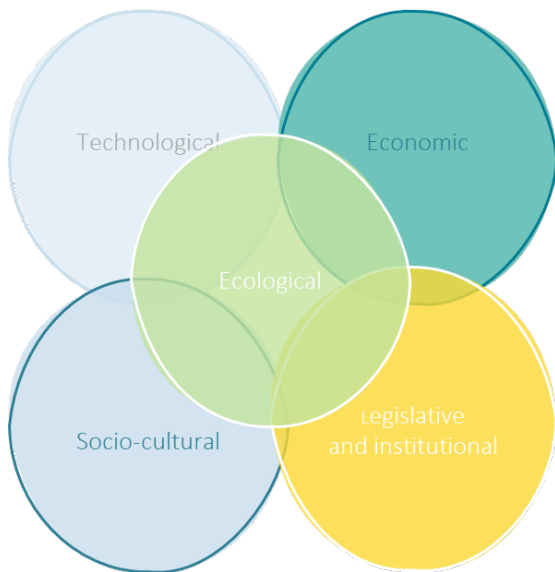


Figure 4: Systemic approach of stakeholders: involving actors from 5 domains

To perform the local stakeholder analysis, we followed a structured approach consisting of several steps:

1. Identifying all relevant stakeholders
2. Determining the level of power (influence) and interest of each stakeholder
3. Choose the most important stakeholders based on PI-grid
4. Identifying the jobs, pains and gains of these stakeholders
5. Determining the information & engagement needs of these stakeholders

Together with the site and communication leads, we completed steps 1 through 3. We identified and prioritised the stakeholders, ensuring that each site has a clear understanding of who to focus on and how to approach them. The result of the stakeholder analysis is a visual mapping of each stakeholder relevant to their interest and power. See Figure 5 for the map that Darmstadt made.

In line with the global – local approach principle, each site organises its own local stakeholder management and communication based on the overall communication principles of PUSH-IT. Therefore, the local sites are responsible for the execution of step 4 and 5. We have equipped them with the necessary materials, tools, and guidance to carry out these activities. An example of a local stakeholder approach matrix is given in Figure 6.

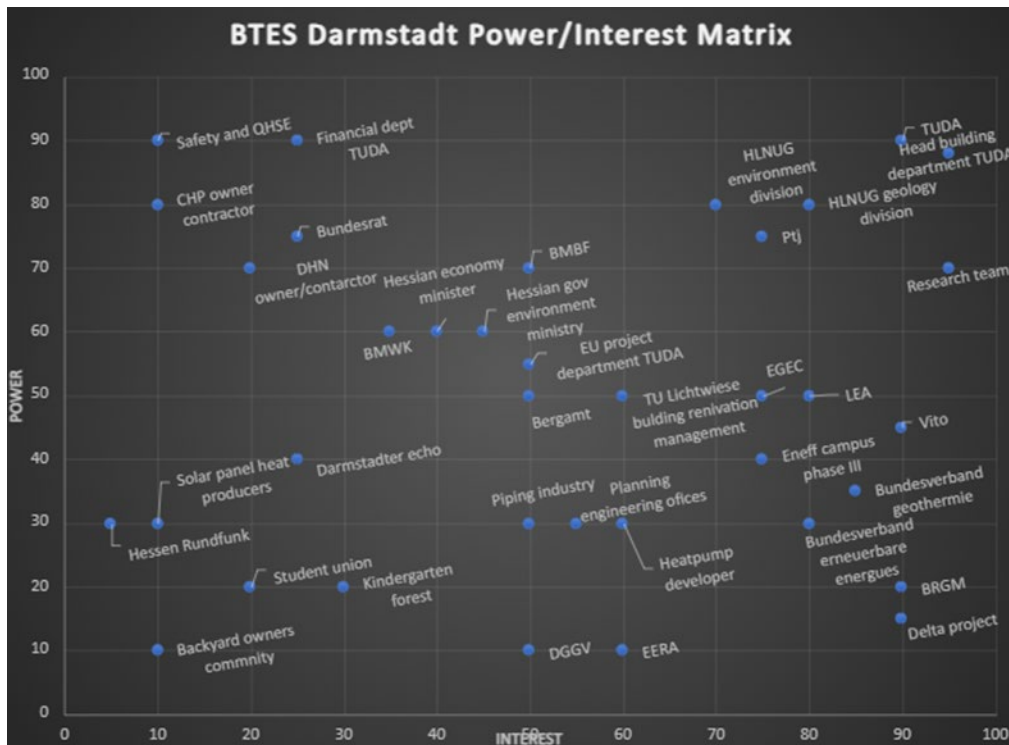


Figure 5: Stakeholder map for the Darmstadt site

Stakeholders	Level	Approach
Partners	Key figure Inspire, engage and activate	Strategic
Local residents	Subjects Keep informed, maintain interest	Operational
Governments	Key figure Inspire, engage and activate	Strategic
Educational institutions	Context setter Keep satisfied & engage	Tactical
Energy companies & Grid operators	Key figure Inspire, engage and activate	Strategic
Entrepreneurs/ companies	Subjects Keep informed & maintain interest	Operational
Interest groups	The crowd Monitor & keep informed	Tactical
Housing companies	Subjects Keep informed & maintain interest	Operational
Media	Subjects Keep informed & maintain interest	Strategical
Environmental agencies	Context setter Keep satisfied & engage	Tactical

Figure 6: Example of a stakeholder approach matrix

Stakeholder analysis: awareness on key topics

To inform the communication strategy, it is important to know what level of awareness important stakeholders have on key topics related to thermal energy storage. An analysis of stakeholder awareness was conducted in a co-creation workshop with consortium members. For each site, the site teams have given an estimation for the level of awareness about UTES, why we need it and what the impacts are. The participants also gave suggestions for key

topics that stakeholders lacked knowledge of. They did this for several groups of stakeholders. A summary of results is shown below in Table 12.

From this analysis, the following preliminary observations and conclusions were drawn. The level of awareness of the problem(s) is for most sites and stakeholders average to high. Awareness of the solution is lower and awareness of the impact is lowest. The stakeholders in the energy sector (energy suppliers, heat grid operators, mining regulation authorities) have a higher awareness than others. The general public has the lowest level of awareness (1.7/5). Especially about the solution of UTES and its impacts the awareness is low. Asset owners and legislators also have a relatively low level of awareness.

Site teams made similar estimations. The largest difference between the sites is the level of awareness of legislators. In some sites, the legislator already has a moderate level of awareness, while in other locations, the awareness is low. Compared to follower sites, demonstration sites had more knowledge to estimate the level of awareness of their stakeholders. Some follower sites could not give an indication for one or multiple stakeholders. Compared to sites with other types of UTES, the MTES sites indicated that the mining authorities had less awareness. In the sites with other types, the mining authorities were judged to be more aware.

The goal for Communication Strategy Phase 2: Engagement is to test these estimations and assumptions through engagement with these stakeholder groups. This will be done in stakeholder workshops and through public surveys on public perceptions towards underground thermal energy storage, in collaboration with the efforts of Work Package 2 (societal engagement). The gathered information is used to tailor communication activities to the awareness gaps of the stakeholder groups.

Table 12: Estimated levels of awareness of stakeholder groups on key topics of underground thermal energy storage*

	Average - all sites			
	Awareness	Aware of the problem	Aware of the solution (UTES)	Aware of the impact of UTES
Internal (consortium)	4,78	5	5	5
Municipality	2,43	3	2	2
Legislators	2,33	3	2	2
Energy suppliers	3,07	5	3	2
Heat grid operators	3,00	5	3	2
Mining regulation authorities	2,73	3	3	3
Water regulation authorities	2,40	3	2	2
Asset owners (mine, land, other)	2,00	3	2	1
General public	1,71	3	1	1
average - all audiences	2,72	3,56	2,49	2,10

*Average estimations for all sites. For each stakeholder, at each site, the site teams estimated the level of awareness of that stakeholder in three categories: awareness of the problems that UTES can help solve (e.g. seasonal mismatch, decarbonising the heat system); awareness of UTES as a solution to these problems (what ATES/BTES/MTES is, its role in heat networks, safety and reliability); and awareness of the impacts of implementing UTES (spatial and in the subsurface, robustness and affordability of the heat supply, governance and societal engagement). The results of all six sites were combined and averaged.

Example of a local communication strategy

The stakeholder mapping leads to a focused content strategy where each stakeholder group will be addressed in a manner that best reflects their specific needs. For local (site level) topics, the creation of this strategy and content is responsibility of the site teams. An example of a content strategy is given in the Table 13 below. For global (project-level) topics, the content strategy was coordinated by the Communication Team, where content will be provided according to a content calendar by the relevant WP actors (see section 4.8).

Table 13: Example of a content strategy.

Target group	Level	Approach	What content is relevant and inspiring for this stakeholder?
Partners	Key figure Inspire, engage and activate	Strategic	Broader approach, main milestones, updates on progress, implications of results on their work/sector, inspire and build relationships through sharing of inspiring stories and achievements
Local residents	Subjects Keep informed, maintain interest	Operational	Planning, construction-related disturbances, accessibility, liveability, safety, impact on their lives/environment, inspire with positive and unique aspects of underground heat storage, plant visits, education, engagement
Governments	Key figure Inspire, engage and activate	Strategic	Site invitations, progress updates, showcases, highlight climate-related results, link political ambitions to results, environmental management
Educational institutions	Context setter Keep satisfied & engage	Tactical	Engage students in the story and possibilities, interviews with professors/students, guest lectures, engagement
Energy companies	Key figure Inspire, engage and activate	Strategic	Main milestones, updates on progress, inspire and build relationships through sharing of inspiring stories and achievements
Entrepreneurs/ companies	Subjects Keep informed & maintain interest	Operational	Planning, construction-related disturbances, accessibility, liveability, safety, economic prospects, connection and contribution
Interest groups	The crowd Monitor & keep informed	Tactical	Seek input and address needs, status, planning, site visits, possibilities for collaboration, safety
Housing corporations	Subjects Keep informed & maintain interest	Operational	Sustainable and economic elements
Media	Subjects Keep informed & maintain interest	Strategical	Main milestones, progress, emphasize sustainability, inspiration and information
Environmental agencies	Context setter Keep satisfied & engage	Tactical	Main milestones, progress, emphasize sustainability, liveability, safety

Step 2: stakeholder workshops and events

To engage stakeholders in the work of PUSH-IT, collect input and disseminate information, PUSH-IT will take part in events and organise stakeholder workshops. The event strategy is described in Annex 1, Event Strategy.

Workshops will be organised at the three pilot sites with relevant governmental and industrial stakeholders to identify their needs, barriers, and perspectives, while fostering local-level knowledge sharing and collaboration.

To organise the stakeholder workshops for the pilot sites, the local sites should follow the following steps:

1. **Reevaluate stakeholders:** Reassess the stakeholders for each pilot site, identifying key stakeholders whose involvement is crucial to the success of the project.
2. **Identify key governmental, professional and industrial stakeholder groups,** such as district heating grid management, heat providers, municipality, province: These groups will be invited to participate in the stakeholder workshops.
3. **Invite stakeholder groups:** Send invitations to representatives from each stakeholder group, ensuring a balanced and diverse representation.
4. **Facilitate the workshop:** During the workshop, engage participants in discussions to uncover their needs, barriers, and perspectives, fostering an open dialogue.
5. **Adapt your local communication strategy:** Based on the feedback gathered during the workshop, adjust the communication strategy to address the specific concerns and opportunities identified by stakeholders.

Planning stakeholder workshops

Two rounds of stakeholder workshops will be held at each pilot site. The first round is scheduled between May and September 2025, followed by a second round a year later.

These workshops serve several purposes. First, they allow us to assess any changes in stakeholder interests and needs over time. By reconnecting after a year, we can understand how priorities and interests may have shifted. Second, these sessions provide an opportunity to share progress and celebrate successes, reinforcing the value of stakeholder contributions. Finally, the workshops help us identify new challenges and opportunities that may impact the project's success.

Based on the feedback collected during these workshops, we will adjust our strategies to better align with stakeholder needs. This process will not only strengthen relationships but also enhance engagement with stakeholders. By actively incorporating their insights, we ensure that our project remains relevant and beneficial to everyone involved.

Workshop aims

The main aim of the stakeholder workshops is to collect and send information. We want to identify interests, needs and barriers of each stakeholder group and adjust the local and overall communication strategy accordingly. In these sessions, each pilot site should explore the specific needs stakeholders have regarding technical, economic, legal, governance, and organisational aspects of Underground Thermal Energy Storage (UTES),

For example, depending on your specific local context and needs, the workshop could be focused on the following:

- **Communication needs:** Determine what information stakeholders require, when they need it, how it should be communicated, and in what channel and format.
- **Awareness of UTES:** Assess stakeholders' understanding of UTES, including its purpose, functionality, and impacts.
- **Knowledge gaps:** Identify what additional knowledge stakeholders need and what they need to make informed decisions.
- **Relevance of PUSH-IT:** Determine the significance of PUSH-IT for the different stakeholders and how it fits into the broader heat transition.
- **Concerns and challenges:** Discuss major concerns regarding the execution of the heat transition and identify specific challenges for PUSH-IT, including potential risks and how to mitigate them.
- **Innovation needs:** Identify innovation requirements, such as new business models, legislation, or technologies that align with local contexts.

Step 3: Broader stakeholder engagement and activation

- final symposium
 - presentation of results from the WP's, convening with both academics, representatives from local governments and industry
- summer school aimed at a such as students and industry professionals
- industry events and conferences, connecting with industry professionals

4.8 Strategic content calendar

Using a global strategic content calendar is crucial for the success of the PUSH-IT project. By having a well-planned and organised content calendar, we can ensure better control and results when producing and publishing content. It allows us to tailor our messaging to the specific needs and interests of our target groups, ensuring that the content created resonates with them effectively. The content calendar serves as a roadmap for informing and engaging our target groups throughout the project duration.

In addition to providing information about the research and realization of the project, the PUSH-IT project aims to inspire our target groups and increase awareness of PUSH-IT's significance. By incorporating inspiring and engaging content into our calendar, we can captivate the attention of our target groups and create a lasting impact.

To develop the content calendar, we identified the main target groups that the project wants to reach and engage with. For each target group, we determine on a regular basis what content will be shared, when it will be published, where it will be distributed, and the means through which it will be communicated. The Communication Team oversees updating the content calendar and coordinating its implementation; the WP and site communication leads will use it to create content and publish it to their local channels, aligning with local realities and developments.

To ensure a comprehensive approach, the content calendar is structured around six themes: **technology, societal engagement, business & economics, governance & regulations, development & realisation, and environment & sustainability**. Each theme corresponds to a specific aspect of the project. This approach allows us to delve into various dimensions of the PUSH-IT project, ensuring that our communication provides a system perspective. Furthermore, the project aims to link our topics to relevant current events and project milestones, creating timely and impactful content that resonates with our target groups. Table 14 shows examples of what

topics can be discussed in content for the different themes. The specific topics are determined on a regular basis in collaboration with the WP teams and local sites.

Table 14: Content themes and corresponding topics.

Technology	Social	Business & Economics	Governance	Development & Realisation	Safety	Environment & Sustainability
Why do we need this technology?	Social acceptance of the different technologies	Is this economically viable compared to other technologies?	Regulatory challenges in heat storage systems	Meet the researchers / General explanation research	How is safety monitored and ensured?	Role of the technologies in the energy transition EU
Animation explainers/ infographic technology	Results of social engagement survey Exeter	How does heat storage contribute to affordable energy?	Should a government or an energy company be responsible for energy storage	Summer school update	Impact on water quality / biodiversity	The environmental benefits of high-temperature heat storage.
Linking issues: geothermal - district heating - energy storage	What are the benefits of heat storage for society?	How does the system perform compared to other energy solutions?	Should a government or an energy company be responsible for energy storage	General explanation of the research at each site	Impact on the natural environment surrounding the project	What are the spatial effects of TES?
Conversations with experts on advancements in Geothermal Energy.	What is the role of the end-user / energy consumer?		Way in which this technology fits in the country's energy plan	Lectures / information nights about the project	Safety during drilling	Insights from Environmental experts on PUSH-IT's Impact

Based on the content themes, project progress, and in collaboration with the WP teams and project sites, a strategic content calendar has been by the Communication Team. This calendar is used by the defined content owners (those responsible for creating the content) to create the content at the right time for the right medium. An example of what the content calendar could look like is shown in Figure 7.

Year	Date	Week	Theme	Subject	Target Group	Angle	Prio **	Type content	Content Owner	Channel
			Technology	Why do we need this technology?	Geothermal operators, district heating operators, governments, municipalities	Explaining the role of this technology in the energy transition	1	Article	TBD	Website
			Social	What are the benefits of heat storage for society?	Local communities, public	How does heat storage contribute to a more sustainable and healthy society?	3	Article	TBD	Website
			Business & Economics	Upscaling of the technology	Geothermal operators, district heating operators, governments, municipalities	How easily can this be upscaled / applied to other sites?	3	Article	TBD	Website, newsletter
			Governance	Regulatory challenges in heat storage systems	Geothermal operators, district heating operators, governments, municipalities	The complexities of governance and regulations surrounding heat storage systems	3	Article	TBD	Website, newsletter
			R&D dissemination	Project wide update on progress	Scientific community	What are the newest project findings?	2	Article	TBD	Website, newsletter
			Safety	Safety of the technologies	Geothermal operators, district heating operators, governments, municipalities, local communities	How is safety monitored and ensured?	1	Article	TBD	Website
			Environment & Sustainability	Role of the technology in the EU energy transition	Geothermal operators, district heating operators, governments, municipalities	What is the potential of the technology in Europe?	3	Article	TBD	Website
			Technology	Explainer video	Local communities, public	Animation explainers about the different technologies	2	Video	TBD	Website, newsletter
			Realisation	What is the progress on the pilot sites?	Local communities, public	Short update of every project site	2	Article	TBD	Website, newsletter

Figure 7: Content calendar example

4.9 Channels and Media

The channels and media PUSH-IT will use as communication means will derive from the stakeholder analysis and is work in progress for now. An indication of relevant media is given in Table 15. On these channels, a mix of media will be created, including videos, interviews, explainers, infographics, info stands, workshops and others. Ambassadors will be selected among key figures involved in PUSH-IT who can use their network, expertise and reputation to amplify PUSH-IT's communication efforts. These will be determined for each communication effort in more detail when creating the content calendar after performing the stakeholder analysis. A visual identity will be created to ensure consistency and recognisability in all of PUSH-IT's communication. An overview of the communication means used is given in Table 16. Also see the Event Strategy for more details about the events PUSH-IT is attending.

Outreach, engagement and number of views and followers of content on PUSH-IT's own media channels will be monitored on a quarterly basis and used to evaluate efficacy of communication efforts. Coordinators of the PUSH-IT consortium partner channels will be involved to amplify PUSH-IT's content and increase our reach.

Table 15: Overview of media used for PUSH-IT communication.

Medium	Examples
PUSH-IT own channels	<p>Website https://push-it-thermalstorage.eu The website is the main portal for PUSH-IT information and will be regularly updated to provide all pertinent project information until at least 2032, and web traffic will be monitored. It contains the following information:</p> <ul style="list-style-type: none"> • General information PUSH-IT: goals, WPs, facts & figures, partners, FAQ • Project deliverables and an overview/archive of all published data and/or links hereto • Publication press & news releases • Image database • Contact information spokespersons

Medium	Examples
	<p>Social media</p> <p>LinkedIn: https://www.linkedin.com/company/project-push-it/ YouTube: https://www.youtube.com/@PUSH-IT-thermalstorage Vimeo: https://vimeo.com/projectpushit</p> <p>Social media pages of consortium partners Social media profiles of key figures involved in PUSH-IT Every 2 weeks at least 1 post</p> <ul style="list-style-type: none"> • Reposts and comments on relevant posts from others • Active participation in conversations • Posts with links to website articles and updates <p>Newsletter</p> <p>Once every 3 months</p> <ul style="list-style-type: none"> • Overview of project progress and news • Most recent articles and interviews • Upcoming milestones • Upcoming events
Media channels of PUSH-IT consortium members	To amplify the reach of PUSH-IT's communication, media channels of PUSH-IT's consortium members will be used, since these already have a significant reach. This will include the websites, LinkedIn, Instagram and Twitter pages of consortium members, including those of specific faculties tied to the project. Use of these media will be coordinated via the communication leads of the involved teams.
External websites and blogs	Think GeoEnergy International Geothermal Association Geothermal Rising Blog Local websites of e.g. municipality, university, developer, operator, etc.
News media	Local and regional newspapers/websites in demo and follower site locations
Magazines	National trade journals International trade journals
External events	GeoTHERM Offenburg Energy Geoscience Conference 2023 Euroheat & Power RHC Annual Conference 2023 EAGE Annual European Sustainable Energy Week 2023 European Geothermal PhD Days IGC 2023 - International Geothermal Investment Conference
PUSH-IT own events	Workshops, information events, site visits, final symposium

Table 16: Overview of means used for PUSH-IT communication.

Means	Description
Videos and graphics	Interviews, explainers, infographics, factsheet
Project identity	Including logos & colour scheme, templates and other materials to be used for PUSH-IT communication.

Means	Description
Ambassadors	Key figures involved in PUSH-IT who can use their network, expertise and reputation to amplify PUSH-IT's communication efforts
Media kit	Media kit for journalists and policymakers
Physical promotion materials	Roll-up banners, brochures and other material, if applicable

4.9.1 Statistics social media

As of October 2024, the PUSH-IT project has demonstrated solid progress in building its online presence and engaging its audience across multiple channels*. Below are the key statistics:

- **PUSH-IT website:**
 - The website has seen 35,000 visits and generated 779,000 hits. These figures show growing interest in the project, with many visitors engaging with the content provided on the platform.
- **LinkedIn:**
 - As of October 2024, the PUSH-IT [LinkedIn page](#) has 795 followers. Through consistent updates and strategic content, it has generated 77,000 impressions and attracted 43,000 unique views. These numbers indicate that the project is gaining visibility and attention from stakeholders and the public through this professional social network.
- **Quarterly newsletter:**
 - PUSH-IT has published 4 newsletters since the project began, with a current subscriber base of 136 people. These newsletters serve as a direct communication tool, keeping the consortium informed on project milestones, achievements, and upcoming events.

**statistics were measured on October 10, 2024*

4.9.2 Social media targets for 2025 and 2026

In alignment with PUSH-IT's communication strategy, we have set ambitious yet achievable targets for 2025 and 2026. These goals aim to increase the project's outreach and engagement across our key platforms.

- **PUSH-IT website:**
 - For 2025, the aim is to double website traffic, targeting 70,000 visits and 100,000 hits. By 2026, the goal is to further increase to 120,000 visits and 150,000 hits. These projections reflect the expected growth of the project as we expand our activities and attract more attention globally.
- **LinkedIn:**
 - By the end of **2025**, PUSH-IT aims to reach **2,000 followers** on LinkedIn, generating approximately **200,000 impressions** and achieving **85,000 unique views**. By the end of **2026**, these numbers are expected to rise to **2,500 followers**, **300,000 impressions**, and **120,000 unique views**. This growth will be supported by regular updates, research results, project milestones, strategic content that appeals to our target audience.

- **Quarterly newsletter:**
 - The target for **2025** is to have **200 subscribers**, with **4 newsletters** published throughout the year. For **2026**, the goal is to further grow the audience to **250 subscribers** while maintaining the quarterly publication schedule.

4.10 PUSH-IT visual identity & colour schemes



Figure 8: PUSH-IT horizontal logo



Figure 9: PUSH-IT vertical logo

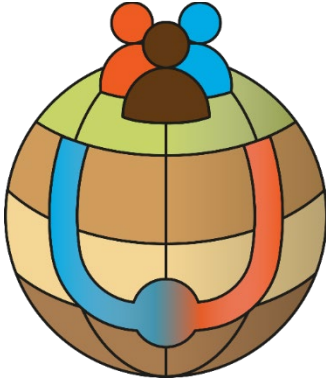


Figure 10: PUSH-IT logo without project title

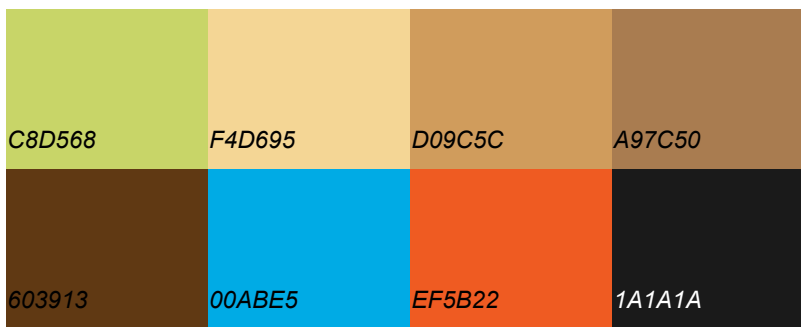


Figure 11: PUSH-IT colour scheme

4.11 Acknowledgement of EU funding

According to Article 17.2 of the Horizon Europe grant agreement, EU funding must be acknowledged in the following way:

Annex 1: Detailed strategies

Event Strategy

Goals and ambitions

The event strategy is an important part of our overall communication strategy. Events help us in achieving our communication and dissemination goals. Events are an important way to build a network, spread outcomes and collect feedback. By aligning each event with our communication goals, we guarantee that our messages are clear, impactful, and resonate with our stakeholders.

Events offer valuable opportunities to engage with key stakeholders and build support for PUSH-IT's technologies. They provide a platform for direct interaction, raising awareness, collecting feedback, and fostering collaboration. Through these events, we can showcase the practical benefits of our technology, address concerns in real-time, and strengthen relationships with our audience.

Main goals

- 1) Raise awareness and visibility**
 - a. Increase public and stakeholder awareness of PUSH-IT's solutions.
- 2) Demonstrate the value and impact of PUSH-IT's solutions**
 - a. Showcase the practical benefits and impact of the organization's technologies, projects, or initiatives.
- 3) Engage with stakeholders and gain insights**
 - a. Facilitate meaningful interactions with stakeholders.
 - b. Gather input and feedback from stakeholders in order to improve.
- 4) Strengthen relationships and collaboration**
 - a. Develop and reinforce connections with key stakeholders, including potential partners and collaborators.

Event selection

We consider six types of events:

- 1) Local community events:**
 - a. Goal:
 - Inform the public, raise awareness, and encourage engagement regarding high-temperature energy storage technology.
 - b. Examples:
 - i. Information Nights: Public presentations where experts share the latest updates on the project, address concerns, and answer questions.
 - c. Frequency
 - i. Yearly or as needed, connected to project milestones (e.g. start drilling), permitting and community needs.
 - d. Organisation
 - i. Responsibility of the local sites.
- 2) Site visits**
 - a. Goal
 - i. Showcase the technology and demonstrate project progress
 - b. Examples
 - i. Open houses: opportunities for local residents or specific groups (schools, local businesses) to tour facilities or interact with project leaders

in an informal setting, gaining a better understanding of how the technology works and its benefits

- ii. Stakeholder Tours: Organized visits for community leaders, industry professionals, and government representatives to showcase the technology
- iii.
- c. Frequency
 - i. Yearly: ideally tied to construction progress to show tangible progress and results.
- d. Organisation
 - i. Responsibility of the local sites.

3) Workshops and seminars

- a. Goal: Educate stakeholders, promote collaboration, and encourage knowledge sharing
- b. Examples
 - i. Technical workshops: Focused sessions on the design, safety, and efficiency of geothermal storage technologies, aimed at technical experts and public sector stakeholders.
 - ii. Industrial stakeholder workshops: discussions on integrating societal, economic, and technical feasibility into geothermal storage solutions for large-scale adoption.
- c. Frequency
 - i. One yearly workshop per pilot site: starting in year 3.
- d. Organisation
 - i. Responsibility of WP4, in collaboration with site leads.

4) Conferences and network events

- a. Goal: Engage with policymakers, industry leaders, energy professionals, and academics to share knowledge, foster discussions, and strengthen relationships and networks.
- b. Focus:
 - i. Conferences and events that specifically focus on heat-related industries and innovation. Look for events that gather key stakeholders, industry leaders, and decision-makers within the heating and energy sectors
 - ii. Scientific symposia hosted by academic institutions known for their contributions to the field of thermal energy storage or district heating networks.
 - iii. Participation in conferences where government officials or policy makers are a primary audience, such as energy policy summits or government-led energy conferences. These events provide an opportunity to directly influence and collaborate with decision-makers at the national or regional level.
- c. Examples:
 - i. European Geothermal Congress: Brings together researchers, policymakers, and industry leaders to discuss the latest advancements in geothermal technologies and their integration into energy systems.
 - ii. EAGE Annual: A large international conference focused on geosciences and engineering, where geothermal energy storage can be positioned alongside other cutting-edge developments in sustainable energy solutions.

- iii. Global Geothermal Summit: An international summit that highlights breakthroughs in geothermal energy, including energy storage solutions, and fosters global collaboration for the transition to renewable energy.
- iv. European Geosciences Union Conference: A conference that brings together scientists and engineers from across Europe to share research on the Earth's processes, including geothermal storage technologies and their role in sustainable energy.
- d. Frequency:
 - i. Four times a year, with events aligned with key energy or heat sector conferences.
- e. Organisation
 - i. Responsibility of the sites and work packages to attend conferences and network events.
 - ii. WP4 maintains an event calendar to keep track of interesting events they could attend.

5) Summer school

- a. **Goal:** Provide in-depth training on the implementation of geothermal energy storage technologies to young professionals, researchers, and students.
- b. **Description:** The summer school is a specialized educational program designed to transfer knowledge to students and PhD-candidate, being the next generation of energy professionals. The focus will be on practical skills and strategies for implementing geothermal energy storage projects, bridging the gap between theoretical understanding and real-world application.
- c. **Frequency:** One-time event at the end of the fourth year, timed to coincide with the completion of key project milestones and insights.
- d. **Organisation:** WP4 together with the consortium and TU Delft in particular

6) Final symposium

- a. **Goal:** Present the results and outcomes of the PUSH-IT project; disseminate learnings and activate key stakeholders to implement the findings.
- b. **Description:** The final symposium serves as the capstone event for the project, bringing together all stakeholders to reflect on the progress made, share final results, and discuss the future of high temperature underground energy storage.
- c. **Example:** This event will include keynote presentations, panel discussions, and roundtables with policymakers, industry leaders, and researchers
- d. **Frequency:** One-time event at the conclusion of the project.
- e. **Organisation:** WP4 and WP5

Target Audience	Event Type
Public stakeholders	Local community events, site visits
Industry professionals	Workshops, site visits, demonstrations, conferences, networking events, trade fairs, webinars
Scientific stakeholders	Conferences, symposiums, workshops, summer school, webinars
Governmental stakeholders	Workshops, conferences, site visits

Communication

To ensure PUSH-IT has a strong presence at events, an effective communication plan must be in place. Below are key strategies for before, during, and after the event to ensure visibility and engagement.

Before the event: Create engaging content

Before attending an event, it is useful to generate interest and excitement. Here are some tips:

- **Pre-event LinkedIn posts:** Post announcements on your own and/or PUSH-IT's LinkedIn a few weeks prior to the event or when participants can sign up, highlighting PUSH-IT's involvement. Include visuals like event banners or relevant images to draw attention.
- **Event details:** Share specifics like the event's name, date, and location, as well as what PUSH-IT will be showcasing (presentations, booth activities, etc.).
- **Key themes:** Emphasize the topics PUSH-IT will discuss and how they align with current trends in energy storage and heating.

During the event: Communication and stakeholder engagement

Engagement at the event is just as critical. PUSH-IT should focus on face-to-face communication and ensure that attendees leave with a clear understanding of the project's value.

Tip: When presenting with a poster or banner, ensure you use the 6-60-6 rule: in 6 seconds the key message should be clear. In 60 seconds, the visitor can read the contents of the banner or poster. And in 6 minutes the visitor can engage in a conversation with the representative to learn more about the topic being presented.

- **Setup your stage:** Ensure that your stage, either the stand, table or booth is visually appealing with PUSH-IT branding (banners, flyers, brochures). PUSH-IT's key messages should be visible and easy to understand at a glance. Communication materials are available.
 - **Contact list:** Gather contact details from people interested in the project. They can either fill out a contact form with their email addresses or scan a QR code on the banner. Alternatively, distribute personal business cards to foster connections.
- **Workshops and presentations:** Ensure that all presentations use the PUSH-IT templates and include a QR code leading to the project website or an email address for follow-ups.
- **Q&A:** Prepare a set of frequently asked questions. Have knowledgeable team members ready to answer questions and engage in discussions.
- **Networking:** Engage with potential partners, collaborators, and key stakeholders by arranging meetings or casual discussions during the event.

After the event: Follow-up

Following up after an event is crucial for maintaining momentum and fostering continued interest in PUSH-IT:

- **LinkedIn recap:** After the event, share a post-event summary on your personal or organizational LinkedIn profile, or on PUSH-IT's official LinkedIn page. If posting on PUSH-IT's LinkedIn, please coordinate with the WP4 team. Your recap should highlight key takeaways, important discussions, and insights gained during the event. Be sure to include photos to boost engagement and visibility.
- **Stakeholder outreach:** Reach out to stakeholders or contacts made during the event to continue discussions and explore potential collaborations (see contact list).

Roles and responsibilities for attending events

Event Coordination

- **Event calendar:** WP4 will maintain a shared event calendar. PUSH-IT members are encouraged to add relevant events that align with the project's goals.
 - If you are attending an event, please include your name and details in the calendar.
- **Materials:** Banners, brochures, presentation slides, and other communication materials can be provided by WP4. We advise you to collaborate closely with WP4 to ensure consistency in branding and messaging.
- **Participation:** Each work package or site is responsible for selecting and attending events that align with the overall PUSH-IT strategy.
- **Dissemination tracker:** After attending an event, please log your participation in the dissemination tracker to help monitor PUSH-IT's outreach and engagement efforts.

Content creation

- Each team is responsible for creating and posting their own LinkedIn content to announce PUSH-IT's participation in upcoming events.
- WP4 will not create separate posts but will be happy to repost or share your provided text to help increase visibility.

Communication guidance

- For best practices, consult the WP4 team, which can offer advice on how to communicate effectively during events to maximize PUSH-IT's visibility.

Event process overview

Stage	Action Items
Pre-event	<ul style="list-style-type: none"> - Add the event to the event calendar with the details of the attending team member(s). - Coordinate with WP4 for materials and ensure consistent branding. - Create LinkedIn content to promote PUSH-IT's participation. Share this content with WP4 for (re)posting if desired.
During the event	<ul style="list-style-type: none"> - Engage attendees using e.g. posters and flyers, and face-to-face communication. - Capture photos, videos, and insights for post-event content.
Post-event	<ul style="list-style-type: none"> - Log participation in the dissemination tracker. - Share an event summary on LinkedIn, highlighting key takeaways and lessons learned. WP4 can repost your post or post the message on the PUSH-IT LinkedIn - Reach out to stakeholders met during the event for follow-up discussions and collaboration opportunities.

The EU aims to have a net-zero greenhouse gas (GHG) economy by 2050, with 55% reduction on 1990 levels by 2030. At present, heating and cooling represent around 50% of the final energy demand in Europe and are mainly supplied by fossil fuel derived energy. It is therefore essential for heating and cooling to decarbonise to achieve EU ambitions.

A challenge for decarbonizing heat systems is the size of the seasonal mismatch between demand for heat and heat generation from sustainable sources – this mismatch is much larger than the equivalent intermittency in electricity supply and demand. The two main solutions to address this mismatch are: (i) to install a large capacity, so that peak demands can be met even at low production levels; or (ii) to store energy for later use if it is not needed at time of conversion. Many sustainable heat supply systems are characterised by high capital expenditure and low operational costs. Therefore, an installed capacity tailored at peak demand is not cost effective, while extending the annual operation period is advantageous for meeting energy needs, reducing levelised cost of energy (LCOE) and decarbonisation. Optimal utilisation of sustainable heat requires storing large amounts of heat to account for seasonal supply and demand fluctuations. Various technologies have been proposed for large-scale heat storage in geothermal reservoirs and low temperature storage is routinely applied. PUSH-IT focuses on extending storage temperature ranges to high temperatures. We will tackle remaining barriers, demonstrate applicability, increase public engagement, and optimise and de-risk operations. We will showcase three technology options that are fit for a wide variety of geological conditions covering most locations in Europe.



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