Deliverable 7.9

Project Management Plan

Drafted by: Neetu Kumari (TNO)

Date: 9/03/2023

Grant agreement No: 101069672

Project start date: 1st September 2022

Duration:42months

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069672 (SPIRIT).

BASIC INFORMATION ON THE DELIVERABLE	
DISSEMINATION LEVEL	Public
DUE DATE OF DELIVERABLE	31/01/2023
ACTUAL SUBMISSION DATE	10/03/2023
WORK PACKAGE	WP7 – Project management, coordination & Ethics
TASK	T7.2– Project management
TYPE	Report
NUMBER OF PAGES	44

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Date	Version	Description
15/01/2023	0.1	First draft
24/02/2023	0.2	First revision
9/03/2023	1.0	Final version

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PROJECT PARTNERS

TNO: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK

DTI: TEKNOLOGISK INSTITUT

DLR: DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV

EHPA: EUROPEAN HEAT PUMP ASSOCIATION

MYK: NV MAYEKAWA EUROPE SA

SINLOC: SINLOC-SISTEMA INIZIATIVE LOCALI SPA

EURAC: ACCADEMIA EUROPEA DI BOLZANO

EHP: EUROHEAT & POWER

DTU: DANMARKS TEKNISKE UNIVERSITET

TVP: TVP Solar

TIS: TIENSE SUIKERRAFFINADERIJ N.V.

TLK: TLK ENERGY GMBH

GEA: GEA Refrigeration Germany GmbH

SPIL: Spilling Technologies GmbH

SKPS: Smurfit Kappa Paper Services B.V.

SKC: SMURFIT KAPPA CZECH SRO

SP: STELLA POLARIS AS

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ABBREVIATIONS AND ACRONYMS

C&D: Communication and Dissemination

C&DM: Communication and Dissemination Manager

EAB: External Advisory Board

EB: Exploitation Board

EC: European Commission

EU: European Union

GA: Grant Agreement

HEU: Horizon Europe

IHP: Industrial Heat Pumps

KPI: Key Performance Indicator

PC: Project Coordinator

PMP: Project Management Plan

PMT: Project Management Team

RM: Risk Manager

RTO(s): Research and Technological Organisation(s)

SPIRIT: Implementation of Sustainable heat upgrade technologies for Industry

WP(s): Work Package(s)

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Table of Contents

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069672 (SPIRIT).

1. Introduction

This Project Management Plan (PMP) is intended to describe in somewhat detail how the HEU SPIRIT project is managed. This document provides guidance to the partners and ensures the quality of the processes.

This document will present governance structure, description of activities and roles of partners and way of reporting.

2. Governance structure

The governance structure of the project is illustrated in Figure 1. The roles of the different boards is analyzed in the subsequent sections.

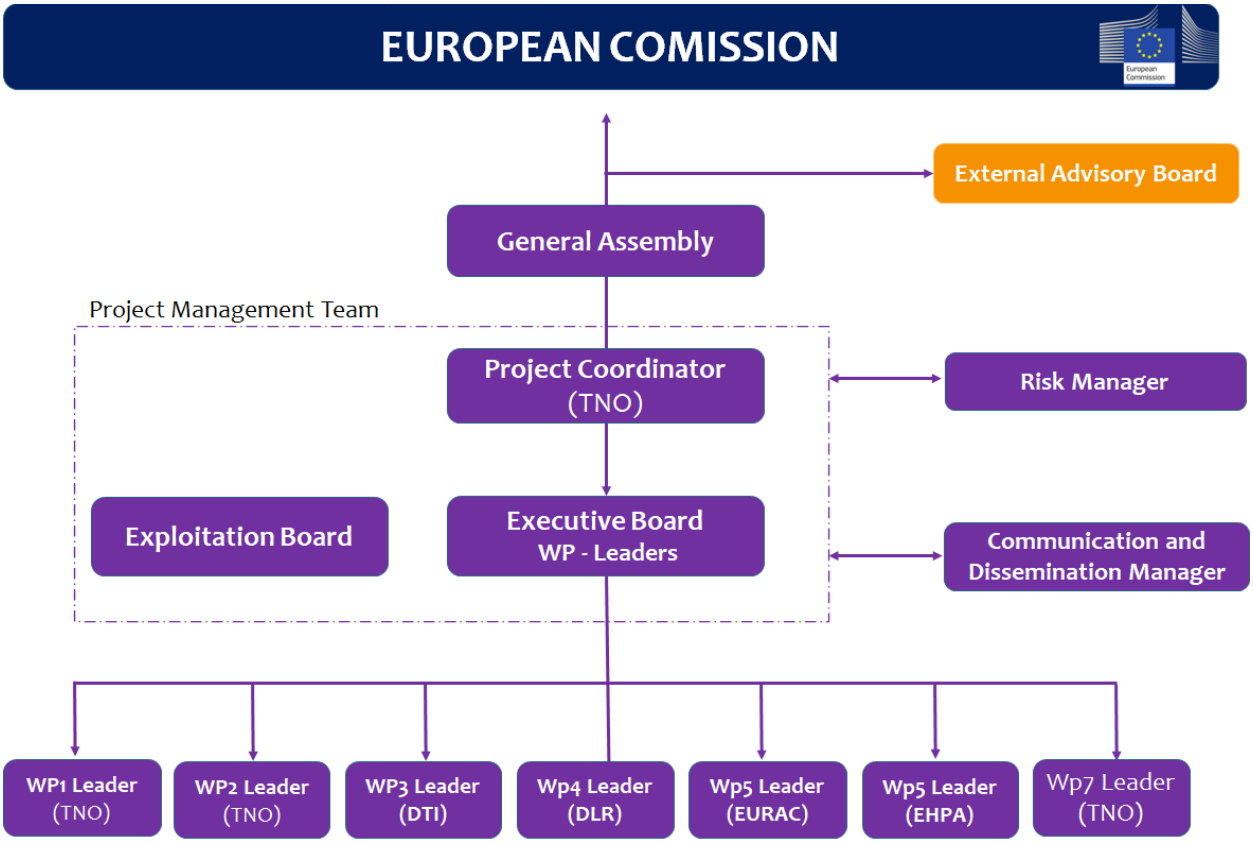

Figure 1: *Governance structure*

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2.1. General Assembly and Project Management Team (PMT)

The General Assembly comprises one representative from each partner (the main contact person as registered in the EU portal), while the Project Management Team embodies the Project Coordinator, Executive Board (Work Package leaders) and Exploitation Board. These bodies are complementary and will undertake the overall project management and control. Their role will be to collate all technical and administrative issues regarding the project and make decisions on resolving any scientific, technical and administrative issues as well as planning the overall project strategy. These include (but are not limited to) the following activities:

- Monitor the overall direction of the project encompassing the discussion and proposal of major changes in the work plan in response to emerging problems or changes in situations;
- Approval of major modifications to project plans;
- Dealing with non-performing partners;
- Consideration of long-term exploitation issues, including licensing and patenting;
- Training aspects;
- Technical co-ordination and information exchange among work packages;
- Overall co-ordination and management of the project;
- Progress review;
- Control of planning and deliverables;
- Financial issues;
- Establishment of collaboration with other projects for knowledge exchange

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2.2. Project Coordinator and WP leaders

Project Coordinator (PC)

The project coordinator will be responsible for the day-to-day coordination of the project, including consolidation of the project planning, organization of communication between the partners, and project progress control by direct link with the work package leaders and partner representatives.

The PC in particular will be responsible for the following tasks:

- Communicate to the EC the administrative and financial data;
- Prepare, update and manage the consortium agreement between the participants;
- Obtain and collect audit certificates about the financial management from all the participants;
- Collect partner cost statements and perform their Quality Assessment before delivering them to the EC;
- Act as the sole direct interface between the Consortium and the European Commission;
- Coordinate at consortium level the technical activities in the project;
- Oversee the promotion of the gender equality in the project;
- Organize the project meetings every six months, including the kick off meeting and PMT/GA meetings, following an agenda that will be proposed by the PC and agreed by participants at least two weeks before the meeting. Additional thematic WP meetings can be organized to discuss about progress issues;
- Collect the scientific contributions from WP leaders to be included in the progress reports;
- Consolidate, finalize and ensure the timely delivery of project technical deliverables, including the six-months project reports and final report to be delivered to the European Commission;
- Supervise the set-up of an internal area of the project web site to be used as web-based collaborative platform;
- Coordinate at consortium level the knowledge management and the other innovation related activities;
- Coordinate the dissemination and technology transfer activities in the project.

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Work package Leaders (Executive Board)

Work package leaders will be responsible for the day-to-day scientific coordination of the WP tasks.

The Work Package leaders in particular will be responsible for the following tasks:

- Coordinate the different tasks and activities covered by the work package and ensure effective communication among the participants;
- Collect the scientific parts of the project and will send them to the project coordinator to be included in the progress reports
- Initiate corrective actions for deviations from agreed work plans;
- Identify areas of emerging risk;
- Organize communication between tasks and between the WPs and the project coordinator;
- Monitor the technical progress;
- Take final decisions on technical methods and equipment to be used;
- Ensure the well-timed availability of work package deliverables;
- Coordinate the interaction and collaboration with other work packages;
- Convene work package technical meetings, according to the specific needs of the WP, under the chairmanship of the WP leader;
- Arrange technical reviews as required by the MB or the Commission;
- Represent the consortium at conferences and workshops and in all dissemination events related to the work package;
- Provide all necessary information to the dissemination and technology transfer board when requested.

2.3. Exploitation Board

The EB, led by DTI, consists of partners appointed as exploitation managers to perform innovation management and meets *once per year (e.g., in progress meetings)*. The partners appointed in the kick-off meeting include MYK, GEA, SPLI, TIS ,SP and SKC. During meetings the Exploitation plan will be updated. The EB will be responsible to

- Establish contacts with relevant stakeholders;
- Organize targeted exploitation actions such as workshops or webinars;

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- Identify the potential of the results and suggest protection tools and exploitation strategies;
- Prepare and update the exploitation plan of the project;
- Check the valorisation potential of papers prepared by scientists into IP before publications;
- Support the PC in reporting about exploitation to the PMT

2.4. External Advisory Board

The guidance of an eventual external advisory panel consisting of representatives from potential users and interested third parties is anticipated. This panel will provide advice on user priorities that will guide PMT decisions on project direction, plans and exploitation. Members of the panel will be expected to attend the project workshops outlined in the dissemination plan, and invited to submit advisory feedback to the PC. Current member of the EAB are representatives of

- BASF
- CEPI
- Starch Europe
- VTT
- Vattenfall
- BP
- Solar Heat Europe

2.5. Risk Manager

Risk Manager who will be appointed by DTI, RM will be responsible of all consortium partners to provide input and mitigate risk within the project, the RM will lead the consortium in the coordination effort of collation, monitoring and analysis of the risks within the project. The RM reports findings to the Project Coordinator on a six monthly basis, and advises on any possible remedial action. The RM will create a risk evaluation template, which will be used by partners to track risk, and as a living document be updated and appended to the periodic progress reports. The RM will also be responsible for the Risk Management Strategy.

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2.6. Communication & Dissemination Manager

Communication & Dissemination manager who will be appointed by EHPA, C&DM will develop and implement the communication and dissemination strategy. C&DM will provide an online platform and communication tools for effective dissemination and engagement based on a coherent strategy, disseminate the main findings of the project and to support partners in communicating and disseminating their work. C&DM will also ensure the capacity building and knowledge transfer between the various target groups, while engaging and influencing key stakeholders, with the ultimate aim of affecting policy, research, and practice.

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3. Analysis of activities

3.1. WP1: Design, Engineering, Construction & Integration

Objectives

The overall objective of this work package is to design, construct and integrate three (3) heat pump systems at three (3) end-user locations. This allows the consortium to demonstrate industrial heat pump technology up to TRL 8 within a full-scale industrial process. The sub-objectives are:

- Design and construct industrial heat pumps according to the specifications of the industrial end-users;
- Design and construct the interfaces for the heat pumps at the industrial sites;
- To mechanically and electrically integrate the heat pumps and industrial processes and subsequently commission of the combined process.

Roles

TNO is the Work Package leader and as such responsible for overall progress within this work package

T1.1 TNO – responsible for the basis of design document, providing templates for this, guiding the BOD process for the **SP** demonstration case, **DTI** - guiding the BOD process for the **TIS** demonstration case**, DLR** – guiding the BOD process for the **SK** demonstration case, **MYK, SP** -providing input for the heat pump and integration specifications for the **SP** case, **GEA, TIS** - providing input for the heat pump and integration specifications for the **TIS** case, **SPIL, SKC/SKPS** -providing input for the heat pump and integration specifications for the **SK** case.

T1.2 DLR - responsible for the basis engineering (BE) document, providing templates for this, guiding the BE process for the **SK** demonstration case, **TNO -** guiding the BE process for the **SP** demonstration case, **DTI -** guiding the BE process for the **TIS** demonstration case**, MYK, SP** -carry out the BE for the heat pump and the integration and provide input to the BE document for the **SP** case, **GEA, TIS** - carry out the BE for the

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heat pump and the integration and provide input to the BE document for the **TIS** case, **SPIL, SKC/SKPS** - carry out the BE for the heat pump and the integration and provide input to the BE document for the **SK** case.

T1.3 DTI – responsible for the detailed (process, mechanical, electrical) engineering (DE) document for both the heat pump skids and the industrial interfaces, guiding the DE process for the **TIS** case. **TNO** - guiding the DE process for the **SP** demonstration case **DTI** guiding the DE process for the **TIS** demonstration case, **DLR** guiding the DE process for the **SK** demonstration case **MYK, SP** -carry out the DE for the heat pump and the integration and provide input to the DE document for the **SP** case, **GEA, TIS** - carry out the DE for the heat pump and the integration and provide input to the DE document for the **TIS** case, **SPIL, SKC/SKPS** - carry out the DE for the heat pump and the integration and provide input to the DE document for the **SK** case.

T1.4 GEA - construction of the heat pump for the **TIS** case, FAT testing**, TIS** construction of the interface for the heat pump at their site, FAT testing. **MYK** construction of the heat pump for the **SP** case, FAT testing**, SP** construction of the interface for the heat pump at their site, FAT testing, **SPIL** construction of the heat pump for the **SK** case, FAT testing**, SKC** construction of the interface for the heat pump at their site, FAT testing.

T1.5 SP, SKPS, SKC, TIS, **GEA, SPIL, MYK** - Commissioning: FAT testing, preparation of manuals, training of operators. Pre-start up actions (vacuuming, filling, etc.). Normal start up procedure and checks. The Declaration of Acceptance.

T1.6 TNO – preparing document on lessons learned in terms of best practices and improvements, **DTI** – provide input on lessons learned document, **DLR** - provide input on lessons learned document, **GEA** - provide input on lessons learned document, decommissioning of heat pump at TIS site, if required, **MYK** - provide input on lessons learned document, decommissioning of heat pump at SP site, if required, **SPIL** - provide input on lessons learned document, decommissioning of heat pump at **SK** site, if required, **TIS**, provide input on lessons learned document, decommissioning of integration works at **TIS** site, if required, **SP**, provide input on lessons learned document, decommissioning of integration works at **SP** site, if required, **SK**, provide input on lessons learned document, decommissioning of integration works at **SK** site, if required.

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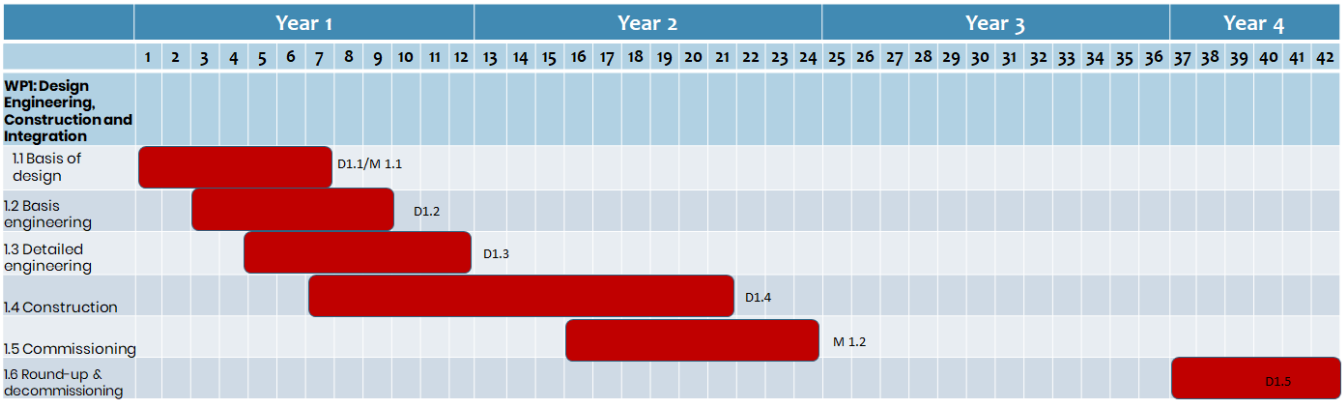

Figure 2 – *Gantt chart for WP1*

Deliverables

Number	Description	Lead	Due date	Expected date
D1.1	Basis of design: Report covering aspects of the pre-engineering study which forms the basis of design	TNO	3	7
D1.2	Basic engineering package: Report providing details on the basic engineering of heat pump integration at the three demonstration sites	DLR	5	9
D1.3	Detailed engineering package: Report providing details on the basic engineering of heat pump integration at the three demonstration sites	DTI	7	12

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D1.4	Heat pump skid: Three heat pump skids delivered to the end user locations	GEA	16	21
D1.5	Future plan of Industrial demonstrators	TNO	38	38
D1.6	Lessons learned: Report on the lessons learned in terms of best practices and possible process improvements for integration of heat pumps into industrial demonstrators	TNO	42	42

Milestones

Milestone	Name	Lead	Due date	Expected date
1	Basis of design approved	TNO	5	7
2	Basic engineering package	TNO	5	9
4	Detailed engineering package	TNO	7	12

3.2. WP2: Industrial demonstrations

Objectives:

The objective of this work package is to perform the demonstration campaigns, the data acquisition and analysis of heat pumps in industrial settings. This demonstrates industrial heat pumps as a TRL 8 technology a full-scale industrial process. The sub-objectives are:

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- To define testing program and testing standards for industrial heat pumps • To monitor long-term performance for more than 2000 hours per year and demonstrate safe and reliable operation
- To monitor the condition of compressor related components of the heat pumps
- To numerically analyse and characterise the measured performance of the heat pump systems and compare with the original design
- To optimize the overall performance of the combined heat pump and process at each end user location

Roles

TNO is the Work Package leader and as such responsible for overall progress within this work package

T2.1 TNO - responsible for defining the testing program will be the basis for the experimental campaign of the three demonstration cases of the heat pumps under different conditions (steady state and dynamic), defining the testing program for the **SP** demonstration case, **DTI** defining the testing program for the **TIS** demonstration case**, DLR** – defining the testing program for the **SK** demonstration case, **MYK**, **SP** - providing input for the testing program for the **SP** case, **GEA, TIS** - providing input for the testing program for the **TIS** case, **SPIL, SKC/SKPS** - providing input for the testing program for the **SK** case.

T2.2 TNO – responsible for defining the testing standard for the industrial heat pumps (IHPs). dependent on operation conditions, DTI - provides input to create a common benchmark method for measuring the performance of IHPs and establish a standard that specifies methods for testing and rating of performance.

T2.3 DLR – responsible for measuring the performance of the various industrial heat pumps under conditions established in the test program and with reference to modelling results, **TNO** - guiding demonstration and monitoring the **SP** demonstration case, **MYK, SP** – provide input on demonstration and monitoring on **SP** site, **DTI -** guiding demonstration and monitoring the **TIS** demonstration case **GEA, TIS -** provide input on demonstration and monitoring on **TIS** site, **DLR** - guiding demonstration and monitoring the **SK** demonstration case, **SKC/SKPS, SPLI** – provide input on demonstration and monitoring on **SK** site.

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T2.4 DLR – create two digital twins of the three demonstration sites, a steady-state parameter-based model and a transient-based model that considers the dynamics of the system, **TNO, DTI** – provide input on digital twins creation, **TLK** – provide input on modelling tool, **MYK,SP** – provide input on the modeling tools to improve understanding of the system for **SP** case, **GEA,TIS** - provide input on the modeling tools to improve understanding of the system for **TIS** Case, **SPIL, SKC/SKPS** - provide input on the modeling tools to improve understanding of the system for **SK** case.

T2.5 DLR – utilize the digital twins developed in task T2.4 to optimize the controllers' set points (e.g., superheat at the outlet of the compressor) of the three demonstration site, **TNO, DTI** – using digital twin to optimize the heat pump's operation with the industrial process**, TLK** – providing input on the digital twin optimization process, **MYK, SP,–** provide input on heat pump performance of **SP** case, **GEA,TIS** – provide input on heat pump performance of **TIS** case, **SPIL, SKC/SKPS -** provide input on heat pump performance of **SK** case.

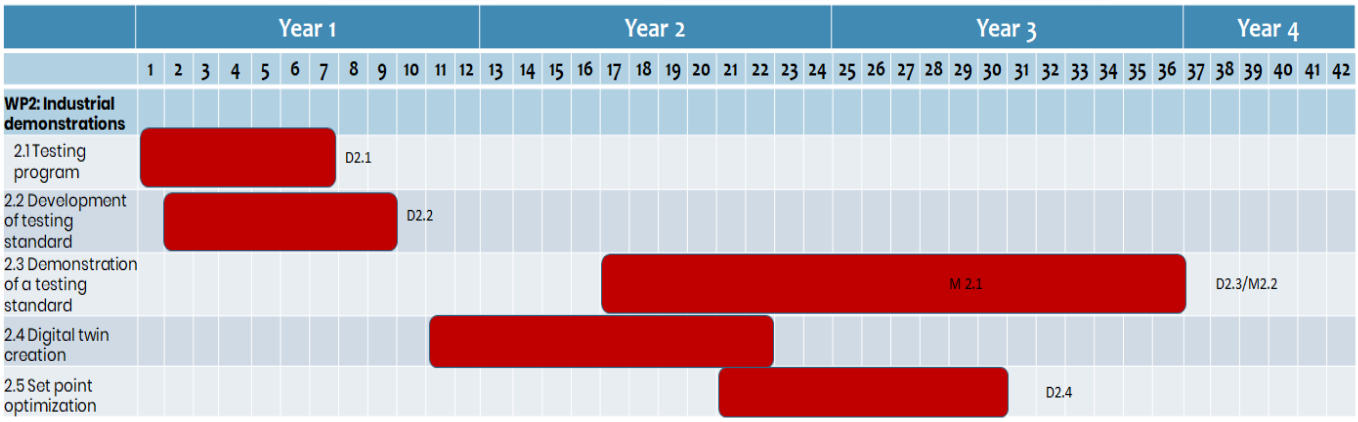

Figure 3 – *Gantt chart for WP2*

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Deliverables

Number	Description	Lead	Due date	Expected date
D2.1	Testing program: Report outlining in detail the test program conditions (steady state and dynamic) under which the heat pumps will operate for the various demonstrations	TNO	3	7
D2.2	Testing standard for IHP: Report containing a benchmark (standard) method for measuring and establishing the performance of IHPs	TNO	7	9
D2.3	Demonstration & performance monitoring: Report outlining the measured performance of the various industrial heat pumps under conditions established in the test program and with reference to modelling results	DLR	36	36
D2.4	Steady state and dynamic models: Numerical models (digital twins) of the three heat pump demonstrator units applied to the industrial processes used for process monitoring and optimization	DLR	30	30

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Milestones

Milestone	Name	Lead	Due date	Expected Date
5	Heat pump commissioning completed	TNO	18	24
9	Stable operation of heat pump	TNO	30	30
12	Demonstration program completed	TNO	36	36

3.3. WP3: Advanced technical developments

Objectives

The overall objective of this work package is to conduct technological developments, improving the competitiveness of high-temperature heat pumps with a focus on enabling low-cost standard units with high performances and large operating windows for a large variety of applications. These objectives are reached by the following sub-objectives:

- To conduct relevant technical developments and modifications to compressors to allow optimized and stable operation at temperatures of up to 160°C.
- To identify and test zeotropic mixtures as working fluids that provide a higher performance of heat pumps in the temperature range of 100°C to 160°C.
- To develop lubrication systems ensuring stable operation and enabling high performances by heat recovery
- To develop innovative operational strategies which enhance the dynamic performance of the coupled heat pump system and industrial process and thereby enhance the range of applications to transient processes

Roles

DTI is the Work Package leader and as such responsible for overall progress within this work package

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T3.1 DTI – responsible for optimizing the compressor design. Identifying the specific challenges and exploiting the respective potentials for the end users, optimizing temperature stability and compressor components, **GEA** – provide input on screw compressor (O-rings, compressor block, rotors, valves and electronical terminal board), **MYK** - provide input on heat pump package (available compressor information, valves, heat exchangers, instrumentation), **SPIL** – provide input on steam compressor (O-rings, compressor block, rotors, valves and electronical terminal board)

T3.2 TNO – identify suitable lubricants for the systems, design an oil separation system with optimization of the injection ports for the oil system by minimizing the oil flow, optimization of the heat recovery from oil cooling, **DLR, GEA, Mayekawa** – provide input on lubrication systems for heat pumps including heat recovery.

T3.3 TNO - conduct experimental analysis to validate and improve the heat pump performance using zeotropic working fluid mixtures. **DTI** – provide assistance with experimental analysis.

T3.4 DTI - perform case studies for the application of digital-twin based set point optimization for applications with variable loads and off-design operation and recommendations for exploiting the potentials from digital twins. **TLK-** provide assistance in implementation of digital twain in Modelica language based on the TIL Library, **TNO, DLR** - provide input on case studies for the application of digital-twin based set point optimization. **TVP** – Provide data from existing HVFP (High Vacuum Flat Panel) based solar systems and support the development of digital-twin for Industrial Heat Pump (IHP) systems running with solar heat. Review the results of the digital-twin-based simulations – optimization.

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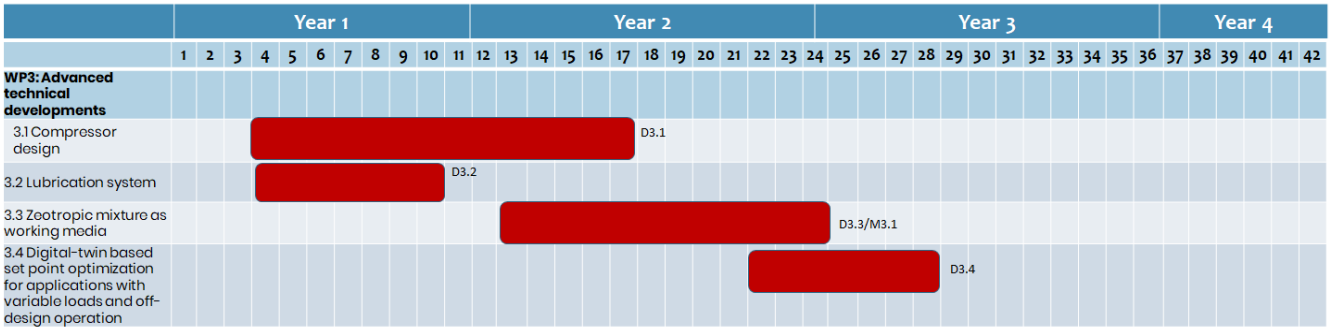

Figure 4 – *Gantt chart for WP3*

Deliverables

Number	Description	Lead	Due date	Expected date
D3.1	Optimized compressor design portfolios: Report containing details on three heat pump compressor design portfolios optimized to supply temperatures in the range of 100°C-160°C	DTI	17	17
D3.2	Lubrication system design: Report containing design recommendations of lubrication systems for heat pumps including heat recovery	TNO	10	10

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D3.3	Zeotropic working fluids: Report on the experimental analysis of performance improvement potentials using zeotropic working fluid mixtures	TNO	24	24
D3.4	Case studies for application of digital-twin: Report containing three case studies for the application of digital-twin based set point optimization for applications with variable loads and off design operation and recommendations for exploiting the potentials from digital twins	DTI	28	28

Milestones

Milestone	Name	Lead	Due date	Expected Date
7	Technical improvements established	DTI	24	24

3.4. WP4: Repeatable concepts and modular design

Objectives

The overall objective of this work package is twofold: first, to ensure that following the conclusion of this project, the heat pump manufacturers are able to produce modular heat pump units, which use a limited number of components to cover a large number of market applications, at a price that makes the technology competitive with

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alternate heating technologies. And second, to ensure that there are guidelines and standard methods of process integration made available to stakeholders on the integration of heat pumps in industry

- To develop a standard equipment portfolio for industrial heat pumps
- To simplify manufacturing processes for high-temperature heat pump systems
- To identify how modular components (compressors, heat exchangers, etc.) can be combined to cover a large share of the heat pump market
- To determine standard heat pump integration methods for the applications in industry

Roles

DLR is the Work Package leader and as such responsible for overall progress within this work package

T4.1 DLR – responsible for detailed modular heat pump design (scope of components, design, engineering, and manufacturing). It entails both manufacturer and process specific requirements. Investigating the existing examples of modular design concepts, evaluate and used as inspiration and reference, **GEA**, **MYK** – provide input on how to adapt their technologies to use another working medium suitable for higher temperatures, **SPIL** – provide input on piston compressors to reduce the specific investment costs. **TNO, DTI,** - provide input on low-cost modular heat pump

T4.2 DLR – identify and make recommendations on developments needed specific to the market opportunities and development needs for the modular heat pump concept developed in T4.1, **TNO, DTI** – study different technologies and suppliers, various scenarios for the design of the final heat pump system (MVR, vapor compression, zeotropic mixtures) make a portfolio of heat pumps that can cover different heat capacities and temperature levels, **GEA, SPIL, MYK** - provide input on the possible industrial heat pump market and subsequently identify potential sales volumes.

T4.3 DTI – responsible for the development of strategies for both electrification and solar thermal integration for the demonstration sites, **DTU** – developing the guidelines for integration based on advanced methods for industrial process integration and heat pump optimization, **DLR**, **TNO** – developing the basic initial design (typical heat sources, and sinks, site infrastructure etc.) provide input on defining standard integration concepts and strategies for the respective industries and the temperature

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ranges, **SP, SKPS, TIS** – provide input on specific issues that are typical for the paper and food industries. **TVP** - Perform on-site survey of the SPIRIT demo sites to assess the solar thermal potential (pre-feasibility level) based on the medium and long term goals of SPIRIT and of the respective industrial user. Performing simulations for solar heat generation for the demonstration sites (based on heat consumption profile/ data available). Elaborate the requirements for solar thermal integration in each site (e.g. positioning, size, target processes, system configuration & integration, etc.). TVP will elaborate on two alternative approaches for the integration of solar thermal systems with SPIRIT IHPs (with and without excess heat) towards full decarbonisation of process heat. Monitoring and control strategies will be reviewed with respect to solar thermal and IHP integration.

T4.4 TLK – responsible for developing a web based heat pump integration tool, which will be used to design, dimension, and optimize the most relevant heat pump cycles concerning thermodynamic performance and economic key-performance indicators, based on inputs for a heat source, heat sink, and additional boundary conditions, **TNO, DTI, DLR –** support TLK on tool development, providing input on models of heat pump demonstrators, working fluid selection, process integration concepts, and business models for upgraded heat.

T4.5 TNO – responsible for conducting the Life Cycle Assessment of the heat pump technology applied to the demonstration cases taking into account the guidelines of ISO 14040/1404, **TNO** -guiding LCA process for the **SP** demonstration case **MYK, SP** - collecting data of the heat pump assessment on the **SP** demonstration site, **DTI** - guiding LCA process for the **TIS** demonstration case**, GEA, TIS** - collecting data of the heat pump assessment on the **TIS** demonstration site, **DLR** - guiding LCA process for the **SKC** demonstration case, **SPIL, SKC –** collecting data of the heat pump assessment on the **SKC** demonstration site the heat pump assessment will be done by collecting data on the demonstration site.

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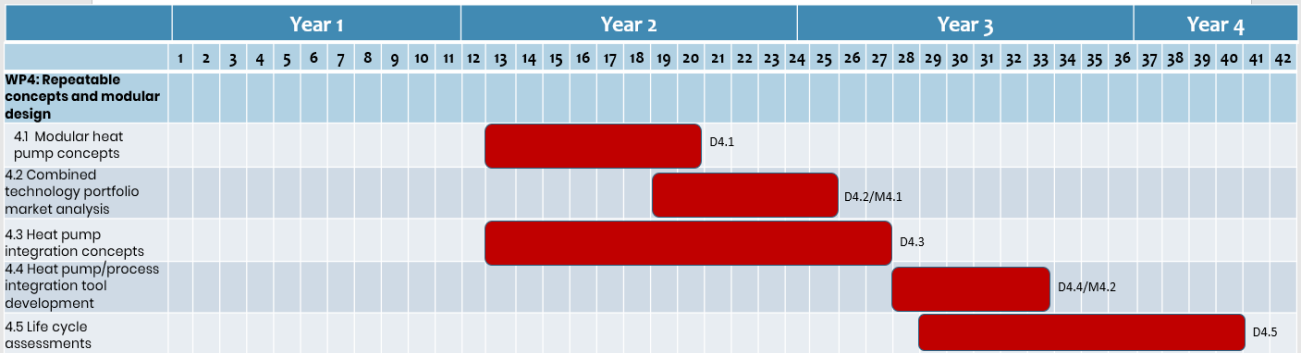

Figure 5: *Gantt chart for WP4*

Deliverables

Number	Description	Lead	Due date	Expected date
D4.1	Modular heat pump design: Report outlining the modular design concepts developed and their benefits over existing practices, combined technology portfolio market analysis.	DLR	20	20
D4.2	Integration concepts and recommendations: Report containing general recommendations for the application of heat pumps applied to industry and case studies on the optimal integration of heat pump technology in ten (10) processes identified through the market study as being most relevant for heat pump integration	DTI	25	25

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D4.3	Heat pump integration tool: Online publication of heat pump integration tool used to design, dimension and optimize heat pumps applied to industrial processes	TLK	33	33
D4.4	Lifecycle analysis: Report containing the life cycle analysis for each demonstrator.	TNO	40	40

Milestones

Milestone	Name	Lead	Due date	Expected date
8	Modular heat pump concepts for each manufacturer with modular equipment inventory	DLR	25	25
11	Heat pump integration tool developed	DLR	33	33

2.5 WP5: Maximizing technical and commercial impact

Objectives

The overall objective of this work package is to determine the applications and conditions in which heat pumps are attractive technology for industry and to subsequently develop and apply strategies such that their impact can be maximized. The sub-objectives are:

- To identify the potential applications of heat pumps for industrial processes and determine their potential impact in terms of achieving energy and CO_2 savings
- To identify under which conditions industrial heat pumps are an attractive technology with reference to competing technology options
- To develop business models and contractual agreements for the upgrade of heat (for the full life cycle) in single and multi-stakeholder environments (i.e., transfer heat across process, site or operational boundaries)

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- To determine the extent to which current policy incentives facilitate the uptake of heat pump technology and which policy or regulatory barriers are hindering their uptake
- To determine the skills which are needed (and missing) in the market to facilitate the uptake and installation of heat pump technology in industry • To identify other non-technical barriers which currently hinder the uptake of industrial heat pump technology and to take relevant steps towards addressing and resolving these barriers
- To determine the potential of heat pump technology, developed as part of the SPIRIT project to have impact for other end-use applications (i.e., buildings, district heating)
- To develop strategies for the rollout and implementation of the heat pumps demonstrated in SPIRIT

Roles

EURAC is the Work Package leader and as such responsible for overall progress within this work package

T5.1 EURAC – responsible for Market analysis by determining and analyzing the conditions for the industrial heat pump market, also identify the energy and CO2 saving potential of heat pumps under the various scenarios providing information such as total market size in terms of installed capacity and number of units, whilst also determining the technical characteristics of the heat pumps which make up the market (sink temperatures, temperature lifts, heat pump sizes), **EHPA, SINLOC, TNO, DTI, DLR** – provide input on the identification of the most suitable mix of technologies (not only heat pumps) for different industrial process under various scenarios based on KPIs defined (e.g., CO_2 emissions, investment costs, levelized cost of heat, etc.).

T5.2 EHPA – responsible for identifying the policy, regulatory, and other non-technical barriers in EU Member States and Associated Countries containing approaches, comparisons and recommendations, **EHP, DLR, TNO, DTI –** provide input on Policy, regulations and other non-technical barriers document. **TVP** - Share experience from solar heat for industrial processes with respect to regulatory barriers that apply for solar steam generation (safety-related requirements; regulatory permissions, etc.)

T5.3 SINLOC – responsible for Business models by outlining the business models developed and analysis of the contractual agreements which will encourage the

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commercial uptake, **GEA, SPIL, MYK, SP, SKC/SKPS**, **TIS** – will provide relevant information on possible contractual arrangements that could encourage the commercial uptake and a broad diffusion of the technology, starting from the recognition of similar experiences in Europe, and leveraging on the market experience of industrial partners and their legal departments. **TVP** - Build on the experience from Heat Purchase Agreements (HPAs) from solar thermal to elaborate business/ financing models and agreements between the industrial user, technology providers and financiers.

T5.4 DTU – responsible for technology transfer to district heating sector by focusing on the high-temperature demands in European district heating, potential heat sources and assessment of potential for industrial heat pumps in the sector**, EHP** – provide input to identify district heating operators and other stakeholders which have high temperature demand. **TVP** – Study the scenario of coupling solar district heating with high-temperature heat pumps for potential DH projects in Europe.

T5.5 EHPA - preparing recommendation for the competency framework for industrial heat pumps**, DLR, GEA, SPIL, MYK –** Provide input on skills and competency developments needed to establish an industrial heat pump sector.

T5.6 DTI - outlining the Market implementation strategy for exploitation of industrial heat pumps from the perspective of end-users and technology suppliers, defining a process to commercialize the new technology and finalize the process of diffusion into the market, **GEA, SPIL, MYK,** – provide input on the implementation strategy, investments needed to facilitate large scale entry into the market, further developments needed to reach cost targets, adoption of modular design concepts, target market and marketing strategies, **SP, TIS, SKC/SKPS** – provide input on performance monitoring, integration concepts and business model to provide an overarching strategy for further exploitation of heat pumps in their processes. **TVP** - Contribute to exploitation strategies involving solar heat under 2 scenarios: 1. Scale-up SPIRIT IHP demo systems with the application of solar heat. A feasibility study per demo site will be produced. 2. Application of IHP & solar thermal system coupling as packaged solution for heat upgrade in applications across industrial sectors (e.g. food & beverage; pulp & paper; pharmaceuticals; chemicals). TVP will engineer generic solutions combining IHP & solar thermal.

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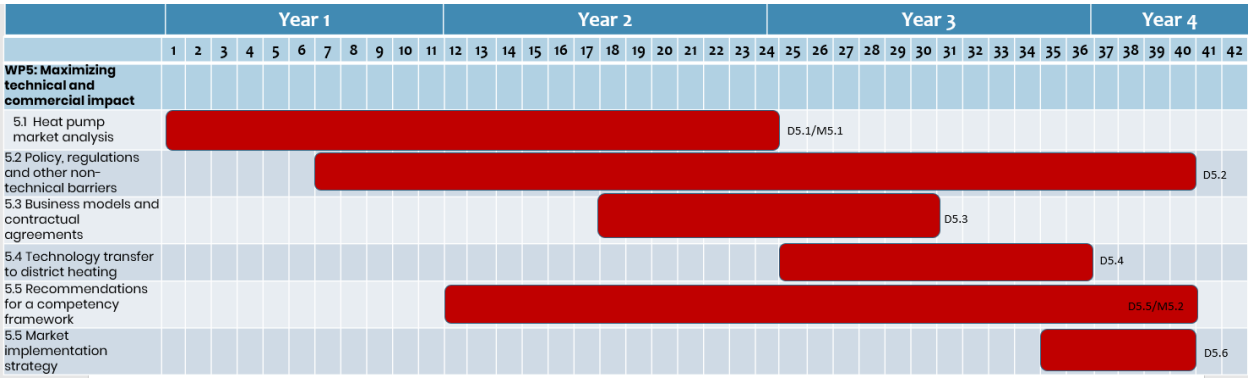

Figure 6: *Gantt chart for WP5*

Deliverables

Number	Description	Lead	Due date	Expected date
D5.1	Market analysis: Database on the collated thermal energy and energy carriers' inventory in industry and report on the associated heat pump market analysis for the various scenarios	EURAC	24	24
D5.2	Policy, regulatory and non-technical barriers: Report on the policy, regulatory and non-technical barriers in EU Member States and Associated Countries containing approaches, comparisons and recommendations	EHPA	40	40

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D5.3	Business models and contractual agreements: Report outlining the business models developed and analysis of the contractual agreements which will encourage the commercial uptake	SINLOC	30	30
D5.4	Technology transfer to district heating sector: Report on the high-temperature demands in European district heating, potential heat sources and assessment of potential for industrial heat pumps in the sector	DTU	36	36
D5.5	Skill and competency recommendations: Report outlining the skill and competency developments needed to establish an industrial heat pump sector	EHPA	40	40
D5.6	Market Implementation strategy: Report outlining the strategy for exploitation of industrial heat pumps from the perspective of end-users and technology suppliers	DTI	40	40

Milestones

Milestone	Name	Lead	Due date	Expected Date
6	Potential industrial heat pump market established	EURAC	24	24
13	Skill & competency framework for the industrial heat pump sector	EURAC	40	40

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2.6 WP6: Dissemination and raising awareness

Objectives

This work package will develop and implement the communication and dissemination strategy as described in the dissemination plan in the Impact section of this proposal. The overall objective is to ensure the impact of the SPIRIT results on key target audiences for effective communication and dissemination.

- To provide an online platform and communication tools for effective dissemination and engagement based on a coherent strategy, disseminate the main findings of the project and to support partners in communicating and disseminating their work.
- To ensure capacity building and knowledge transfer between the various target groups, while engaging and influencing key stakeholders, with the ultimate aim of affecting policy, research, and practice.
- To facilitate a regular flow of information between project partners and to ensure a constant exchange of information between research and policy developments.
- To make stakeholders understand the aim of the project and appreciate its significance for their own organization, clients and collaborators.

Roles

EHPA is the Work Package leader and as such responsible for overall progress within this work package

T6.1 EHPA – responsible for Communication and dissemination strategy, providing an online platform and communication tools, disseminate the main findings of the project and to support partners in communicating and disseminating their work, **EHP** – Provide input in Communication and dissemination strategy and plan document.

T6.2 EHPA - responsible for the overall branding of the SPIRIT project. In particular, it consists of (a) the logo and brand guidelines; (b) the website (screenshots of the main tabs); (c) the social media pages; (d) the templates (.docx; .pptx), **TNO, DTI, DLR, MYK,**

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SINLOC, EURAC, EHP, DTU, TVP, TIS, TLK, GEA, SPIL, SKC/SKPS, SP – provide input on the communication tools that will be used for the SPIRIT project.

T6.3 EHPA – responsible for organizing Summer school on industrial heat pumps for interested parties (i.e., end users, consultants, etc.), students, and young professionals to enhance the knowledge and competencies in the market and also ensuring the knowledge transfer to the industry, Links will be made to the project demonstration sites, including site visits, **DTU**- will grant ECTS to the participants and host the Summer school, **TNO, DTI, DLR** – provide input on generating the syllabus, the planning, and the execution of the summer school.

T6.4 EHPA – responsible for developing a series of policy briefs in a suitable format for an effective knowledge transfer. These briefs will be presented during online seminars or in meetings organized with relevant policymakers, Furthermore, the outcomes of WP5, more specifically from T5.3 will be used to inform the content and messages of the policy briefs. These briefs will be presented during online seminars or in meetings organized with relevant policymakers, **EHP** – provide input on Policy briefs document.

T6.5 EHPA - responsible for organizing the final SPIRIT conference, which will be a hybrid event which will bring the overall project to a close. The full SPIRIT consortium and all relevant stakeholders from the value chain of industrial heat pumps will be invited: experts from relevant sector, policy/investment makers, researcher, end-user, technology providers, among others. **TNO, DTI, DLR, MYK, SINLOC, EURAC, EHP, DTU, TVP, TIS, TLK, GEA, SPIL, SKC/SKPS, SP** – provide assistance in organizing the SPIRIT final conference.

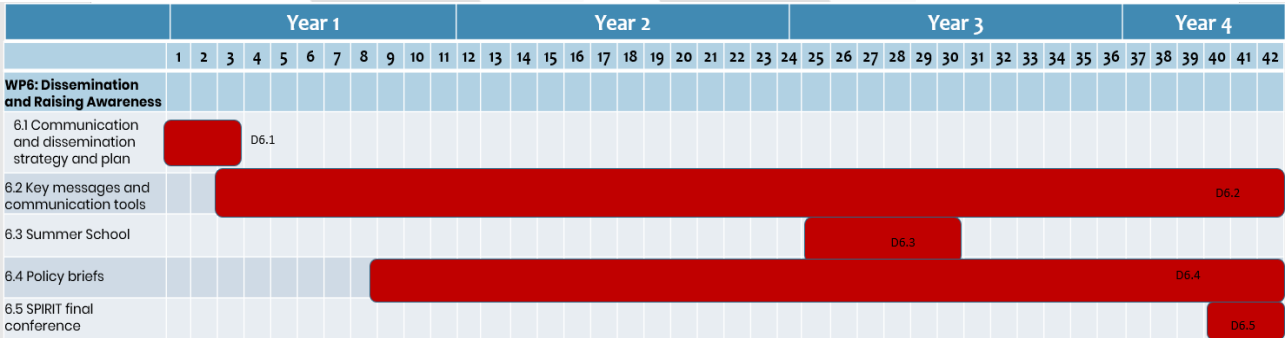

Figure 7: *Gantt chart for WP6*

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Deliverables

Number	Description	Lead	Due date	Expected date
D6.1	Communication and dissemination strategy and plan: Report outlining the communication and dissemination strategy and the plan for executing this in the project	EHPA	3	3
D6.2	Visual identity, logo and templates: Creation of the visual identity for the project including important templates, social media accounts and the project website	EHPA	4	4
D6.3	Communication and dissemination strategy and plan update: Updated report from D6.1 including overview of the realized communication and dissemination activities	EHPA	21	21
D6.4	Newsletters, policy briefs	EHPA	42	42
D6.4	Summer school on industrial heat pump technology: Delivery of the first summer school on industrial heat pumps to university students, young professionals and other interested stakeholders	EHPA	30	30

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D6.5	SPIRIT final conference: Hybrid final conference to present the main findings and outcomes of the SPIRIT project to stakeholders	EHPA	42	42

Milestones

Milestone	Name	Lead	Due date	Expected date
3	Project website	EHPA	6	6
10	Summer school	EHPA	30	30
14	Final conference	EHPA	42	42

2.7 WP7: Project management, coordination & ethics requirements

Objectives

The overall objective of this work package is to ensure the SPIRIT project achieves all the objectives outlined in the proposal whilst adhering to the requirements and boundary conditions set forth:

- To ensure that the overall objectives of SPIRIT are met at the end of the project and within the project budget and at the set quality levels;
- To ensure that the project deliverables and milestones are completed in time and within budget;
- To identify, analyse, prevent, and mitigate any potential risk that would threaten the implementation of SPIRIT according to planning and allocated resources. To facilitate effective and efficient communication between consortium partners, and the integration of work packages;
- To coordinate the overall legal, contractual, financial, and administrative procedures of the project;

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- To maintain a transparent and effective communication with the European Commission;
- To inform the Executive Board and the Technical Team on results regularly, forward their feedback to the consortium partners and implement their recommendations in the project plan whenever required;
- To ensure data management is done to ensure data integrity and safety.

Roles

TNO is the Work Package leader and as such responsible for overall progress within this work package

T7.1 TNO – responsible for the overall legal, contractual, financial, administrative procedures and coordination of the project. The financial procedures include the consolidation of cost, follow-up of EC payments, and transfer of partner shares. The administrative procedures include financial records, timeline management, and coordination of costs statements. Furthermore, will also be responsible for the project periodic progress reporting to the European Commission.

T7.2 TNO – responsible for the daily management of the SPIRIT project which includes Scheduling, planning, decision making, and conflict resolution as well as monitoring the financial progress and the progress concerning content, identifying the major deviations from the project plan. Periodic project meetings and teleconferences for project progress, Milestones and deliverables monitoring.

T7.3 DTI - responsible for the appointing a Risk Manager who will be a representative of DTI, to enhance the risk management of the SPIRIT project. The RM will implement the risk analysis and mitigation strategy. The Risk Manager reports findings to the Project Coordinator on a six-monthly basis, and advises on any possible remedial action. The Risk Manager will create a Risk Evaluation Strategy and Risk Evaluation Template Document, which is deliverable D7.5, which will be used by partners to track risk, and will be used as a living document which will be updated and appended to the periodic progress reports, **TNO, MYK,SP, DLR, SPIL, SKC/SKPS, DTI**, **GEA, TIS, TVP TLK, EHPA, SINLOC, EURAC, EHP** – provide input to track down the risk involved in the project.

T7.4 TNO – responsible for maintaining a transparent and effective communication with the European Commission by sharing the periodic progress reports and exchanging the legal, financial, and administrative forms, also informing regularly the

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Executive Board and the Technical Team about the progress and project results. **DTI, DLR, MYK, SINLOC, EURAC, EHP, DTU, TVP, TIS, TLK, GEA, SPIL, SKC/SKPS, SP**, **EHPA** – provide inputs about the project progress and results.

T7.5 TNO – responsible for making a data management plan following the Horizon Europe guidelines, regularly update, with updates including the Periodic reports. The data management plan will cover the overall data management cycle, addressing the relevant aspects of making data FAIR (findable, accessible, interoperable and re-usable), and will include information on how the research data is handled during, after and end of the project; which data is collected and generated. **DTI, DLR, MYK, SINLOC, EURAC, EHP, DTU, TVP, TIS, TLK, GEA, SPIL, SKC/SKPS, SP**, **EHPA –** provide input on data management plan document.

T7.6 TNO – responsible for the 'ethics requirement' of the project, which will comply two deliverables. The first deliverable concerns the Human – Protection of Personal Data (H-POPD) report, D7.10. The second deliverable under this task is D7.11, the Environmental Protection and Safety (EPQ) report. **DTI, DLR, MYK, TIS, GEA, SPIL, SKC, SP –** will describe their role in the project and illustrate their approaches and arrangements to cover environmental protection and safety issues.

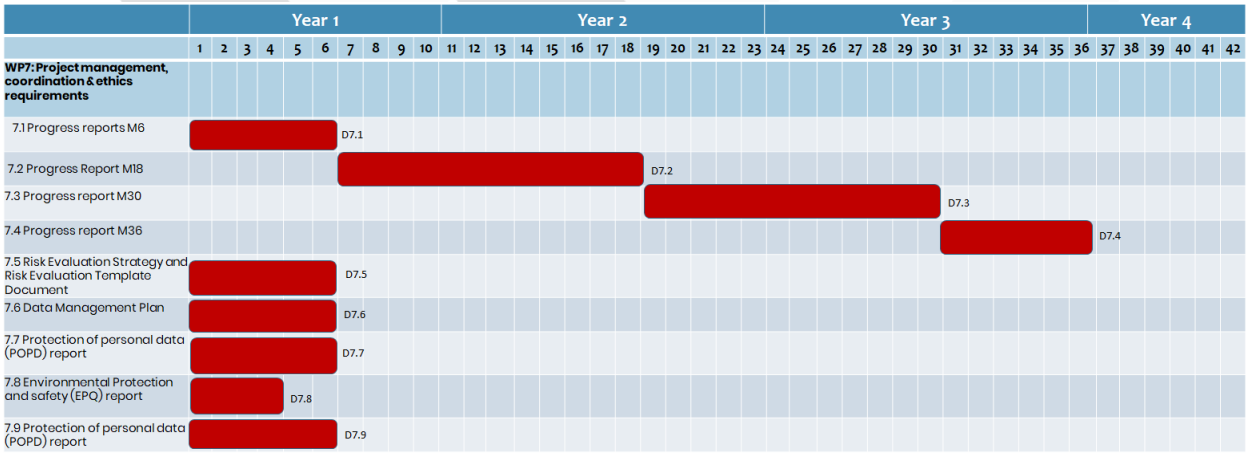

Figure 8: *Gantt chart for WP7*

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Deliverables

Number	Description	Lead	Due date	Expected date
D7.1	Progress reports M6	TNO	6	6
D7.2	Progress report	TNO	18	18
D7.3	Progress report M30	TNO	30	30
D7.4	Progress report M36	TNO	36	36
D7.5	Risk Evaluation Strategy and Risk Evaluation Template Document	TNO	6	8
D7.6	Data Management Plan	TNO	6	7
D7.7	Protection of personal data (POPD) report	TNO	3	6
D7.8	Environmental Protection and safety (EPQ) report	TNO	3	4
D7.9	Project Management Plan (PMP)	TNO	5	6

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4. Reporting

4.1. EU reporting

The reporting to the European Commission, where the SPIRIT consortia will provide information on the status of deliverables and milestones. Moreover, other important matters will also be included, such as risk affecting the project, published scientific papers, intellectual property management advancement, or project dissemination initiatives. The periodic reporting will be cover the Technical reports , Financial reports and Financial statements.

The project involves 4 reporting periods, as shown below:

- P1: from month 1 to month 6
- P2: from month 6 to month 18
- P3: from month 18 to month 30
- P4: from month 30 to month 36

The beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the grant agreement. These moments correspond with P2 and P3 above.

- for additional prefinancing (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part. The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool. The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities);
- the explanation on the use of resources (or detailed cost reporting table, if required);
- the certificates on the financial statements (CFS) – only for the final report

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Financial statement

The financial statement must detail the eligible costs and contributions for each budget category and, for the final payment, also the revenues for the action. All eligible costs and contributions incurred should be declared, even if they exceed the amounts indicated in the estimated budget (Grant agreement), Amounts that are not declared in the individual financial statements will not be taken into account by the granting authority. By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries
confirm that:
- the information provided is complete, reliable and true
- the costs and contributions declared are eligible

For TVP which is an Associated Partner in SPIRIT shall be responsible for the funding of its own obligations in the Project. They will report to the Swiss authorities to get the funding. As TVP has secured funding from the Swiss Funding Authority for its activities under the Project.

4.2. Deliverables and quality assurance

The preparation of the deliverables will include the following phases:

Phase 1: Lead partner coordinates the preparation of the deliverable based on input from partners, and then it is submitted to the coordinator.

Phase 2: The deliverable is made available for review by all relevant partners.

Phase 3: The coordinator and WP leader review the deliverable and propose revisions.

Phase 4: The coordinator receives the final version and submits it in electronic form to the EC.

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4.3. Communication

The GA and PMT will convene every 6 months for the evaluation of the current work status, for making appropriate decisions regarding future work and the facilitation of the work objectives. Additionally, the boards can convene at the request of any of the board leaders. Therefore, the boards will meet physically at least twice every year. In addition to these meetings, the GA and PMT will exploit, when needed, tele-conferences through suitable electronic platforms.

The beneficiaries must continuously report on the progress of the action (e.g., deliverables, milestones, outputs/outcomes, critical risks, indicators, etc.; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority). Standardized deliverables (e.g., progress reports not linked to payments, reports on cumulative expenditure, special reports, etc.; if any) will be submitted using the templates published on the Portal.

The working language for communication written, electronic or oral is English. Project information will be exchanged through the electronic circulation of working papers, project meetings and tele-conferences. A secured web-based document repository has been set-up in Teams to assist partners to quick and easy access of all communication material, administration documents, scientific information relevant to the project for the effective execution of the project tasks. Physical meetings will promote partner interaction and the selection of times and places will be strongly influenced by cost and convenience considerations. Even though representatives from each partner organization should attend each progress meeting, distant participation is possible through the Teams platform. Regular progress meetings will enable the distant participation of additional co-workers for the minimization of travel costs. Resource utilization will be carefully reviewed every 6 months at the meetings of the PMT. Additional teleconference meetings may take place between the PC and the WP leaders or GA to discuss current issues related to the progress of the scientific and management work in order to early detect deviations from the work plan.

All information like minutes of meetings, visit reports, WP reports, relevant publications and so forth will be communicated to the project coordinator, who will be responsible for passing information to the partners.

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To this end a SPIRIT dedicated web-site for the project will be maintained by EHPA and updated with the assistance of all partners. The web site will be complementary to the Teams repository.

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5. Resources

Web-sites

https://spirit-heat.eu/

LinkedIn

https://www.linkedin.com/company/83523876/admin/

Twitter

https://twitter.com/SPIRITProjectHE

YouTube

https://www.youtube.com/@SPIRITHorizonEurope

CORDIS

https://cordis.europa.eu/project/id/101069672

Model Grant Agreement

https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/aga_en.pdf

Grant Agreement

CORDIS and Teams repository

Meeting material and economics

Teams repository

HORIZON results platform

https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform

Open science platform

https://open-research-europe.ec.europa.eu/in

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