SECOND PROJECT PROGRESS REPORT

Project acronym: COLLECTiEF

Project title: Collective Intelligence for Energy Flexibility

Call: H2020-LC-SC3-EE-2020-2

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement No 101033683

Disclaimer

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Project no.	101033683
Project acronym:	COLLECTiEF
Project title:	Collective Intelligence for Energy Flexibility
Call:	H2020-LC-SC3-2018-2019-2020
Start date of project:	01.06.2021
Duration:	48 months
Deliverable title:	
Deliverable No.:	D1.5
Document Version>	4.7
Due date of deliverable:	31.05.2022
Actual date of submission:	31.05.2022
Deliverable Lead Partner:	Partner No. 1, NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU
Work Package:	1
No of Pages:	67
Keywords:	Project summary, Activities performed, Action plan, Internal project progress report.

Name	Organization
Mohammadreza Aghaei Medya Temelli Fenerci Silvia Erba Amin Moazami	NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU
Jelena Lazic	GEONARDO GEO

History of Changes

Date	Changes	
01.05.2022	Section 2.2	The action plans and milestones are now updated
	Section 3	The engagement strategic activities are now updated by M12
	Section 4.1	Scientific publications activities by M12 are added as a separate table
	Section 4.2	The workshops and seminars are updated Upcoming activities are merged with 4.2
	Section 4.3	Collaboration with the sister projects is updated with the current activities
	Section 4.4	The social media campaign by M12 is now added and updated
	Section 4.5	The updates related to the webpage are added
	Section 5	The activities, difficulties, problems, solutions as well as changes in the team members which were reported by partners, have been updated.
	Section 6	The list of the risks and related mitigation plans have been updated.

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Dissemination level

PU	Public

History

Version	Date	Reason	Revised by
4.2	01.05.2022	First version	Mohammadreza Aghaei, Medya Temelli Fenerci, Silvia Erba, and Amin Moazami, NTNU
4.3	11.05.2022	Document review	Jelena Lazic, GEO
4.4	18.05.2022	Second version	Mohammadreza Aghaei, Medya Temelli Fenerci NTNU
4.5	23.05.2022	Document approval	Jelena Lazic, GEO
4.6	25.05.2022	Final version	Mohammadreza Aghaei, Medya Temelli Fenerci NTNU
4.7	30.05.2022	Final approval	Amin Moazami, NTNU

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Executive Summary

The main purpose of this deliverable is to report the progress of the COLLECTiEF project within the second six months. The second phase of the project ran from October 2021 to March 2022 (M05-M10) and dealt with the further development of the COLLECTiEF project with a focus on planning for small-scale demonstration including the algorithms development and procurement of sensors as well as for users/stakeholders' engagement, sensor/device installation in the pilot buildings and initiating monitoring phase. The algorithms are also tested in the simulation environment and their overall concept is validated.

This report aims to present the key achievements and the fulfilled works as well as the status of each work package by the end of M10. Furthermore, the upcoming activities planned for M10-M12 as well as the next period (M12-M24) are reported.

The activities of the consortium for the second period of the COLLECTiEF project, have been initiated on the 1st of October 2021 and the defined milestones, tasks and deliverables have been successfully completed for this period (M05-M10), thanks to all COLLECTiEF partners who actively participated in the project and closely collaborated to achieve the targeted goals and progresses.

During the second phase of the project, the partners have had several meetings (internally, WPs, EB etc.) to perform the tasks and complete the foreseen deliverables. For better follow up and coordination of the consortium, an action plan based on the objectives and milestones of COLLECTiEF has been structured and prepared. This allowed us to follow step-by-step the expected work progress and monitor the activities of each partner in relation to the tasks as well as engage the working packages and partners to achieve the targeted objectives. The action plan includes the foreseen activities aligned with the tasks and the responsible person/organization who must complete and deliver the works by defined milestones as described in the Grant Agreement. This progress report is structured as follows:

- *Chapter 1* summarizes the project overview and objectives, and work packages.
- *Chapter 2* describes the project implementation strategy including the action plan, engagement strategy and project progress report.
- *Chapter 3* expresses engagement strategy, full timeline and involved tasks.
- *Chapter 4* reports the dissemination, promotion, and exploitation activities by M10.
- Chapter 5 explains the activities performed by the beneficiaries, progress overview per work package as well as the dissemination, and exploitation activities according to the action plan for the first phase of the project. Moreover, the project deviations, difficulties and solutions are discussed in this chapter.
- *Chapter 6* updates the project risks and the related statements.

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List of Acronyms

CI	Collective Intelligence
D	Deliverable
DoA	Description of Action
D&C	Dissemination and Communication
DMP	Data Management Plan
DYK	Did You Know
EB	Executive Board
DET	Dissemination and Exploitation Team
GA	Grant Agreement
GDPR	General Data Protection Regulation
IPPR	Internal Project Progress Report
KPIs	Key Performance Indicators
M	Month
MS	Milestone
M&V	Measurement & Verification Protocol
NSD	Norwegian Center for Research Data
Partner	The beneficiary in the COLLECTiEF Project
PM	Person Month
QA	Quality Assurance
QC	Quality Control
SDG	Sustainable Development Goal
TRL	Technology Readiness Level
WP	Work Package

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1. Project overview

1.1. The project summary and objectives

The European Union (EU) has been at the forehand of international efforts to tackle the global challenge of climate change and emissions of carbon dioxide (CO_2) impacts, and to deploy affordable, reliable, and modern energy services as well as to increase the share of renewable energy, according to the 7th and 13th Sustainable Development Goal (SDG7[1]& SDG13[2]).

COLLECTiEF research project commits to addressing the reliable and practical solutions for the challenges of climate change impacts and renewable energy penetration, by enhancing the energy flexibility and climate resilience through a collective intelligence (CI) approach.

COLLECTiEF is an EU-funded H2020 project, running for 4 years – from 2021 to 2025. COLLECTiEF aims to enhance, implement, test, and evaluate an interoperable and saleable energy management system based on CI that allows easy and seamless integration of legacy equipment into a collaborative network within and between existing buildings and urban energy systems with reduced installation cost, data transfer and computational power while increasing data security, energy flexibility and climate resilience. To achieve this goal, the COLLECTiEF consortium develops software and hardware packages to install and smart up buildings and their legacy equipment on large scale, meanwhile, to maintain simple and robust communication with the energy grid, see Figure 1.

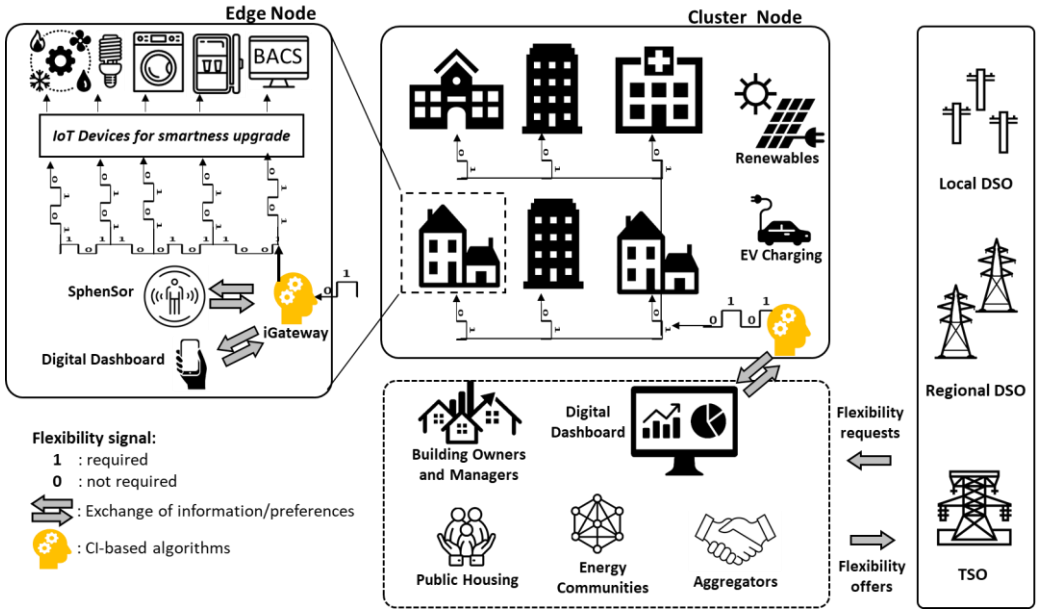

Figure 1 The conceptual design of COLLECTiEF

[1] EU. (2015). 7th Sustainable Development Goal (SDG7). https://ec.europa.eu/international-partnerships/sdg/clean-energy_en

[2] EU. (2015). 13th Sustainable Development Goal (SDG13). https://ec.europa.eu/international-partnerships/sdg/clean-energy_en

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COLLECTiEF project has six main objectives (presented in Table 1) which assure step-by-step progress over four years to accomplish the project.

Table 1 COLLECTiEF objectives

Objective	Description
1	Enhancement and adaptation of **algorithms** for creating a CI-based energy flexible network
2	Realization of CI-based cost-effective **system components** with easy deployment and maintenance
3	Demonstration and **testing** of a CI-based energy network in the real environment
4	Testing and implementing a scalable and customizable occupant-centric fusion **sensor network** for accurate and non-invasive environmental monitoring
5	Designing and implementing a smart, user-centric, and user-friendly **digital platform** for interacting with users and controlling technical building systems
6	The new business model for energy services including a clear model for **commercialization** of the COLLECTiEF system.

The main core of the COLLECTiEF project is related to enhancing existing and developing further the CI algorithms for control strategies of the COLLECTiEF system. The CI algorithms (Obj.1) will shape the design of the sensor network (Obj.4), the user inputs/interactions and the digital dashboards (Obj.5), and the system components at the edge and cluster nodes (Obj.2). The solutions will be tested in the pilots and ameliorated during the demonstration phase (Obj.3). The final goal is to have the system qualified (TRL8) and ready for commercialization with a new business model (Obj.6). Objective's relations are depicted in Figure 2.

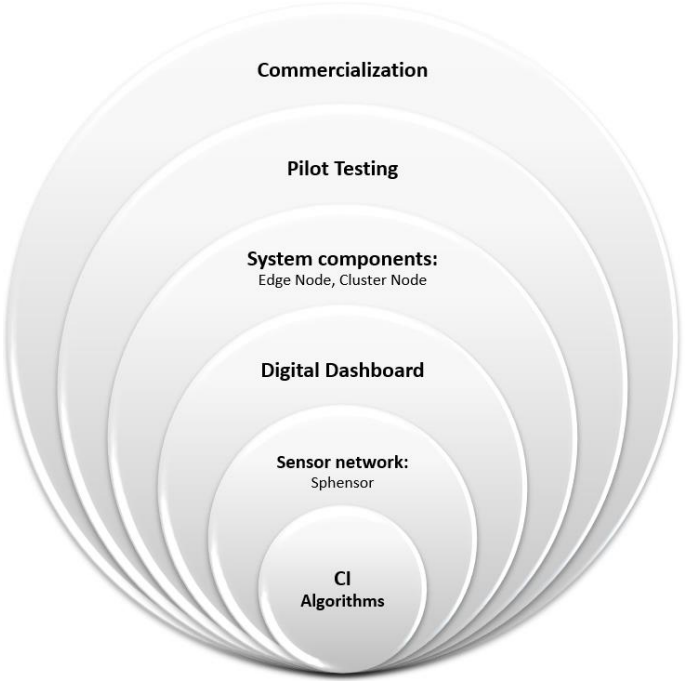

Figure 2 The objectives relations in the COLLECTiEF project

COLLECTiEF consortium consists of 14 beneficiaries from universities, institutions, manufacturing/construction companies, and municipal sectors from six countries across Europe. The

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detailed information and competences of the COLLECTiEF project's beneficiaries are briefly presented in deliverable D1.1. Figure 3 shows the value chain of COLLECTiEF and the involved partners in each stage.

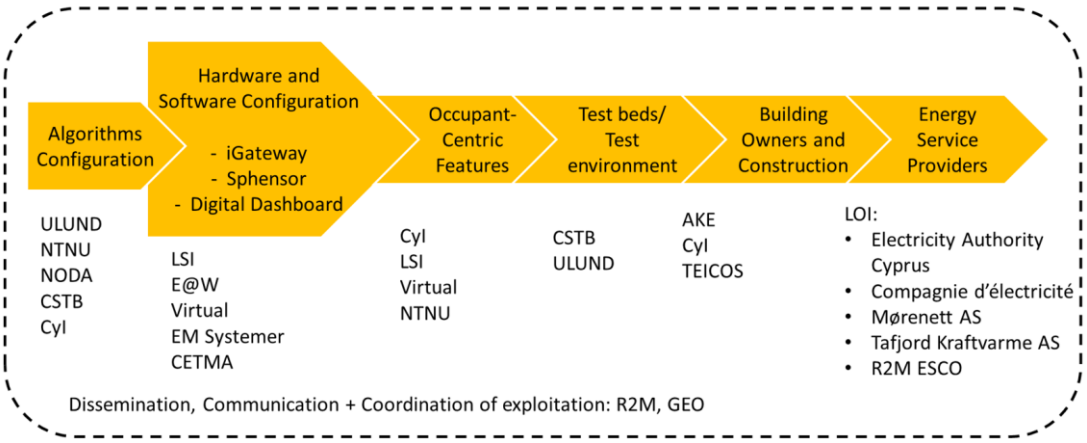

Figure 3 COLLECTiEF value chain

1.2. The work packages

COLLECTiEF comprises seven work packages (see Figure 4) aligned with each other which aim at developing, implementing, testing and evaluating the proposed energy management system based on Collective Intelligence (CI). The detailed information about the work packages is provided in section 5.

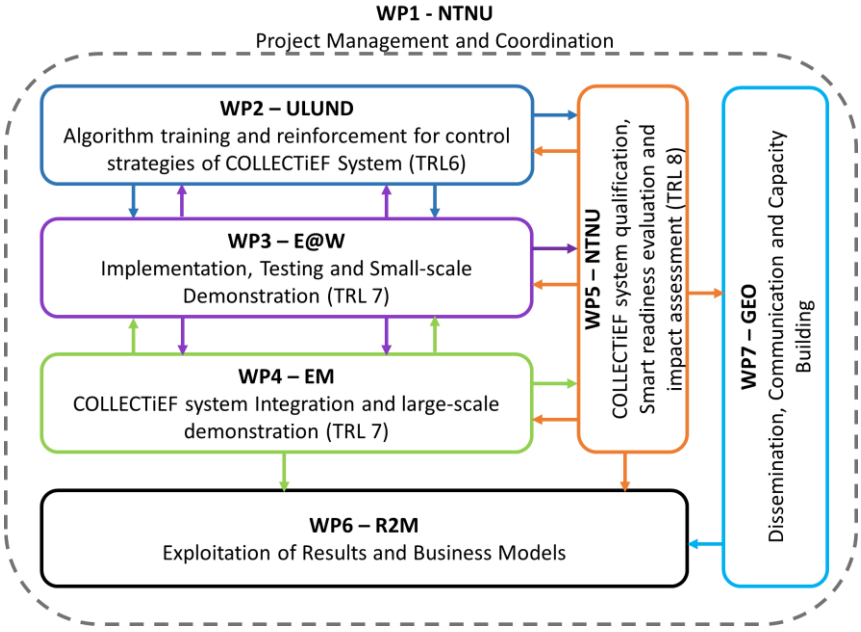

Figure 4 The overview of work packages

The Gantt Chart of the COLLECTiEF project is covering tasks and milestones within 48 months conceived in various phases to carry out the defined tasks as well as ensure to achieve the expected outcomes, see Figure 5.

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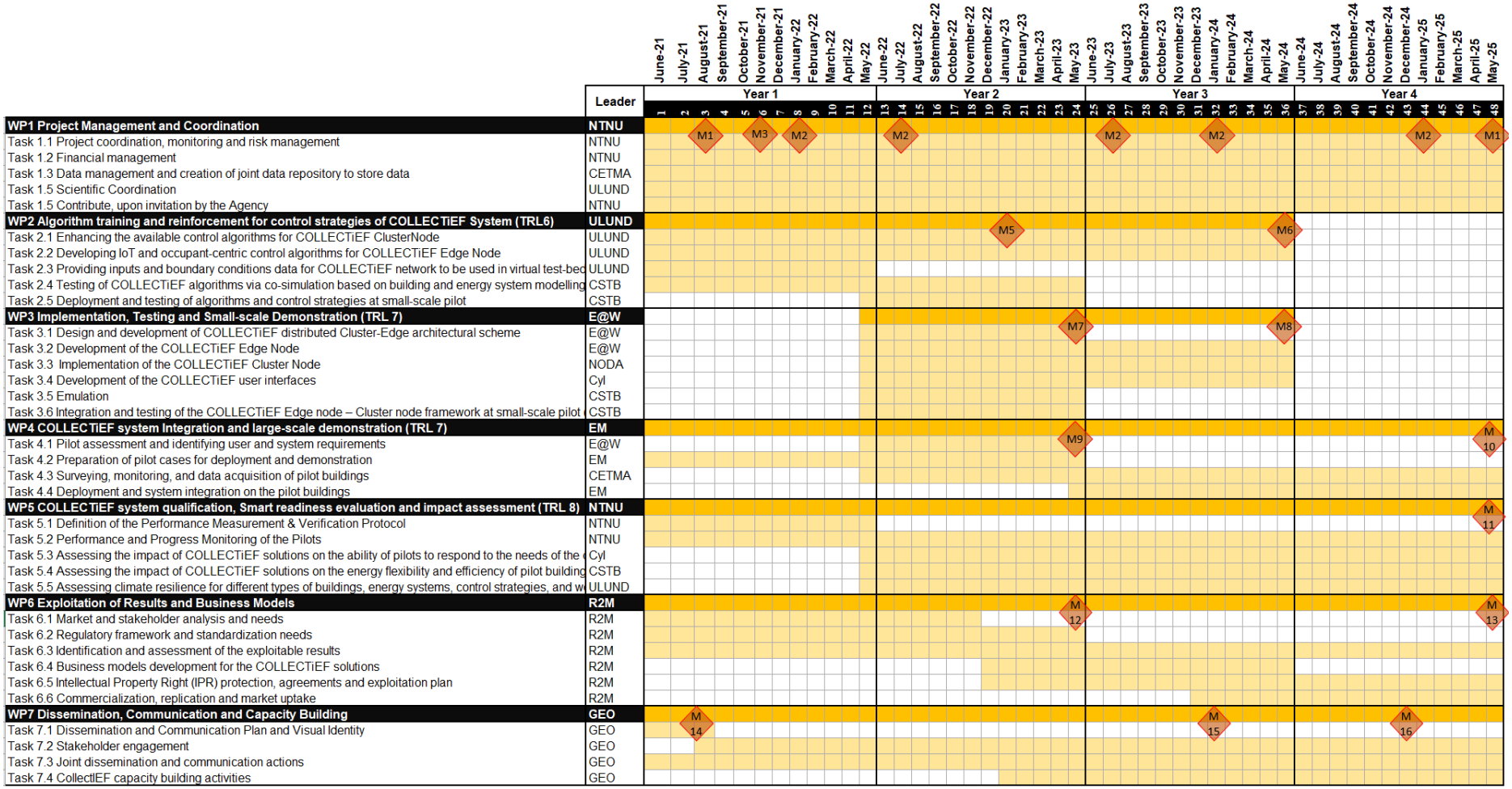

Figure 5 Project Gantt Chart: WPs and tasks distribution

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2. Project structure

COLLECTiEF project originates from the identification of available technologies within the consortium that have been validated and demonstrated in previous projects and which fall under technology readiness level (TRL) 5/6. These technologies allow the creation of a complete CI-based energy network and within the 4-year timeline of the project, the main aim is to qualify COLLECTiEF solutions in four real applications, hereafter called “DEMO”, which will bring the overall TRL to 8. Therefore, the project management is divided into two main phases see Figure 6 and Figure 7:

- Before the start of the DEMO
- After the start of the DEMO

This classification aims at organizing and monitoring the defined tasks as well as at providing a better overview of the project's progress. The main activities can be summarized as follows:

Milestones: Before the Start of DEMO (M1-M24)

- General project management concept defined
- Project communication kit developed
- Data management plan
- Control algorithms ready for testing
- Edge Node, Cluster Node, human-building interface, and occupant-centric sensor network ready for testing
- Installation in pilots completed
- Market and stakeholder analysis and regulatory framework analysis completed

Milestones: After the Start of DEMO (M24-M48)

- Testing in small-scale test bed completed
- Stakeholder workshops conducted
- Demonstration phase in large-scale
- Business model defined, showing commercial feasibility
- Capacity training material ready for use
- Demonstration phase in large-scale pilots completed
- System complete and qualified (TRL8)
- Project completed

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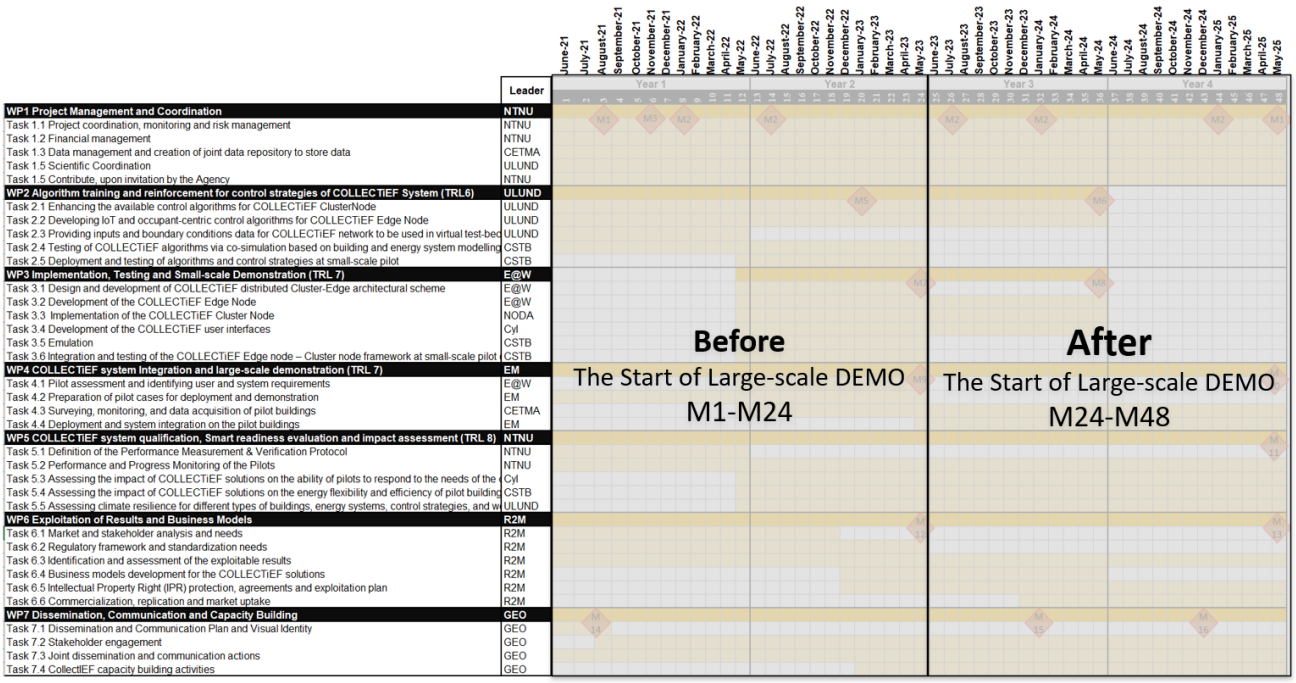

Figure 6 The project implementation based on the development of a large-scale DEMO

The two periods have been through further breakdown to better identify the main activities within each time section:

- **Before the start of Large-scale DEMO 1st Year (M01-M12)**

Objective: Complete TRL 5 for COLLECTiEF solutions — technology validated in a relevant environment

The technologies will be tested in a co-simulation environment DIMOSIM.

- **Before the start of Large-scale DEMO 2nd Year (M13-M24)**

Objective: Complete TRL 6 for COLLECTiEF solutions — technology demonstrated in a relevant environment

The technologies will be tested in a small-scale real environment (G2Elab).

- **After the start of Large-scale DEMO 1st Year (M25-M36)**

Objective: Complete TRL 7 for COLLECTiEF solutions — System prototype demonstration in an operational environment

The technologies will be tested in three real applications (overall 12 pilot buildings in Norway, Italy and Cyprus).

- **After the start of Large-scale DEMO 2nd Year (M37-M48)**

Objective: Complete TRL 8 for COLLECTiEF solutions — System complete and qualified

The COLLECTiEF system will be qualified for all the expected impact criteria.

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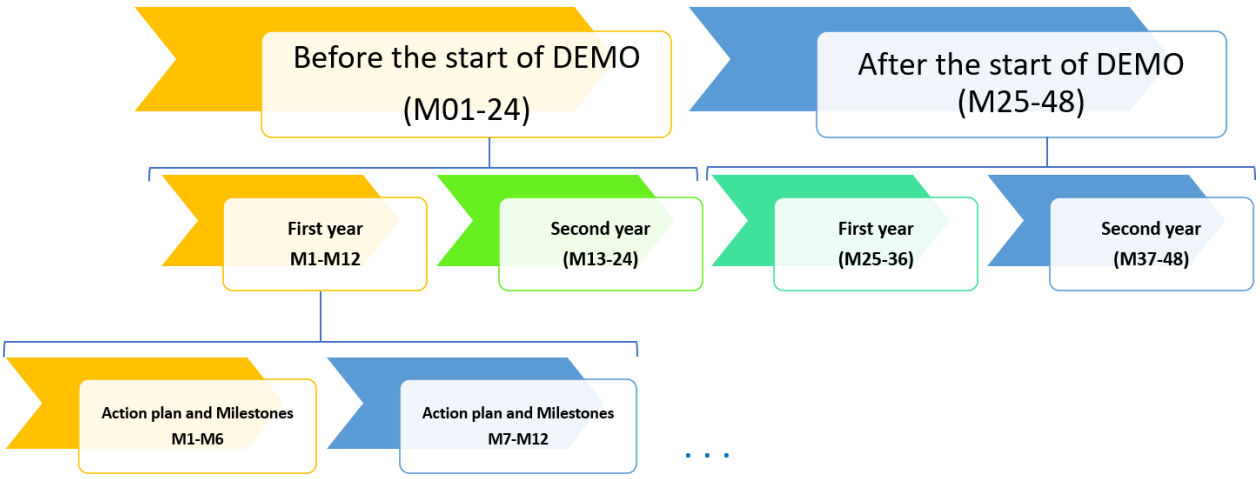

Figure 7 COLLECTiEF implementation procedure

Pursuing the above-mentioned objectives and milestones for the project, the management team focused on the first year and developed a second action plan for the second six months of the project. The action plan details the activities per work package, per task, and partner. In the following sections, the logic and strategies for the development of the action plan for M05-M10 are elaborated. The action plan for the first semester of the second year (M12-M24) will be drafted during the General Assembly meeting on 23rd-24th June.

2.1. Project period: Before the start of Large-scale DEMO Year 1 (M01-M12)

In the first year of the COLLECTiEF project, the consortium focuses on developing the general scheme of the project management, communication and dissemination, data management plan, control algorithm development and testing, performance and progress monitoring of the pilots, the definition of the performance measurement & verification protocol, market and stakeholder analysis, regulatory framework, standardization, and exploitation.

Figure 8 depicts the information flow and the interconnection between the tasks up to M12 (WP1 management is excluded). As shown in Figure 8, the first three tasks of WP2 are related to the boundary conditions which are defined as inputs for the co-simulation platform (Task 2.4). Subsequently, the simulation is executed and then provides the feedback for the algorithm development procedure. This process will be reiterated to improve the control algorithms. In WP5, metrics, Key Performance Indicators (KPIs) and Measurement & Verification (M&V) protocol are defined to evaluate the simulation outputs and the improvement of the algorithms. Therefore, the output of the simulation (Task 2.4) is monitored by the KPIs and then returns to WP2 for improving the algorithms. In Task 5.2, the defined KPIs are computed based on the data provided from WP2 and the performance and progress monitoring of the pilots are evaluated. The regulatory framework, which is presented in WP6, influences the definition of KPIs and the M&V protocol. Moreover, the results and exploitable outcomes are assessed and exploited by Task 6.3. Market stakeholders and their needs, as well as stakeholder engagement, are analysed in Task 6.1 and Task 7.2. The project dissemination and communication plan are defined in Task 7.1 and also discussed in section 4.

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During the second year (M12-M24) of the project, the technology of the COLLECTiEF system (TRL 5) will be validated in a relevant environment. This means that the algorithms are enhanced, developed, and tested in the simulation environment as well as their overall concept will be validated.

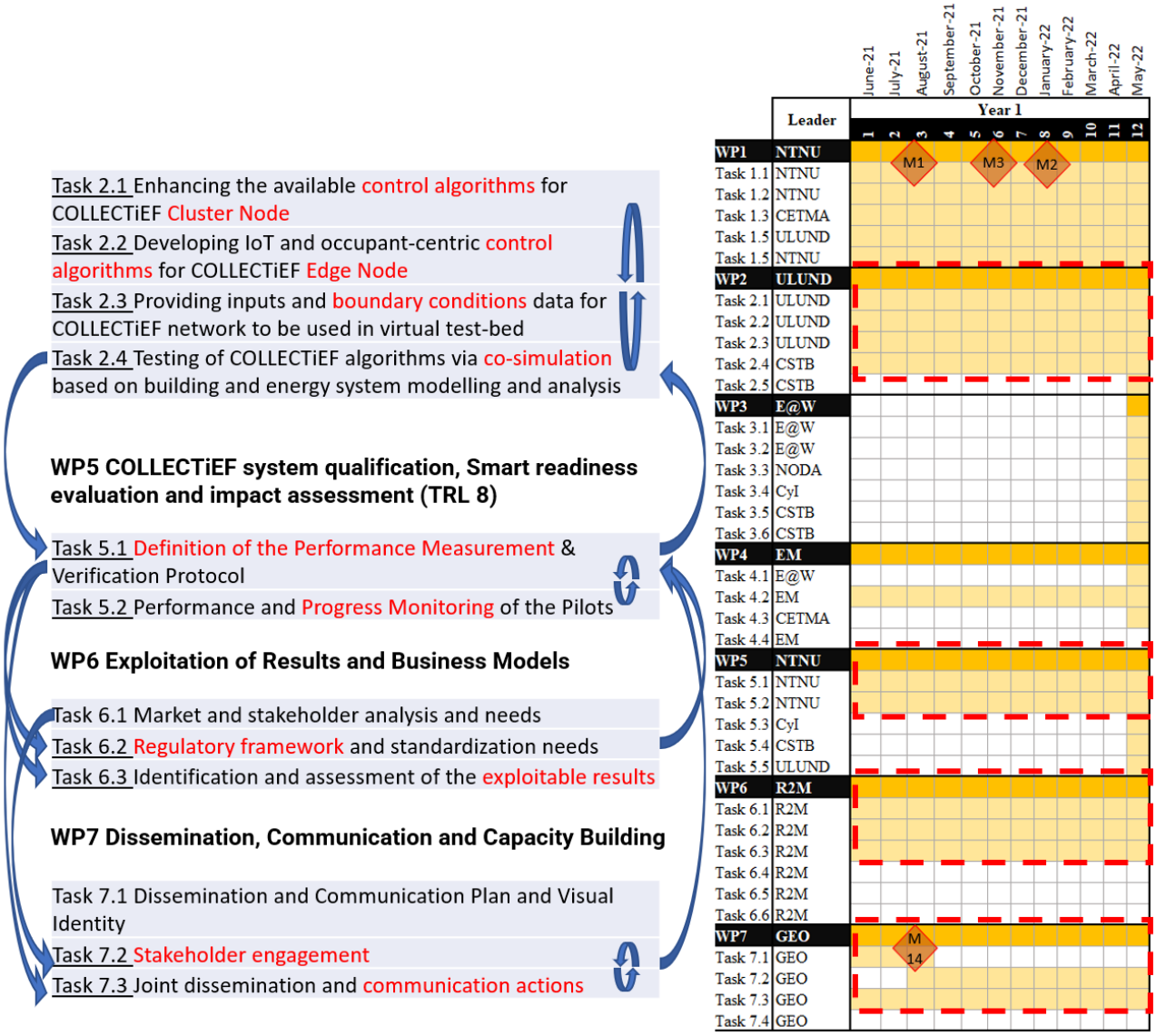

Figure 8 Detailed action plan and the involved tasks – Before the Start of Large-Scale DEMO 1st Year (M1-M12)

During the second six months of the project (M5-M12), the consortium focused on understanding the system requirements, initiating the algorithm development, testing the first round of simulation on a simplified cluster of typical buildings in the Web service of DIMOSIM, identifying the stakeholder engagement plan including informed consent procedure with data management plan, development of control algorithms, procurement of occupant-centric sensors, users/stakeholders engagement, installation of the sensors/devices at pilot buildings. identifying parameters, measurement, and monitoring protocols and completing the list of KPIs, completing the communication materials. According to the Grant Agreement (GA), the deliverables D1.5 and D5.1, are submitted by M12.

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2.2. Action plans and milestones M1-M6

At the beginning of the COLLECTiEF project, an action plan was structured based on the project implementation strategy and milestones for a runtime of six months to follow up and coordinate the whole consortium. This aims at following step-by-step the expected work progress and monitoring the activities of each partner in relation to the tasks as well as engage partners to achieve the targeted objectives. The action plan includes the foreseen activities aligned with the tasks and the responsible person/organization who must complete and deliver the works by defined milestones as described in the Grant Agreement.

In addition, a list of internal milestones was created and shared with the partners to follow up on the progress expectations during the project timeline. Table 2 shows the second internal milestone that the project aimed at by M12. It should be noted that the partners were requested to report their progress by M10 for progress report preparation.

Table 2 List of internal milestones by M12

Working package no.	Milestone by M12
WP1	• The second project progress report is submitted to the EU (D1.5) • The organization plan and GA meeting arrangement are ready. • Second internal financial reporting is completed
WP2	• The data collection and storage have started • The algorithms at the cluster level are under development and testing in simulation • The first set of control logic and algorithms are developed and tested in a simulated environment for 3 pilot buildings • The preliminary results are ready to be tested at a smart-scale demonstration pilot (G2ELAB) • All the inputs/boundaries including historical/current/future weather files, energy price/tariffs/incentives/DR and behaviour modelling for algorithms development are implemented in DIMOSIM • All the demo sites are modelled and calibrated in DIMOSIM and the first set of CI algorithms at the Edge Node are tested in simulation • Preliminary results for G2ELAB are ready to be verified in a real environment at the living lab
WP3	• Full cluster-edge architecture is defined, and the simulation platform is ready to test CI algorithms at both Cluster and Edge Nodes. • Cluster-Edge Architecture is complete in collaboration with WP2 (Task 2.4) • The architecture scheme is implemented in DIMOSIM for testing and development of CI-based controls and logic • Installation of the Sphensors and BriGs in the pilot sites are complete and debugged; • The system is connected to the NTNU server for data storage. • The preparation for emulation is initiated based on Sphensors and BriGs installed at G2ELAB • The integration plan at G2ELAB is ready

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WP4	• A complete surveying, monitoring and data acquisition system is up and running in all pilot buildings
WP5	• D5.1 is delivered to the EU • Performance monitoring of the pilot buildings is started based on the installed monitoring and data acquisition system
WP6	• R2M and GEO will further update the database and prepare a draft market analysis • The first template will be circulated by M12 to get the first input on the regulatory framework of each country • The template for exploitable results is ready for circulating among partners
WP7	• R2M and GEO will further update the database and prepare a draft market analysis • Campaign for stakeholder engagement and the advertisement of COLLECTiEF activities, achievements, and the tool on MEDIA- project's website are ongoing

2.3. Internal Project Progress Report (IPPR)

The management team has created a system of monitoring and reporting activities using Internal Progress Reports (IPPR). IPPR gives the coordinator a good understanding of the status and progress of the work and allows them to detect any possible, risks, delays, or deviations well in advance. The partners share information about the ongoing and planned work and can assess the percentage of the completed task. Furthermore, the cumulative report serves as a helpful basis for the creation of technical periodic reports.

The IPPRs will support the quality assurance within the COLLECTiEF project and will help monitor the project's process along and towards its objectives. Table 3 lists the schedule plan of IPPR submission due by the project partners. A detailed description of the IPPR process has been provided in D1.1.

Table 3 Schedule for Internal Project Progress Report (IPPR)

Number	Title	Due Date (in months)	Delivered for review
IPPR1	Internal Project Progress Report - M4	4	30-Sep-21
IPPR2	Internal Project Progress Report - M7	7	31-Dec-21
IPPR3	Internal Project Progress Report - M10	10	31-Mar-22
IPPR4	Internal Project Progress Report - M13	13	30-Jun-22
IPPR5	Internal Project Progress Report - M16	16	30-Sep-22
IPPR6	Internal Project Progress Report - M19	19	31-Dec-22
IPPR7	Internal Project Progress Report - M22	22	31-Mar-23
IPPR8	Internal Project Progress Report - M25	25	30-Jun-23
IPPR9	Internal Project Progress Report - M28	28	30-Sep-23
IPPR10	Internal Project Progress Report - M31	31	31-Dec-23
IPPR11	Internal Project Progress Report - M34	34	31-Mar-24
IPPR12	Internal Project Progress Report - M37	37	30-Jun-24

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IPPR13	Internal Project Progress Report - M40	40	30-Sep-24
IPPR14	Internal Project Progress Report - M43	43	31-Dec-24
IPPR15	Internal Project Progress Report - M46	46	31-Mar-25

Table 4 demonstrates the IPPR schedule in relation to the 5 Project Progress Reports that will be delivered EU commission during the project.

Table 4 Schedule and period of activities for project progress report

Number	Due Date (in months)	Collected IPPR	Period Activities Covered
First Progress Report	M6	IPPR1 (M1-M4)	M1-M4
Second Progress Report	**M12**	**IPPR2 (M5-M7), IPPR3 (M8-M10)**	**M5-M10**
Third Progress Report	M24	IPPR4 (M11-M13), IPPR5 (M14-M16), IPPR6 (M17-M19), IPPR7 (M20-M22)	M11-M22
Fourth Progress Report	M30	IPPR8 (M23-M25), IPPR9 (M26-M28)	M23-M28
Fifth Progress Report	M42	IPPR10 (M29-M31), IPPR11 (M32-M34), IPPR12 (M35-M37), IPPR13 (M38-M40)	M29-M40

Through the IPPR template, the project partners have been asked to prepare their inputs according to the defined IPPR template (see Table 5) and report the difficulties and problems faced during project implementation over the reporting period as well as provide their solutions and opinion to the coordinator based on the planned Description of the Action (DoA). Section 5 provides the overview of work progress according to the second-semester action plan (M06-M12) based on IPPR2 and IPPR3 collected from project partners.

Table 5 Structure of COLLECTiEF's IPPR table for each WP

WPX – [The title of WPX]
Overview of Tasks in WP X: Copy those tasks from the DoA that you are involved in
Explain the work carried out in WPX during the reporting period for your beneficiary! <fill in>
Explain also the overall assessment on percentage complete of your tasks within WPX and the planning of next steps. <fill in>
Explain the reasons for deviations from the DoA, the consequences and the proposed corrective actions. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule and the impact on other WP/tasks. <fill in if appliable>
- Difficulties – Problems – Solutions – Lessons Learned • Outline and provide the necessary explanation of any difficulties/problems (internal or external) you faced during project implementation over the reporting semester/period. • How did you manage to address / solve those problems (if you have managed to do so)? What were the corrective actions you took and/or plan to take?

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- What was the outcome of your corrective action(s)?

- Changes in the project team
  - Outline changes (if any) in:
  - the legal status of your organisation; and
  - the project team from your organisation (i.e. those people involved in project activities)

- Additional comments or requests for the coordinator.

3. Engagement strategy

To maximize the exploitation potential of the COLLECTiEF project under WP7, the consortium has been actively reaching out to the relevant stakeholders and end-users. As part of the overall strategy, a stakeholder database, which is now ready and will be updated throughout the project, consists of relevant stakeholders and end-users such as public authorities, policymakers, energy efficiency practitioners, smart energy storage companies, as well as umbrella and multiplier organizations. The stakeholder database is confidential and serves as a contact base for the capacity building activities; interested parties will be duly informed as to when the industry workshops and educational training start. The stakeholder database is compiled through a) **Partner contributions**, b) "**Associated Partners", and** c) **Newsletters**.

As the project progresses, its achievements and results will be actively conveyed to the target groups to stimulate exploitation; the list of stakeholders will facilitate this task as it will contain names of institutions interested in contributing to COLLECTiEF research and commercial activities or are interested in knowing more technical details on the application of COLLECTiEF solutions.

Within the COLLECTiEF stakeholder engagement strategy, an important part plays the **engagement of building and flat owners** in pilot sites. Relations between property and facilities managers and occupants contribute toward meeting compliance obligations and the achievement of wider project objectives. Our strategy involves a) clarifying the needs and expectations of occupants, b) explaining the functionality of our solutions, c) providing clear timelines for agile installation of the sensor and monitoring system, and d) explaining the benefits of COLLECTiEF solutions. It is also important to establish communication and engagement methods that can be used to share information and evaluate how these needs can be met.

The activities below document the building owner's engagement activities that were implemented during the second phase of the project by M12:

- Preparing printed communication materials – project materials have been translated into Norwegian and Italian by NTNU and TEICOS and designs adapted by GEO
- Preparing general presentation of the project
- Preparing a project video to be displayed
- On-site meeting for presentation of the project - December 2021 in Milan and January 2022 in Ålesund.
- Call for the nomination – collecting interested flat owners to participate
- Setting up the installation plan

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The building owner's engagement activities have been continued in the second phase and now concentrate on:

- Printed communication materials are ready to be shown at the pilot buildings with translations
- The general presentation is ready and has been presented in different stakeholders' meetings
- On-site meetings for the presentation of the projects have been carried out.
- Preparing FAQ for the residents and participants from the pilot sites are ongoing

The full timeline can be seen in Figure 9 and the involved tasks are presented in Figure 10.

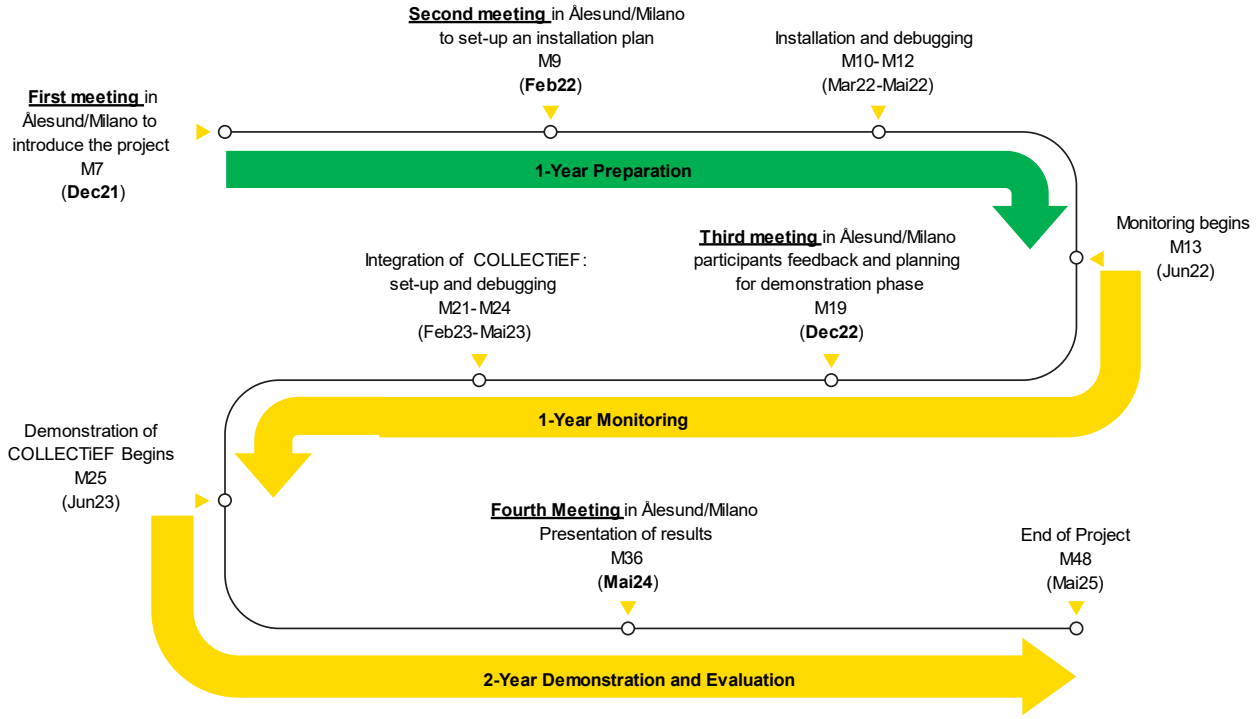

Figure 9 Timeline of engagement strategy (green arrow shows the current state of the project)

Future ad-hoc stakeholder engagement strategies will be similarly co-created with relevant partners. The engagement of stakeholders and database development has been started from M3 and continues until the end of the project (M48).

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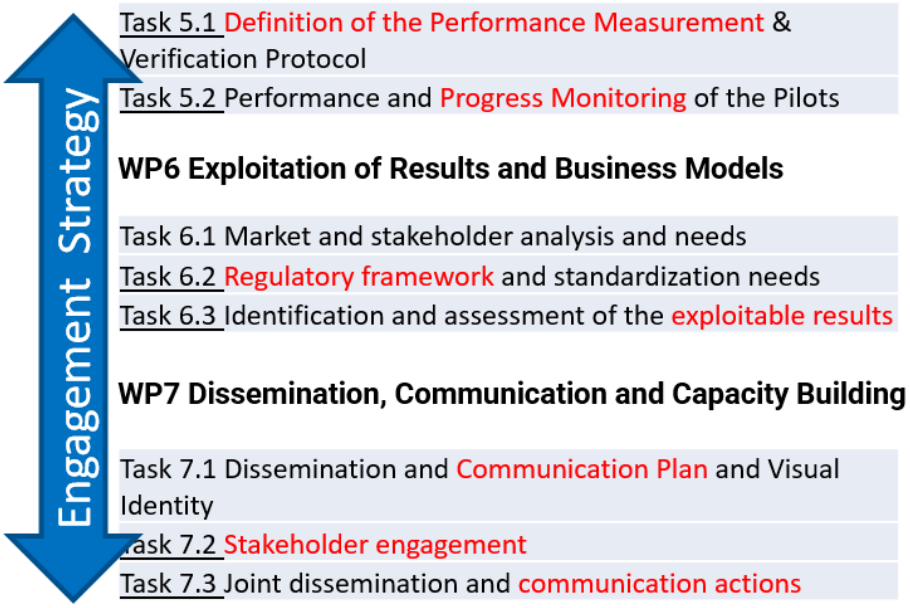

Figure 10 Engagement strategy and involved tasks

4. Dissemination, promotion, and exploitation activities

At the early stage of the project, dissemination, communication, and exploitation activities have been planned by the DET to involve all partners to be committed to creating impacts via providing promotion and exploitation actions for the COLLECTiEF project. The detailed information on dissemination and communication plan and visual identity has been reported in deliverable D7.1.

In the second period of the project (M6-M12) various dissemination and communication tools such as the website, social media posts, campaigns, scientific articles, and videos are developed and carried out. In this section, the main joint dissemination activities related to Task 7.3 are reported.

4.1. Scientific publications

The following scientific publications have been published as a dissemination activity by M10.

- Published journal and conference articles:
  - Nik VM, Moazami A. “Empowering energy flexibility and climate resilience using collective intelligence-based demand side management (CI-DSM)”. J. Phys.: Conf. Ser. 2021; 2069:012149. doi.org/10.1088/1742-6596/2069/1/012149.
  - Yang Y, Nik VM. “Assessing the climate change adaptation over four European cities”. J. Phys.: Conf. Ser. 2021; 2069:012069. doi.org/10.1088/1742-6596/2069/1/012069.Javanroodi K, Nik VM, and Scartezzini J-L, “Quantifying the impacts of urban morphology on modifying microclimate conditions in extreme weather conditions”, J. Phys.: Conf. Ser., vol. 2042, no. 1, p. 012058, Nov. 2021, doi: 10.1088/1742-6596/2042/1/012058.
  - Mohammad Hosseini, Amin Moazami, Vahid M. Nik, ‘’Collective Intelligence function in Extreme Weather Conditions: High-resolution impact assessment of Energy Flexibility on Building Energy Performance’’, 5th international conference on building energy and environment, will be presented in July 2022.

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- Hosseini M, Javanroodi K, Nik VM. “High-resolution impact assessment of climate change on building energy performance considering extreme weather events and microclimate – Investigating variations in indoor thermal comfort and degree-days”, Sustainable Cities and Society, vol. 78, p. 103634, Mar. 2022, doi: 10.1016/j.scs.2021.103634.
- Yang Y, Javanroodi K, Nik VM. “Climate Change and Renewable Energy Generation in Europe – Long-Term Impact Assessment on Solar and Wind Energy Using High-Resolution Future Climate Data and Considering Climate Uncertainties”, Energies, vol. 15, no. 1, Art. no. 1, Jan. 2022, doi: 10.3390/en15010302.

- Submitted articles to COBEE 2022 and SEST conferences:
  - Hosseini M, Nik VM, Moazami A. “Collective intelligence function in extreme weather conditions: High-resolution impact assessment of energy flexibility on building energy performance”, COBEE 2022.
  - Hosseini M, Hajialigol P., Aghaei M, Erba S., Nik VM., Moazami A., “Improving climate resilience and thermal comfort in a complex building through enhanced flexibility of the energy system”, SEST 2022.

Besides, some articles have been submitted to SEST 2022, COBEE and IBPS-Nordic conferences as well as the Journal of Building and Environment. Moreover, NTNU and ULUND have initiated a discussion on a textbook project with Taylor and Francis (CRC) publisher (see section 5.1).

A joint Special Issue (SI) on "Enhancing energy flexibility and climate resilience of urban energy systems" was designed and announced before according to the key points of the COLLECTiEF project, in the journal of Applied Energy & Advances in Applied Energy. The submission deadline is in August 2022 and will be completed by the end of 2022.

4.2. Workshops, conferences, and events

The partners have been introducing and promoting the COLLECTiEF project at various events. DET attended two workshops for building owners and presented the project there. The project was introduced in Ålesund, Norway at a partnership workshop hosted by the United Future Lab. Table 6 lists the events, seminars, workshops, and conferences attended by the partners by M12.

Table 6 The events, seminars, workshops, conferences attended by the partners.

Name of event, seminar, etc.	Date of participation	Venue	Partner	Action and statement
ENLIT	November 21st	Digital and physical	GEO and R2M	
Partners Meeting	February 19th	United Future Lab in Ålesund	NTNU	Project introduction
Meeting with the Vice rector, NTNU Ålesund	April 7th	NTNU in Ålesund	NTNU	Project presentation
Northwest conference	April 26th	Parkenkulturhus in Ålesund	NTNU	Project presentation

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The consortium identified relevant upcoming European and international events. COLLECTiEF will attend the European Sustainable Energy Week (EUSEW) between 26th and 30th September 2022 with the SATO and Smart2B projects. The session title will be "Smart buildings as key enablers for the EU energy transition strategy" and the speakers will address how Horizon 2020 projects with similar objectives proposed different solutions to address the energy transition and how they joined efforts to create a knowledge-sharing framework around the common goals. Furthermore, COLLECTiEF partners will attend the European Conference Sustainable Places 2022 in Nice.

4.3. Collaboration and synergies with sister research projects

COLLECTiEF project is intensively looking to collaborate with the sister research projects and other related EU projects and initiatives. In the second period of the project (M05-M10), we targeted approaching the sister EU project (e.g., 2ISECAP, ActIonHeat, ARISE, BundleUP NEXT, CEES, crossCert, NEEM, PEER, REGENERATE, SER, SMART2B, Sun4All, etc.) for research collaboration and synergies. The detailed information about the targeted sister projects was provided in deliverable D7.1.

We have initiated the preliminary collaboration with SMART2B- Smartness to existing Buildings, the sister research project of COLLECTiEF. In the first stage, the coordinator was invited by the coordinator of the SMART2B EU project to give a presentation about the concept of the COLLECTiEF project.

SMART2B is an EU-funded H2020 project coordinated by CNET – Centre for New Energy Technologies SA in Portugal, running for 3 years – from 2021 to 2024. ''SMART2B provides new business models for the building energy market combining the savings from energy efficiency measures and gains from the active contribution of the building through flexibility services by exploiting the maximum level of smartness [3].

SATO is an EU-funded Horizon 2020 project coordinated by the Faculty of Sciences of the University of Lisbon, in Portugal. The project aims to implement and test a cost-effective solution to assess the real-life energy performance of a building and its energy-consuming equipment. It will also implement a building self-assessment and optimization platform (SATO Platform) equipped with automated self-assessment capabilities that are partially supported by statistical/machine learning methods [4].

[3] SMART2B - Smartness to existing Buildings, EU-H2020 project (Grant agreement ID: 101023666), https://cordis.europa.eu/project/id/101023666.

[4] SATO - Self Assessment Towards Optimization of Building Energy EU-H2020 project (Grant agreement ID: 957128), https://cordis.europa.eu/project/id/957128

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To maximize the H2020 program impact, COLLECTiEF is clustered with SATO, PRECEPT and Smart2B. The project cluster will extend the stakeholders' network and share knowledge and achievement in research and innovation. The coordinators will meet regularly.

4.4. Newsletter, press releases and campaigns

GEO has planned to release press releases in concomitance of important events and achievements. The first press release was published and distributed with the partners in June 2021. DET has organized several campaigns between M6 and M12. COLLECTiEF organized dissemination campaigns for the Energy Efficiency Day on the 6th of October, the World Cities Day on the 31st of October, the World Energy Efficiency Day on the 5th of March (with Smar2B) and the International Mother Earth Day on the 22nd of April. Social media campaigns were organized to engage users and the public including building owners and prosumers. Some of the campaigns entailed the production of non- scientific articles, available on the website and/or organized with sister projects (See Figure 11

The Energy Quiz was initiated in January 2022, with the aim of increasing the engagement rate while raising awareness on energy-related topics, see Figure 12. Furthermore, COLLECTiEF joined the International Mother Earth Day 2022 by using the dedicated hashtags #EarthDay, #InvestInOurPlanet, #smartbuildings and acknowledging the importance and objectives of the global initiative and connecting with relevant followers and organizations in the field. The scope and amount of social media campaigns have exceeded the initial plans set out in D7.1. Over the past six months, the project has creatively engaged in new forms of collaboration (DYK campaign, the Energy Quiz, and the Energy crossword puzzle with Smart2B) to test the most successful strategies for engaging target audiences.

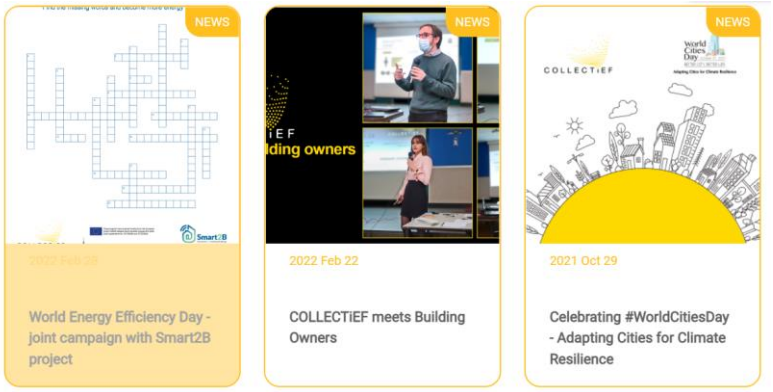

Figure 11 News feed on the website

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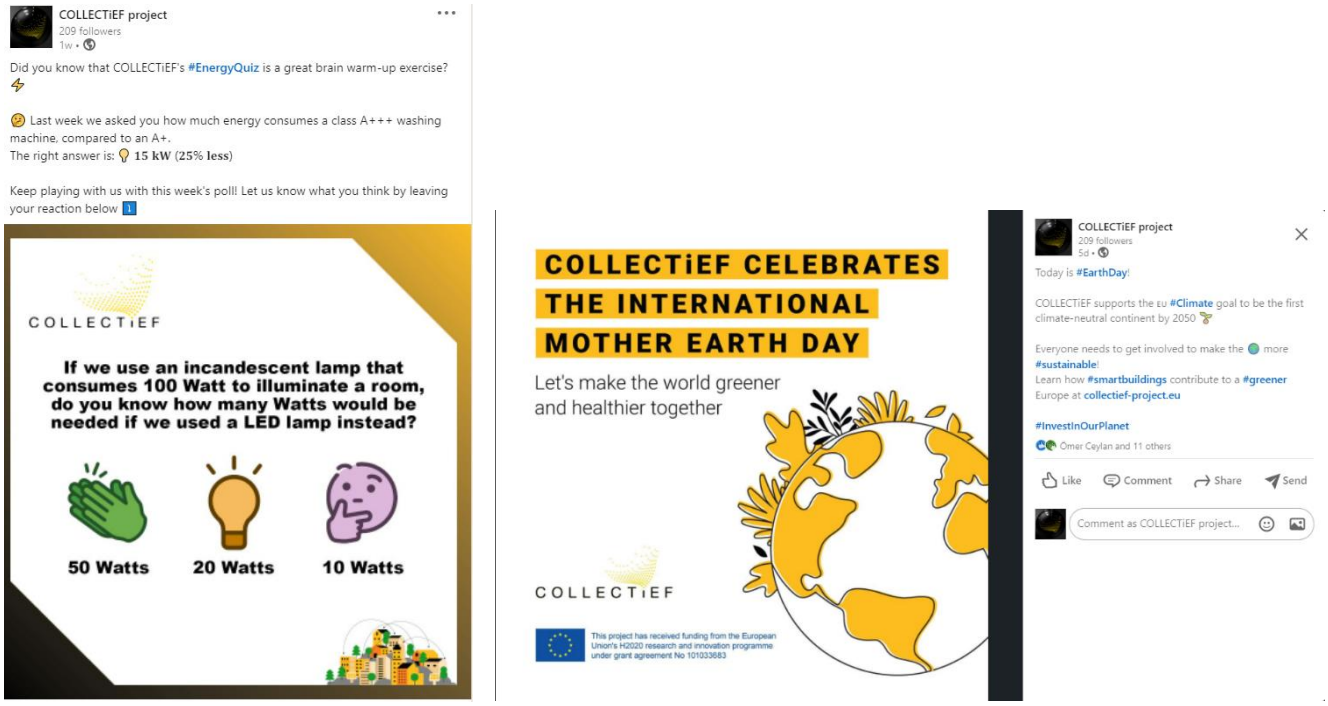

(a) (b)

Figure 12 (a) A snapshot of Energy Quiz; (b) COLLECTiEF celebrating the International Mother Earth Day 2022

4.5. Visual identity, dissemination, and communication materials

At the early stage of the project, the visual identity, dissemination, and communication materials have been designed and prepared for the COLLECTiEF project to promote the consistent visual style of the project among its target audience. Even though the task concluded in M3, pilot leaders provided translations of selected promotional materials which were used during the workshops with building owners and users in December 2021 and January 2022. Furthermore, GEO has recently initiated the adaptation of posters to a format that could serve COLLECTiEF pilot questionnaires on thermal comfort and satisfaction. COLLECTiEF' s webpage and social media.

At the beginning of the project, GEO started to design a user-friendly and interactive website for the COLLECTiEF project to build a virtual dissemination land providing coherent and updated information about the project both to the general audience and the industry experts through clear text and appealing visuals. Moreover, the website describes the project's methodology and objectives and presents the partners in the consortium. To this end, the domain name (https://collectief-project.eu) has been opted among several suggested names by GEO and the webpage officially has been launched in August 2021. The detailed information on the webpage has been provided in deliverable D7.1.

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GEO has set up the COLLECTiEF' s social media from the beginning of the project, providing major updates on the project's key objectives and future activities. The core goal of social media is to enhance the visibility of COLLECTiEF online, namely its activities, research findings and solutions. Table 7 summarizes the list of dissemination and communication (D&C) KPIs and the status by M10.

In order to reach out to a wider audience, but also our core target groups, two social media channels have been established: Twitter and LinkedIn. In addition, a YouTube channel was created with the purpose to host the project's promotional videos, recorded webinars and interviews made by the consortium with experts explaining the benefits and utilization of the COLLECTiEF solutions.

The website is now completed. The translation of the website is being organized. The COLLECTiEF video is now published with the translation. Furthermore, the website and social media channels are continuously fed with the most recent and relevant information and posts, assisting key objectives of international/European campaigns. The social media campaigns are mentioned in detail in 4.4. Press Releases and Campaigns.

Table 7 The list of dissemination and communication (D&C) KPIs and the status by M10

D&C Item	Target for the project	Status by M10
Presentations at scientific conferences	At least 2 presentations (during the project)	1 (Applied Energy Symposium on "Low Carbon Cities & Urban Energy Systems", (CUE2021)
Publications in scientific journals	At least 4 scientific articles (submitted during the project duration)	5 journal articles
Exhibitions	4 exhibitions (1 per demo site)	-
Stakeholder/industry workshops	4 workshops (1 per demo site)	-
eLearning materials	4 eLearnings modules	-
Articles in local languages	At least 10 articles	
Dissemination materials	Number of types of materials printed: 2 types of flyers (initial and midterm); 1 general poster; 1 banner	1 flyer, 1 poster, 1 leaflet and 1 rollup
Participation in events (external, not organized by CLF)	At least 10 events attended	10
Website	6000 hits	
Social Media	Number of posts, followers, engagement rate: at least 200 posts in all project's accounts, 600 followers in total, 1.5 engagement rate	Engagement rate: 3.3% since January 2022
Press release	6 press releases	0
Video	Up to 2 videos	1
Interviews	Up to 5 interviews	-

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5. Action plan and activities performed per working package/task

As mentioned earlier, the IPPRs were collected using the IPPR template (section 2.3). In the following section, a brief description of the activities performed, per working packages and tasks as well as based on the activities of each partner during M05-M10 of the project are provided with regards to the action plan defined by the coordinator using a given colour code:

- Green: if they are completed.
- No colour: If they are ongoing with no deviation.
- Yellow: if they are ongoing with minor deviation.
- Red: if they have stopped or ongoing with major deviation.

5.1. WP1: Project Management and Coordination (M01-M48)

This work package aims at coordinating the COLLECTiEF project management and administration as well as supervising the activities carried out by all partners according to the defined tasks and the action plan to ensure the consortium implements the activities effectively, produces and submits the deliverables and reports on time and with high quality.

During the second period of the project (M05-M10), CETMA submitted the Data Management Plan (DMP) by the end of M06 and NTNU submitted the first progress report (M06).

ULUND in collaboration with NTNU and CyI is conducting the joint Special Issue (SI) ("Enhancing energy flexibility and climate resilience of urban energy systems"). The submission deadline is on 15th August 2022. Besides, initiating a textbook project is under discussion.

During M05-M10, NTNU has organized a series of Executive Board meetings, to concrete the relation and communication among the beneficiaries to discuss the technical activities as well as follow up and monitor the progress of the tasks. All partners have actively participated in the following project meetings:

- Executive Board n.4 (01/12/2021)
- Executive Board n.5 (12/01/2022)
- Second General of Assembly meeting (01/02/2022)
- Executive Board n.6 (02/03/2022)
- Executive Board n.7 (06/04/2022)

Besides, the consortium members have also arranged several internal/WPs meetings and they have actively participated in the draft/preparation of the sub-tasks and other technical-related works.

Due to pandemic Covid-19, we could not be able to hold any physical meetings and all the meetings were organized virtually. However, the consortium plans to organize the third general assembly meeting physically in Ålesund on 23rd – 24th June 2022.

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Task 1.1: Project coordination, monitoring and risk management (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
IPPR2 and IPPR3 are collected from the partners for preparing the second progress report.	Completed	The second progress report is submitted to the EU (D1.5)
Distributing the doodle for scheduling the third General Assembly Meeting at NTNU	Completed	The organization plan and GA meeting arrangement are ready.

Activities performed by partners

Task Leader: NTNU	
Task Contributors: all	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are completed and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• NTNU has arranged the second general assembly and six executive board meetings. • NTNU has defined the Action Plan and updated the IPPR for the second progress report. • NTNU has updated the Risk Management Plan. • NTNU has presented the project to various stakeholders including building users/owners and ENOVA SF. • NTNU (in collaboration with SMART2B and SATO) has planned for organizing a session (Smart buildings as key enablers for the EU energy transition strategy) at EUSEW. • NTNU has planned to host the consortium for the third general assembly meeting by end of June 2022. • NTNU has collected IPPR2 (M05-M07) and IPPR 3 (M08-M10) from the partners. • NTNU has drafted the second project progress report (Deliverable D1.5 – M12).
Deliverables	D1.5: Second Progress Report (M12)
Updated Risk	-

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Task 1.2: Financial management (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Reporting internal financial process	Ongoing	The second internal financial report template is distributed between the partners to complete.

Activities performed by the partner

Task Leader: NTNU	
Task Contributors: -	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task for M10 are ongoing and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• NTNU has completed the first internal financial report.
Deliverables	-

Task 1.3: Data management and creation of a joint data repository to store data (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
The server is connected to the BRiG and ready for storing data collected by Sphensors;	Completed	The system is debugged and the flow of data from the BRiGs, the POEs and the BMS are in place. The data collection and storage have started.
The POEs are set up on the server and with allocated QR codes are ready for installation;	Ongoing	
Available historical data to be collected from BMSs in Norway, Heat cost allocators in Italy and the server in G2ELAB	Ongoing	

Activities performed by the partner

Task Leader: CETMA	
Task Contributors: NTNU	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.

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Activities performed by partner (s) – (M05-M10)	• CETMA and NTNU have prepared and delivered the first version of the data management plan (D1.3) where a framework was established to ensure compliance of the data management plan with EU regulations and the GDPR. • CETMA has arranged several meetings were organised to discuss aspects of the data management plan and to make any changes. • CETMA with the support of NTNU has activated the account and the storage space on the NTNU server. • During this period the POE questionnaire sharing system (short version) was tested. • The POE was set up on the server with assigned QR codes. It is hosted by CETMA only for the test phase "cetma.it". • CETMA and NTNU have organized several meetings about CRCLex in order to verify the possibility of subcontracting to CRClex for the acquisition of the legal basis for assuming the role of joint controller and for deciding on the means and processing of data. • CETMA has checked the technical solutions to collect all data required from the sensors, BMS and G2ELAB. • A test on how to distribute and share surveys (POE - short version) - via QR CODE was performed. • A test of Survey (POE – short version) - QR CODE is ready and further design aspects are to be added. We will move it from the CETMA web domain to the NTNU server. • Communication with the partners (LASTEM and E@W, EM Systemer, CSTB and R2M) is ongoing in order to check the technical solutions to collect all data required from the sensors, BMS and G2ELAB. As planned, the verification of the technical solutions will be completed by M12 to collect all data from BRiG, SmartPlugs, cost allocators, Coster control system in Italy in the NTNU server. • In May (M12), the implementation and testing of the technical solutions are planned and the system will be debugged and the data flow from the BRiGs, POEs and the BMS are in place and data collection and archiving will started. At the beginning of June (M13) the database will be ready for use. • At the end of May (M12), the verifications for the inclusion of CRClex as DPO of the project are completed. Several meetings have been held between the CyI, CETMA, NTNU, NODA, CSTB and G2ELAB to streamline the data flows within the COLLECTiEF ecosystem from the occupant-centric sensors network to the edge node and cluster node, contributing to identifying suitable solutions for the storage and access rights to gather data for model development, in the first part of the project, and validation and deployment, later in the second part of the project.
Deliverables	-
Updated Risk	• CETMA: One of the critical objectives that have not been fully achieved concerns the assumption of a legal basis to take on the role of joint controller. We are in the process of doing this by checking how a company specializing in such services can be brought in as our DPO, but there are some critical aspects relating to budget and possible forms of inclusion in the project

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Task 1.4: Scientific Coordination (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
The scientific coordinator to arrange a research seminar between the scientific personnel of the project to create internal collaborations to boost publications. For example, a new postdoc in Cyprus, PhD and postdoc at NTNU, PhD at CSTB, PhD at Virtual, and their supervisors.	Ongoing	A seminar has been held with all the researchers on the project

Activities performed by the partner

Task Leader: ULUND	
Task Contributors: NTNU	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan have been identified.
Activities performed by partner (s) – (M05-M10)	• ULUND in collaboration with NTNU and CyI has designed, arranged and announced a joint Special Issue (SI) on "Enhancing energy flexibility and climate resilience of urban energy systems" according to the key points of the COLLECTiEF project, in the journal of Applied Energy & Advances in Applied Energy. The submission period will be from 15th January-15th August 2022 and will be completed by the end of 2022. • Published journal and conference articles: ○ Nik VM, Moazami A. “Empowering energy flexibility and climate resilience using collective intelligence-based demand side management (CI-DSM)”. J. Phys.: Conf. Ser. 2021; 2069:012149. doi.org/10.1088/1742-6596/2069/1/012149. ○ Yang Y, Nik VM. “Assessing the climate change adaptation over four European cities”. J. Phys.: Conf. Ser. 2021; 2069:012069. doi.org/10.1088/1742-6596/2069/1/012069.Javanroodi K, Nik VM, and Scartezzini J-L, “Quantifying the impacts of urban morphology on modifying microclimate conditions in extreme weather conditions”, J. Phys.: Conf. Ser., vol. 2042, no. 1, p. 012058, Nov. 2021, doi: 10.1088/1742-6596/2042/1/012058. ○ Mohammad Hosseini, Amin Moazami, Vahid M. Nik, ‘’Collective Intelligence function in Extreme Weather Conditions: High-resolution impact assessment of Energy Flexibility on Building Energy Performance’’, 5th international conference on building energy and environment, will be presented in July 2022. ○ Hosseini M, Javanroodi K, Nik VM. “High-resolution impact assessment of climate change on building energy performance considering extreme weather events and microclimate – Investigating variations in indoor thermal comfort and degree-days”, Sustainable Cities and Society, vol. 78, p. 103634, Mar. 2022, doi: 10.1016/j.scs.2021.103634. ○ Yang Y, Javanroodi K, Nik VM. “Climate Change and Renewable Energy Generation in Europe – Long-Term Impact Assessment on Solar and Wind Energy Using High-Resolution Future Climate Data and Considering

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	Climate Uncertainties", Energies, vol. 15, no. 1, Art. no. 1, Jan. 2022, doi: 10.3390/en15010302.
	• Submitted articles to COBEE 2022 and SEST conferences:
	  ○ Hosseini M, Nik VM, Moazami A. "Collective intelligence function in extreme weather conditions: High-resolution impact assessment of energy flexibility on building energy performance", COBEE 2022.
	  ○ Hosseini M, Hajialigol P., Aghaei M, Erba S., Nik VM., Moazami A., "Improving climate resilience and thermal comfort in a complex building through enhanced flexibility of the energy system", SEST 2022.
	• NTNU and ULUND have initiated a discussion on a textbook project with Taylor and Francis (CRC) publisher. The focus of this textbook will be on the fundamentals including the challenges, impacts, and applications that would be useful for the students and lecturers as well as the energy community. The topics would be a combination of Climate change, Energy flexibility, Control, Energy system and Demand Modelling, Demand Side Management, Resilience, and Smart Grid.
	• CyI has published a paper on the International Journal of Building performance simulation (accepted, in press), and submitted a manuscript to Building and Environment (under review)

Deliverables	-

5.2. WP2: Algorithm training and reinforcement for control strategies of COLLECTiEF System (TRL 6) (M01-M48)

This work package focuses on the algorithms and communication logic of the COLLECTiEF system. The partners will test and enhance existing and new solutions using a virtual testbed, DIMOSIM, and in a real environment at G2Elab.

ULUND in cooperation with NTNU and CSTB has organized the following meetings to plan the activities of the task and the implementation procedure. The partners of WP2 and other beneficiaries who are involved in the relevant activities of WP2 have actively participated in the following meetings:

- API DIMOSIM & calibration (18/10/2021)
- WP2 meeting (31/01/2022)
- WP2 meeting (24/03/2022)

The preliminary actions were carried out for developing a virtual testbed using DIMOSIM for algorithms and controls of the pilot buildings in France (G2Elab) as well as of the pilot buildings in Norway, Cyprus, and Italy.

ULUND could not find a suitable candidate for a post-doctoral position in ''algorithm training and reinforcement for control strategies of the COLLECTiEF System''. ULUND has Initialized the discussions (internal at ULUND) for an Assistant Professor position (partly funded by COLLECTiEF).

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement No 101033683

Task 2.1: Enhancing the available control algorithms for COLLECTiEF Cluster Node (M01-M36)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
The logic and technical approach to implementing CI-based algorithms in DIMOSIM is set and clear for the team	Completed	The NODA setup is running against DIMOSIM; 2) the first round of CI-DSM algorithms at the cluster level are under development and testing in simulation
Having the NODA setup running against DIMOSIM	Ongoing	
Developing CI algorithms in Python for cluster node has been started	Ongoing	
The first round of simulation on a simplified cluster of typical buildings is ready to be tested in the Web service of DIMOSIM	Completed	

Activities performed by the partner

Task Leader: ULUND	
Task Contributors: NODA, NTNU, CSTB	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing and two of the actions are completed by M10. There is a deviation in one of the activities regarding CI algorithms for Cluster Node. Although a simplified model of cluster of typical buildings has been created by CSTB, the main focus of the algorithm developers has been on the Edge Node. The main reason for prioritizing the edge node was to have the algorithms and control logic ready for testing in G2ELab from the start of M13 (June 2022). On the cluster level, the main discussion and development have been on energy flexibility signals than the algorithms.
Activities performed by partner (s) – (M05-M10)	• ULUND and WP2 are developing the algorithms at the edge and cluster nodes. • ULUND and WP beneficiaries are working on some ideas about algorithm development as well as relevant reports and articles. One specific example is a work about 'Impacts of Collective Communication on the Energy Flexibility and Climate Resilience of Buildings in Urban Areas'. • NODA has developed the central software solution in order to o facilitate co-simulation in simulated time. • NODA has outlined the development algorithm in a previous poll on components, i.e., with explicitly communicated flexibility in the form of a system of linear inequalities. NODA has switched from explicitly communicated flexibility in the form of a system of linear inequalities to implicitly communicated flexibility in the form of offset in response to a price signal. The latter solution lends itself to a smaller and more easily managed software solution and is better suited for flexibility metrics in terms of how well a solution can adapt to the supply side cost of energy.
Deliverables (M05-M10)	-
Updated Risk (M05-M10)	• ULUND could not find a suitable candidate for the Postdoc position and is aiming for recruiting an assistant professor instead, which also requires a long process. This might imply a lack of efforts as planned for algorithm development.

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Task 2.2: Developing IoT and occupant-centric control algorithms for COLLECTiEF Edge Node (M01-M36)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Catalogue API for simulations (running) @CSTB	Completed	The first set of control logic and algorithms are developed and tested in a simulated environment for 3 pilot buildings (Italian building apartments, Norwegian Health care center-Eidet, and G2ELAB); 2) The preliminary results are ready to be tested at a smart-scale demonstration pilot (G2ELAB) --> Task 2.5
Demo site modelling: 4 models to be ready and calibrated (Eidet in Norway, G2ELAB in France, Apartments in Italy, 1 campus building in Cyprus)	Ongoing	
ULUND & NTNU has completed the workflow from algorithms development in Python and their connection to DIMOSIM	Completed	
for all the case studies, the following information should be available: state, Action, Reward, Energy price, Agents and actuators to be considered in algorithms development	Ongoing	
Having a prototype algorithm running for G2ELAB with limited control features.	Ongoing	
API is provided from EMSystemer for seven buildings in Ålesund (Norwegian pilot buildings) – Better organization of zones and data access.	Completed	

Activities performed by the partner

Task Leader: ULUND	
Task Contributors: NODA, NTNU, CSTB, CyI, R2M, E@W, Virtual, EM	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing and three of the tasks are completed by M10 as planned. There is a deviation in simulating pilot buildings. This is due to a lack of technical information for some of the pilot buildings, which were required to complete the modelling. Specifically in Norway, all the pilot buildings are undergoing a process to receive Energy Label. Once the process is completed all the necessary data for energy simulations will also be ready.
Activities performed by partner (s) – (M05-M10)	• ULUND is studying and learning more about Reinforcement Learning (RL) and its applications in energy management. Further development of the algorithms considering RL. • CyI has reviewed the standards and guidelines to identify user needs and health requirements (i.e. thermal, visual, acoustic, indoor air quality requirements) for occupants. • CyI has identified the references for strategies for instructing dynamic thermal control in the building where non-fragile and adult people are in sedimentary activity (e.g., offices, residencies)CyI has prepared the first draft of the post-occupancy evaluation (POE) surveys by occupant type and purpose.

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	• E@W had several discussions with LASTEM to consolidate the list of smart plugs, smart thermostats and actuators available in the market, which are suitable for the Edge Node. • The messaging protocols have been discussed and defined by E@W and LASTEM. The protocols are used for communication with field devices in order to apply the lightweight control algorithms to be embedded directly on the iGateway and/or Bourder Router. • NODA has analysed the price signal for the implementation of different behaviours, notably the peak shaving mode of NODA Heat Network, the energy optimizing mode of NODA Building, and a mode for intermittent energy sources targeting the explicitly stated objective. • R2M has initiated a discussion with Virtual on dashboard development, starting from the needs of the stakeholders and of the potential customer segments. • Virtual was in contact with R2M and NODA regarding the software development for the Edge Node user interface.
Deliverables	• -
Updated Risk (M05-M10	• Ålesund municipality (ÅKE) as building owner has the deadline of 15 May to submit the required data for energy labelling. This process has delayed the completion of pilot buildings' energy modelling in DIMOSIM.

Task 2.3: Providing inputs and boundary conditions data for COLLECTiEF network to be used in virtual testbed (M01-M12)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
The first set of future weather data for at least three pilot sites (Norway, France and Italy) are ready in the EPW format to be used at DIMOSIM	Completed	All the inputs/boundaries that need to be considered in simulation including: historical/current/future weather files, energy price/tariffs/incentives/DR and occupant behaviour modelling for algorithms development are implemented in DIMOSIM.
Energy price, demand response programmes, incentive/tariff and/or flexibility markets should be documented and ready for all the pilot sites.	Completed	
The first set of data sets on occupant behaviour modelling is ready in the format to be used at DIMOSIM.	Ongoing	

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Activities performed by the partner

Task Leader: ULUND	
Task Contributors: NTNU, CyI	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are completed by M10 with one ongoing action, and no deviation with regards to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• ULUND has synthesized future climate datasets for the case studies, considering multiple CMIP5 future climate scenarios. • ULUND has sythesyzed representative weather datasets (typical and extreme conditions) for the case studies. • NTNU has prepared preliminary datasets and information on dynamic price, tariffs, and demand response programs. • CyI has prepared a collection and annotation of models of occupant behaviour actions in buildings (e.g., operation of windows, operation of blinds, adjustment of setpoint temperature, clothing level adjustment, light switching, use of appliances) is underway and will be completed • CyI has identified the meteorological variable available at the site. CyI is going to develop an API to automatically download weather data and forecasts from weather stations available at the At the Campus of CYI.
Deliverables	-

Task 2.4: Testing of COLLECTiEF algorithms via co-simulation based on building and energy system modelling and analysis (M01-M24)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Access to web service and APIs are provided by CSTB and tested by the partners. All the related partners understood the logic, functioning and needs of the DIMOSIM testing platform & methodology.	Completed	1) All the demo sites are modelled and calibrated in DIMOSIM; 2) the First set of CI algorithms at the Edge Node are tested in simulation; 3) Preliminary results for G2ELAB are ready to be verified in the real environment at the living lab; 4) Full cluster-edge architecture is defined and simulation platform is ready to test CI algorithms at both Cluster and Edge Nodes.
At least three demo sites to be modelled and calibrated against measured data (Norwegian pilot (Eidet), Italian apartments and G2ELAB)	Ongoing	
The connection between EdgeNode and ClusterNode is discussed and understood. 1) simulating the situation (message passing – edge node, action-based), 2) moving into containers, 3) adding a simulated network, 4) running at the edge.	Ongoing	

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Activities performed by the partner

Task Leader: CSTB	
Task Contributors: NODA, ULUND, ÅKE, CyI, TEICOS, Virtual	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing and one of the actions is completed by M10 as planned. The energy modelling has started and been completed for some of the pilot buildings, but the process is not yet complete for all.
Activities performed by partner (s) – (M05-M10)	• CSTB has created a platform in Gitlab for exchange on simulation in the project. • CSTB has improved DIMOSIM's APIs and added two additional APIs namely (1) virtual district generation and simulation and (2) interactive documentation of API socket exchange for algorithms. • CSTB has improved the functionalities of the DIMOSIM's APIs: (1) improvement of interactive documentation of API socket exchange for algorithms; (2) interactively export simulation results after simulation via url; (3) addition of a more flexible way to set user behaviour in buildings – necessary for the simulation of all pilots; (4) first version of an automatic calibration tool written in Python (launching DIMOSIM API). • CyI has initiated the experimental discussion about CSTB at the G2ELab regarding the completion of the data collection about the Cyprus case study. • NODA has investigated integration with the DIMOSIM co-simulation solution. NODA in collaboration with CSTB has studied the possibilities and limitations of the solution. • NODA and CSTB have worked on a continuous-time system for the discrete-time of DIMOSIM. • TEICOS was in contact with the Italian pilot managers to get data for simulation, as well as to better understand the availability and usability of the data collected. • TEICOS has gathered the electrical and thermal data from the Italian pilot managers.
Deliverables	-
Updated Risk (M05-M10)	• Delays in completion of required data from pilots for energy modelling • The time required to create a calibrated model of the pilot buildings might take longer than expected.

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Task 2.5: Deployment and testing of algorithms and control strategies at small-scale pilot (G2ELab) (M12-M24)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Testing and development of CI algorithms for G2ELAB in a simulated environment	Ongoing	Preliminary results are driven by the simulation and the first round of algorithms are ready to be tested in real conditions at G2ELAB

Activities performed by the partner

Task Leader: CSTB	
Task Contributors: ULUND	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• CSTB has prepared the list, data treatment and detailed analysis of available monitoring data which has been carried out for the small-scale pilot. • CSTB has initiated with the relevant partners and researchers, the planification of COLLECTiEF algorithms in the small-scale pilot at G2elab.
Deliverables	
Updated Risk (M05-M10)	

5.3. WP3: Implementation, Testing and Small-scale Demonstration (M12-M36)

This work package aims at developing and implementing the prototype of the COLLECTiEF network including hardware and software technologies for demonstration in a small-scale real environment in G2Elab.

The start of the WP3 activities is M12, but certain actions were necessary for the completion of other tasks in other WPs. Therefore, we have initiated the integration analysis of Sphensors with different kinds of field devices (e.g., smart plugs) and edge node inside the border router.

- WP leader has organized a WP meeting (on 20th December) including WP3 beneficiaries and other related partners. In this meeting, the working principle of iGateway for gathering and elaborating data from the pilot sites has been presented. Several other following meetings

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have been organized in this period in order to have a better understanding of the activities which will be started from M12. E@W and NODA - Edge Node-Cluster node communication (09/11/2022 and 12/11/2022)
- E@W and EM Systemer- interface the BRIG device with the BMS at the Norwegian pilot (03/03/2022)
- E@W and Virtual - interface the BRIG device with the COLLECTiEF local GUI (28/03/2022)
- E@W and LASTEM - SW integration aspects - (09/11/2021, 15/11/2021, 18/01/2022 and 28/01/2022)

Moreover, we have studied the technical feasibility, intending to optimize the data communication and avoid any eventual redundancies and/or problems related to the data congestion and transmission delays. The market study was also initiated to find smart plugs with Wi-Fi connection and, also with open communication protocols (preferably http RESTful) to permit the communication with the border router. Most consumer smart plugs have indeed closed communication protocols due to the availability of specific software (cloud-based or as an App inside a smartphone) provided from the same device constructor; these products are not compatible with COLLECTiEF project needs; hence these are not considered in the list of compatible smart plugs the pilots. Each smart plug model identified in this phase will be purchased and functionally verified with the border router to assure that the solution is feasible concerning the project needs. Here are some commercial smart plugs identified:

- SONOFF: identified as DIY; RESTful API and IFTTT protocols.
- NETIO: high level and quite expensive products.
- SHELLY: Shelly 1 V3, Shelly 1 PM models.

The preliminary work was performed for the identification of optimal temporal resolution and spatial localization of sensing units for effective data sampling and the optimal thermo-physical characterization of the testing rooms. We also have started to study the relevant studies of user-friendly Human-Building interfaces.

Task 3.1: Design and development of COLLECTiEF distributed Cluster-Edge architectural scheme (M12-M24)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Preparation of the 1st draft of the COLLECTiEF Architecture and its development view, examining the requirements, use cases, partner feedback, programming languages and software technologies	Ongoing	Cluster-Edge Architecture is drafted in collaboration with Task 2.4; 2) The architecture scheme is provided to be implemented in DIMOSIM for testing and development of CI-based controls and logic

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Activities performed by the partner

Task Leader: E@W	
Task Contributors: EM, NODA, Virtual	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• E@W has supported LASTEM in defining the Hardware architecture of the BRIG device that will integrate Border Router and iGateway / Edge Node by supplying Raspberry Pi 4 boards for Hardware integration. E@W has had several discussions with LASTEM to agree on the SW integration aspects with the aim facilitate the development activities foreseen in this WP. • E@W has presented to the partners how iGateway will work to gather and elaborate data from the pilot sites. • E@W has already started the collecting information phase for Architecture definition from the SW developers by sharing the template to provide information on each tool of the COLLECTiEF architecture. • E@W has discussed with NODA about the Edge Node-Cluster node communication. • E@W has discussed with EM Systemer to evaluate how the interface of the BRiG (Border Router) device with the BMS at the Norwegian pilot site. • E@W has discussed with Virtual to evaluate how to interface the BRIG device with the COLLECTiEF local GUI. • EM has demonstrated REST API in Norwegian Building Pilots. • EM has prepared the documentation of API interfacing on the local network (not through EMPortal.no). • LASTEM has studied and evaluated the commercial products in terms of the communication protocols and the functionalities to support smart plugs, smart meters, and smart valves. • LASTEM has started to preliminary verify the possible integration of Sphensor Gateway (border router) with the iGATEWAY from E@W. LASTEM has analysed the porting of the border router on Raspberry Pi 4. • NODA has developed an in-memory DIMOSIM NODA co-simulation solution without regard to other aspects of software architecture. • NODA has worked on the solution over the NODA self-host database solution by refining the blackboard component, cf GitLab/noda-collectief-prototype-2203. • NODA has worked on the solution to set up an integration test environment and refine the algorithmic solutions. • NODA has worked on the solution over a mock network solution, providing development and test environment for integration with the Cluster-Edge communication solution in simulated time. • NODA has worked on the solution over an actual network solution, providing a development and test environment for integration with the Cluster-Edge communication solution in real-time. • NODA has worked on the solution over multiple instances of the NODA self-host running on individual Raspberry Pi devices.
Deliverables	-

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Update Risk (M05-M10)	• NODA: There is no immediate risk attached, but lacking a forum for technical discussions, there is a risk that steps requiring coordination between different partners are disregarded, jeopardising the project outcome. • LASTEM: Integration risks: - Thread radio driver not working properly and with adequate reliability on Raspbian OS = ask the producer to correct the driver - SW of BRiG not working well with the integration of the visualization SW of Virtual (project variation proposal) = not insert the SW of visualization of Virtual in the BRiG - Data storage of visualization SW on the BRiG memory can saturate the memory = add an external memory - Not finishing the FW integration = install the previous FW version and then update it remotely • VIRTUAL: A risk of creating the user interface is that it depends on many stakeholders in order to be able to work as expected in time. It will depend on the whole architecture with hardware, control algorithms, database access, and data interface (API or similar). All of these play a role in feeding and interacting with the user interface.

Task 3.2: Development of the COLLECTiEF Edge Node and integration with field devices (M12-M36)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Sphensors and BRiG are ready for installation	Ongoing	1) Installation of the Sphensors and BRiGs in the pilot sites are complete and debugged; 2) The system is connected to the NTNU server for data storage.
Installation guidelines and plan for all demo sites are ready, including optimal temporal resolution and spatial localization of sensing units for effective data sampling and the optimal thermo-physical characterization of the testing rooms	Ongoing	
COLLECTiEF architectural components and their functional requirements are defined in coordination with Task 2.2 and Task 4.1	Ongoing	

Activities performed by the partner

Task Leader: E@W	
Task Contributors: CETMA, EM, NODA, CSTB, CyI, Virtual, LASTEM	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10, but a global shortage of electronic components has created delays in the assembly process of Sphensors.

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Activities performed by partner (s) – (M05-M10)	• CyI has provided recommendations and information on the installations of the Sphensors in the different types of building covered by the project, reported in D5.1. • LASTEM has designed (first revision) of BRiG's (Border Router + iGATEWAY) board electronic diagram, functional test using simulation software. • LASTEM has designed (first revision) of BRiG's printed circuit board (PCB). • Production of printed circuits (first revision) and supply of electronic components on the market. • LASTEM has worked on porting FW Border Router on the Raspberry Pi 4 platform. • LASTEM has worked on the manual assembly of electronic components (prototype), and functional tests. • LASTEM has designed the mechanical processing to be applied to the box containing the electronic card. • LASTEM has designed (second revision) of BRiG's board electronic diagram. • LASTEM has designed (second revision) of BRiG's printed circuit board (PCB). • LASTEM has produced printed circuits (second revision) and supplies electronic components on the market. • LASTEM has worked on the manual assembly of electronic components (second prototype), and functional tests. LASTEM has checked the function with the current Border Router Sphensor firmware. LASTEM has preliminarily evaluated the FW BRiG architecture for interoperability of the Border Router software modules with those of iGATEWAY and also drafted the related technical specification.
Deliverables	-
Updated Risk	• LASTEM: Shortage of electronic materials can change or postpone the plan of installation. • LASTEM: Shortage of electronic materials can change or postpone the plan of installation

5.4. WP4: COLLECTiEF system integration and large-scale demonstration (M01-M48)

In work package 4, the actual systems namely Edge Node, Cluster Node, occupant-centric fusion sensor network, IoT Operating System, and Human-Building interface are demonstrated in an operational environment at a large scale.
During the first phase of the project, the activities for the involvement and engagement of stakeholders in the process for the definition of the task requirements were prepared. Furthermore, the general administration has been organized by the involved partners.
The data collection procedure from the installed TBSs (legacy equipment) in the pilot buildings has been started.
The technical evaluation of the pilots and initial communication/meetings with their manager/owners in Italy, France, Cyprus and Norway started.

WP4 has organized a meeting on 12/12/2021.

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Task 4.2: Preparation of pilot cases for deployment and demonstration (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
AMS meter (current consumptions and voltages, total consumption, every 2s, the total consumption in hourly resolution will be stored) integration kit into BMS is completed for all Norwegian pilot buildings	Completed	A complete surveying, monitoring and data acquisition system is up and running in all pilot buildings
Extract and storing recorded data from BMSs in Norway, from the Heating system in Italy and Meters in Cyprus is in place and running	Ongoing	
Continue evaluation of BMS status and fix issues	Ongoing	

Activities performed by the partner

Task Leader: EM	
Task Contributors: CyI, ÅKE, TEICOS, LASTEM	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• EM has presented general BACS and demonstration of Norwegian Pilots API. • EM has evaluated the Norwegian pilot buildings. • EM has access to the data of Norwegian pilot buildings. • EM has set up API access for the COLLECTiEF project. • EM and NTNU have worked on an understanding of BAS on Norwegian Pilot Buildings and coding for accessing building data. • ÅKE has participated in the meeting with building users. This meeting was with teachers, nurses, and office workers in addition to the managers. • ÅKE and NTNU have met the building users/occupants to decide on rooms and the position of sensors. • CyI has completed a preliminary list of offices, and classrooms. Furthermore, CyI has signed and submitted the MoU for authorization. • CyI has technically checked the rooms included in the pilot for the identification of technical requirements. Terms of reference for the tendering have started. • LASTEM has identified the sensors to be installed in the pilot buildings. LASTEM has defined the number and position of apartments in the buildings for the monitoring phase. • LASTEM has visited the Italian pilot buildings to analyse the possibilities of installation namely, evaluation of the presence of sockets, connectivity, etc. • LASTEM has identified the connection between the sensors and the BRiG inside the buildings.

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	• LASTEM has identified the activities to be carried on for the installation of the Sphensors in the buildings. • LASTEM has analyzed the relative position of apartments in the pilot site in Milan and the definition of connections between Sphensors/repeaters/Sphensor Gateway. • LASTEM has discussed with EM and Virtual to define API to integrate Sphensors and BMS of the Norwegian pilot buildings. • R2M has gathered the information and analysed the control devices in the Italian pilot by contacting the facility management staff and the manufacturing company of the control devices in the Italian pilot buildings. • TEICOS has analysed the Italian pilot buildings with on-site inspections and surveys. • TEICOS has identified the buildings' thermal and electrical systems during the inspections. • TEICOS has identified the systems and planning of the best applicative solutions; gaining detailed information about the heating systems. • TEICOS has performed the mapping out and identification of the ideal apartments for monitoring. • TEICOS has worked on the users' inputs to define and capture their requirements and expectations. • TEICOS has a defined number of smart plugs and smart valves.
Deliverables	-

Task 4.3: Surveying, monitoring, and data acquisition of pilot buildings (M12-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Build a persistent Data Storage and Management that will provide all the necessary tools for the management of the context history and data that can be stored using relational DBMS technologies.	Ongoing	A complete surveying, monitoring and data acquisition system is up and running in all pilot buildings

Activities performed by the partner

Task Leader: CETMA	
Task Contributors: EM, NTNU, CyI, ÅKE, TEICOS	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• EM has created Creating sample code in Python for POST and GET commands in REST API.

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	• CETMA has prepared complete surveying, monitoring and data acquisition systems that will be up and running in all pilot buildings at the end of May (M12). • CETMA is working on the documentation of the database, describing the conceptual, logical and physical elements of the project (entity-relationship schema; entity and attribute definition; relations and their attributes; cardinality, attributes and properties; views; primary keys, foreign keys, etc.). • R2M has participated in internal consortium training sessions (BACS/BMS, Web API; iGateway demo session).
Deliverables	-
Updated Risk	• The diversity of user types within the pilot buildings (children at schools, elderlies in the health care centres, athletes at the sports centres) makes the POE process very complicated. • ÅKE: Changes in the pandemic

5.5. WP5: COLLECTiEF system qualification, Smart readiness evaluation and impact assessment (M01-M48)

Work package 5 aims to qualify the COLLECTiEF system by assessing the following main impacts: (1) the ability of the buildings to optimize operation for the health and comfort of the occupants, (2) the ability to maintain energy efficiency performance and operation of the building through the adaptation of energy consumption, (3) the ability of the buildings for demand response and interoperability to provide energy flexibility, and climate resilience of buildings and energy systems. In this work package, the smart readiness level of the pilot buildings before and after installation of the COLLECTiEF system is evaluated based on SRI.

In the second phase of the COLLECTiEF project (M05-M10), NTNU as leader of this working package has organized the following meetings in the contribution of the WP5's partners in order to coordinate and develop the tasks and related activities.

- WP5 Meeting on KPIs and D5.1 (10/02/2022)

All partners have actively participated in the meetings for the definition of the Performance measurement & verification protocol and the identification of metrics on the energy flexibility, energy efficiency, indoor environmental quality, and climate resilience. In contribution to the partners, NTNU has coordinated and developed the following activities related to Tasks T5.1 and T5.2:

- Definition of the Performance Measurement & Verification Plan
- Creation of a list of definitions of the terminology used in the M&V plan, according to the reference international standards
- Identification of metrics and KPIs for assessing energy, IEQ, energy flexibility and climate resilience
- Creation of a 'Template for Pilots', to collect data about the COLLECTiEF pilot buildings, their service systems, energy and IEQ monitoring systems and smart readiness functionality levels
- Analysis of energy schemes and prices in the pilots' countries
- The analysis in the pilots' countries is under development and will be contained in D5.1.
- Definition of the users' engagement plan in collaboration with WP7
- Definition of the informed consent procedures
- Analysis of Pilot buildings, collection of materials and synthesis

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- Workshops with the end-users (two workshops and several calls/site visits were organized with the tenants/users of the buildings in Italy and Norway and the users have confirmed their participation in the project)
- Definition of IEQ sensors to be installed in each pilot
- Identification of zones to be monitored
- Creation of a table summarizing technical building systems and controls in the pilots (from available info)

Task 5.1: Definition of the Performance Measurement & Verification Protocol (M01-M12)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
To complete the list of relevant definitions	Completed	D5.1 is delivered to the EU
Detail the methodology for smart readiness assessment	Completed	
Provide guidelines for impacts assessment (measurements and simulations) and (edge/cluster node). Need to discuss with WP2 and Wp5 how to differentiate KPI in these two ways of evaluating impacts.	Ongoing	
Complete the section related to energy and energy flexibility KPIs	Completed	
Complete the section related to IEQ KPIs and POE questionnaires guidelines	Completed	
Complete the section related to climate resilience KPIs	Completed	
Complete the analysis of local demand-response schemes	Ongoing	
Complete the users' engagement plan	Ongoing	
Complete the informed consent procedures	Completed	

Activities performed by the partner

Task Leader: NTNU	
Task Contributors: ULUND, CyI, CSTB	
Overall progress and deviations from the action plan (M05-M10)	No deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• NTNU has described the M&V Plan in detail in the D5.1 – Performance Measurement & Verification protocol – concepts and methods for performance evaluation of COLLECTiEF solutions which will be submitted by M12.

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	• As part of D5.1, NTNU in contribution to the involved partners has prepared the list of definitions, according to the reference international standards, to create a common ground for exchange and communication among the Partners and with the whole research community. • NTNU in contribution to the involved partners has identified a list of KPIs. The KPIs are also listed inside the D5.1 and will be used to evaluate the impacts of the project before and after the implementation of the COLLECTiEF systems. • NTNU has prepared a comprehensive template in .xls format to collect all the necessary information about the Pilots' buildings, their service systems, energy and IEQ monitoring systems and smart readiness functionality levels in a clear, organized, and homogeneous way. This tool has facilitated the responsible partners of each pilot to carry out the task in the most efficient way and it allows easy-to-read analysis of the main features of the building and direct comparison between the different case studies. • NTNU has developed a detailed plan for users' engagement and discussed it with the occupants during the workshops. • NTNU has prepared the informed consent procedures for the participation of occupants/users. This will be submitted as part of D5.1. • CETMA has contributed to D 5.1 with the description of procedures and routines to ensure data quality at the data storage level. • CSTB has contributed to D 5.1 by providing input for the energy flexibility section. • CSTB has described the small-scale pilot G2Elab and presented it to the partners. • CyI has contributed to D 5.1 by providing input for the IEQ section and also designing the occupant-centric experiment and preparing post-occupancy evaluation surveys. • GEO has attended the building owners' workshop and presented the project. • LASTEM, R2M and NTNU have participated in 1st and 2nd Building owners' workshops in Milan and presented the Sphensors to the building owners and provided the best practices during environmental monitoring to the building owners. • TEICOS has participated in 1st and 2nd Building owners' workshops in Milan. • • LASTEM has contributed to D5.1 by providing information about the evaluation of the calibration procedure of Sphensors, definition of initial accuracy and periods for re-calibration. • NODA has consulted on flexibility metrics and recommended a solution in terms of how well a solution can adapt to the supply side cost of energy.
Deliverables	D5.1 Performance Measurement & Verification Protocol – Concepts and methods for performance evaluation of COLLECTiEF solutions

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Task 5.2: Performance and Progress Monitoring of the Pilots (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Completion of missing pilots' description files	Ongoing	Performance monitoring of the pilot buildings is started based on the installed monitoring and data acquisition system
Organization of 2nd workshop with the end-users	Completed	

Activities performed by the partner

Task Leader: NTNU	
Task Contributors: CSTB, CyI, TEICOS, ÅKE, CETMA	
Overall progress and deviations from the action plan (M05-M10)	There is a deviation in the completion of pilot descriptions. For some of the Norwegian pilots, the description is not complete until the energy labelling for these buildings is ready, which contains all the necessary information.
Activities performed by partner (s) – (M05-M10)	• NTNU has filled out one template for each pilot building which contains information about the buildings' geometry and thermal behaviour, their service systems, energy and IEQ monitoring systems and smart readiness functionality level. • NTNU in collaboration with Italian and Norwegian partners has organized two workshops and several calls with the tenants/users of the buildings in Italy and Norway. The users have confirmed their participation in the project. • LASTEM, R2M and NTNU have participated in 1st and 2nd Building owners' workshops in Milan and presented the Sphensors to the building owners and provided the best practices during environmental monitoring to the building owners. • TEICOS has participated in 1st and 2nd Building owners' workshops in Milan. • NTNU has identified the type of IEQ sensors and ordered them from the producers. A plan for their installation and operation has been defined. • NTNU and the partners are currently defining in co-design with the tenants/end-users the zones to be monitored. IEQ sensors are supposed to be installed by M12. • NTNU has developed a summary of technical building systems and controls in each pilot and is available in the project repository. • R2M has supported TEICOS to complete and analyse the description template for the Italian pilot. R2M and TEICOS have also prepared the installation and monitoring plan for actions on the Italian pilots. • R2M has surveyed the available solutions in the market for monitoring of Italian pilot. • CyI has collected data on installed TBSs (legacy equipment) in pilot buildings. • GEO has contributed to organising the building owners' workshop in Milan.

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	• GEO has prepared supporting materials, such as general presentation, timeline design, coordination of the translation of dissemination materials and printing for the building owners' workshop in Milan. • TEICOS had several internal meetings to define the involvement of building owners and managers. • TEICOS has planned and organized the first workshop for the Italian pilot. The information was given about the topics and goals with expected contributions. • TEICOS has presented both technical and user behaviour monitoring systems, gathering input regarding the expectation of results and required user engagement. • TEICOS is Planning the second workshop for the Italian pilot including the collection of the final list of participants, with the presentation of the monitoring devices and discussion about the needs and expectations of the occupants. • TEICOS has gathered the input regarding the expectation of required user engagement and specifications for short- and long-term surveys. • TEICOS has collected the users' ideas and conditions. • ÅKE has supported NTNU in access to buildings and system • CETMA had several meetings with CyI to define the methodological sections of POE Experimental design. The methodology for constructing the measurement scale, sampling and hypothesis testing, and the related statistical methods for data analysis were agreed upon and defined. Part of these contributions was also reported in D 5.1. • CETMA has planned a reliability test and validation phase of the measurement scale in T5.3, where the length of the scale will be optimized and the questionnaire in providing statistically significant answers to the research questions formulated in T 5.3. CETMA will use statistical techniques to ensure the significance of the questionnaire data (e.g. Cronbach's alpha, item correlation measures, exploratory and confirmatory factor analyses, etc.) and subsequently apply statistical modellings such as structural model equations (SEM) as a combination of multilevel regression, ANOVA and factor analysis. • CyI has almost completed the experimental design of the occupant-centric experiment and post-occupancy evaluation surveys.
Deliverables	-
Updated Risk (M05-M10)	• CyI: We are trying the hardest we can to get smart meters installed, but they are not in the project budget and we are looking for external funding. • R2M: Need for adequate engagement and participation of the apartment owners in the Italian pilot. • R2M: Eventual delays in the installation of components for the pilot monitoring before the end of May 2022.

5.6. WP6: Exploitation of Results and Business Models (M01-M48)

Work package 6 sets the foundation for effective development and exploitation of the project results, with a special emphasis on replicability and upscaling across Europe. It also includes the coordination of the exploitation activities of the IP generated in the COLLECTiEF project.

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During the second period of the project, we have studied the stakeholder groups and organizations as well as their needs. The preliminary framework and criteria for market analysis and the list of competitors in the market were prepared. In addition, we are developing the identification of relevant regulatory frameworks and standardization needs at the EU, French and Norwegian levels. The requirements for smartness and automatic controls in buildings, the methods, and requirements to assess the implication of smart controls concerning the buildings' energy performance, the RES integration, the grid & smart grid-related legislation, and the directives and regulations about the energy communities, are being studied and drafted.

The initial analysis of the exploitable results has been carried out by R2M and the preparation of a template for the description of the stakeholder database is in progress. Furthermore, the application of distributed intelligence has been studied to the needs of the clients/stakeholders.

Task 6.1: Market and stakeholder analysis and needs (M01-M18)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Updating the stakeholder database (R2M) with the contributions by all the partners; Preparation 1st draft of market analysis by R2M and GEO	Ongoing	R2M and GEO will further update the database and prepare a draft market analysis

Activities performed by the partner

Task Leader: R2M	
Task Contributors: GEO + all partners	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• R2M in collaboration with the partners has studied and gathered the stakeholder's information. • R2M has studied bibliographic research and development of analysis for the market analysis, particularly for the sections on market segmentation/value chain and potential customers, and on competitors' analysis. • The partners have contributed to preparing the list of market segments and networks.
Deliverables	-
Updated Risk	• R2M: Need feedback and information from the partners.

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Task 6.2: Regulatory framework and standardization needs (M01-M24)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Updating the analysis of the regulatory framework and standardization needs	Ongoing	The first template will be circulated by M12 to get the first input on the regulatory framework of each country

Activities performed by the partner

Task Leader: R2M	
Task Contributors: all partners	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• CSTB has contacted eu.bac and the information meeting will be held in 2022. • LASTEM has assessed the new application field of the school building. LASTEM is performing interviews with indoor air quality experts in school buildings after the new national indication related to air quality in classrooms: UNI/PdR 122:2022.
Deliverables	-

Task 6.3: Identification and assessment of the exploitable results (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Complete template for identification and assessment of the exploitable results	Ongoing	The template for exploitable results is ready for circulating among partners

Activities performed by the partner

Task Leader: R2M	
Task Contributors: all partners	
Overall progress and deviations	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.

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from the action plan (M05-M10)	
Activities performed by partner (s) – (M05-M10)	• R2M has analyzed the exploitable results according to the project and provided the first information on it. • R2M in cooperation with the partners has finalized the analysis template, and communication to gather information on it. • R2M has initiated the priority tasks of the exploitation process for the exploitable results of the project regularly including market analysis. • E@W has updated the E@W ERs for the identification and assessment of exploitable results. • LASTEM has prepared the ER1 (Exploitable Result 1-Sphensor) document for the exploitation of Sphensor as a single system. • NTNU, ULUND and NODA prepared the ER1 document for the exploitation of COLLECTiEF's Edge and Cluster Node algorithms • LASTEM: Resistance in stakeholders to new solutions.
Progress percentage	
Deliverables	-
Updated Risk	• R2M: Resistance in the market to new solutions.

5.7. WP7: Dissemination, communication, and capacity building (M01-M48)

This work package aims to assure the project's proper visibility and spread pertinent information on its goals, activities and results to the relevant stakeholders and scientific communities.

During the second period (M5-M10), GEO has organized several social media campaigns to engage relevant users and the public, including building owners and prosumers. Some of these campaigns entailed the production of non-scientific articles, available on the website and/or were co-organized with sister projects. COLLECTiEF has organized the following campaigns:

- World Cities Day on the 31st of October
- World Energy Efficiency Day on the 5th of March
- International Mother Earth Day on the 22nd of April 2022

The second DET has been held on 13/12/2021.

The Third DET has been held on 29/04/2022

GEO has developed the third (January-April) D&C Plan which was approved by the DET.

The social media activities including the promotion of partners, the campaigns, and continuous newsfeed have been planned and are under development by GEO.

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Task 7.2: Stakeholder engagement (M03-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Updating the stakeholder database	Ongoing	R2M and GEO will further update the database and prepare a draft market analysis "

Activities performed by the partner

Task Leader: GEO	
Task Contributors: all partners	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• translation of the website is being organized and will require the contribution of pilot leaders. • GEO has contributed to preparing the stakeholder database in collaboration with R2M & new collaborations with sister projects (Smart2B, SOTA). • For stakeholder engagement, CyI has contacted Eng. Yiannis Vassiades, Standards Officer at the Cyprus Organisation for Standardisation (CYS), Dr George of PHOEBE Research and Innovation Ltd, (startup on technology integration for advanced applications), Dr Alexis Kyriacou of Lelantus Innovations Ltd. (startup on air quality sensors and AI applications). • ÅKE has contributed to the translation and quality control. • NTNU (in collaboration with SMART2B and SATO) has planned for organizing a session (Smart buildings as key enablers for the EU energy transition strategy) at EUSEW.
Deliverables	-
Updated Risk	• GEO: Low engagement of stakeholders; reluctance to adhere to COLLECTiEF initiatives

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Task 7.3: Joint dissemination and communication actions (M01-M48)

Action plan by the coordinator

Actions	Expected Progress by M10 (30-March-22)	Expected Progress by M12 (31-May-22)
Keep updating social media accounts	Ongoing	Ongoing
Keep going networking and synergies activities	Ongoing	Ongoing
Campaign for stakeholder engagement	Ongoing	Ongoing
The advertisement of COLLECTiEF activities, achievements, and the tool on the project's website	Ongoing	Ongoing

Activities performed by the partner

Task Leader: GEO	
Task Contributors: all partners	
Overall progress and deviations from the action plan (M05-M10)	The main planned activities of this task are ongoing by M10 and no deviation with regard to the work plan has been identified.
Activities performed by partner (s) – (M05-M10)	• GEO has organized several social media campaigns to engage relevant users and the public, including building owners and prosumers. Some of these campaigns entailed the production of non-scientific articles, available on the website and/or were co-organized with sister projects. • GEO has aimed in other social media campaigns at raising awareness of COLLECTiEF's topics and objectives is the energy quiz, posted bi-weekly on LinkedIn and Twitter. • GEO has produced the first COLLECTiEF and was promoted. Translations in local languages were provided too. • GEO attended the ENLIT event on the 21st of November. COLLECTiEF joined the event both online, by showcasing the project video, and in-person by attending the event in Milan. • GEO has developed the materials needed for building owners' engagement (video, presentation, timeline, social media visuals for promotion) • GEO in cooperation with the partners has translated the dissemination materials into Italian and Norwegian. The materials have been provided to support the first workshop with building owners and users. • Campaign to support and promote the building owner's engagement workshops in Italy and Norway. The events were followed by social media coverage and a non-technical article reporting on the events. • GEO has developed the third (January-April) D&C Plan which was approved by the DET. • EM has reviewed the translated materials e.g., the Video script.

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	• All partners have contributed to promoting the COLLECTiEF project by reposting and creating content on social media. • R2M has contributed to the organization of the ENLIT fair, calls, information exchanges, and planning. • R2M has participated in ENLIT Milano for networking and stakeholders' engagement. • R2M has contributed to the organization of 2nd workshop with the pilot occupants.
Deliverables	-

5.8. Project difficulties, problems, solutions – lessons learned

The coordination team has asked the partners to provide a statement of any difficulties or problems (internal or external) that the partners encountered during project implementation over the month fourth to tenth. This includes the explanation of how the partners have managed to address and solve the reported problems as well as on what were the corrective actions in which they have planned to take and what was the outcome of your corrective action(s).

One of the major issues during this period was the purchase and delivery time of electronic components, which has been casting a shadow over the project. This concern was raised by the two partners E@W and LASTEM.

The purchase of the Raspberry Pi 4 was a challenge at the time due to the lack of global supply. E@W has taken the necessary actions and managed to acquire all Raspberry Pi 4 on time. E@W has supported LASTEM in defining the Hardware architecture of the BRIG device that will integrate Border Router and iGateway / Edge Node by supplying Raspberry Pi4 boards for Hardware integration. The second challenge imposed by lack of supply was the required components for the Sphensor production. By the following, the stated comments LASTEM describes the challenge. Their raised concern was brought to the PO at EU Commission by the coordinator.

LASTEM

Difficulties/problems: The situation in the world's electronic components supply chain is completely out of control, with an unexpected lack of electronic components.

In order to accomplish our task, we had to redesign some electronic boards because we could not procure certain components anywhere in the world at any price. We are working for completing the Sphensor production in May.

This integration is critical since this integrated device must be installed in M12 in the buildings, even if the iGATEWAY intelligence will be used only in M24, so the FW can be updated after installation remotely.

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LASTEM has stated the above issue in an email to the coordinator:

"Dear Amin,

Over the last few months, I tried to keep you updated about the heavy difficulties we are experiencing as a result of the current disruptions in the electronic industry's supply chain.

Being an EU financed project, we have always looked at Collectief as a project with the highest priority in our company.

A number of actions have been taken by LASTEM since the project started in order to mitigate the risk of longer delivery times including:

1. *the full redesign of some electronic boards which components suddenly resulted in long delivery time (even up to 24 months!)*
2. *the decision to acquire all components we could from brokers having an immediate availability from stock (at a higher price) instead of taking the risk to wait from the usual suppliers*
3. *Seek for alternative suppliers all over the world*

As a result of this efforts, at the moment, we are still hoping to receive all the necessary components by End of March/Beginning of April which should allow us to assemble and test all boarder routers and sensors for a delivery at the end of April, somehow still in time for the project.

However, the bad performance we are continuing to experience in terms of suppliers' delivery time reliability prompts me to write you the present email suggesting evaluating the possibility to inform the EU Commission about this situation".

As of April 21st, LASTEM has informed the coordination team of the following, meaning the above risk has been reduced to the minimum and the start of monitoring with high probability will continue as planned.

"Hi Amin,

Most components have been delivered and we have started the assembly process.

Testing related to the integration of the sensors with the new border routers are still in process.

Our aim is to ship the sensors and new border routers by 29 April or by 6 May at the latest."

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Other partners in the consortium have reported the following difficulties, problems and solutions in the second period of the project:

CETMA:

Difficulties/problems: Acquiring a legal basis for assuming the role of the data controller.

Corrective actions: Involving in the partnership a company identified by us, CRClex, which could take on the role of our DPO in the project and support us in having a solid legal basis for deciding the means and purposes of data processing in the project.

The outcome of the corrective action: The result is that we will have a DPO who will support us in making legally sound decisions on any actions and processing of project data. We are assessing internally in what form it is possible to do this (e.g., subcontracting), the weight it will have on our budget, and any amendments we need to produce for the project officer.

CyI:

Difficulties/problems: The pilot buildings are not equipped with smart meters. However smart meters are not funded by the COLLECTiEF project. We are looking to install them covering the expense with other sources, if possible.

NODA

Difficulties/problems: The challenge of aligning software development related tasks with the project plan is complicated by subtle but significant challenges due to the highly technical nature of the subject matter: firstly, locating the challenges is a matter of continuous discovery and not something that lends itself to upfront planning and, secondly, some technical challenges cannot be bent to fit the project plan, but the plan will have to adapt to the challenges. For example, it is likely that still unknown key tasks for integrating solutions developed by different partners will fall between the chairs due to, firstly, underestimated efforts and costs and, secondly, budget constraints.

This is a well-known and largely unsolved* challenge of software development, here complicated by the upfront allocation of tasks and budgets. Ideally, everyone involved in coordinating software development should have working experience in software development combined with comprehensive knowledge of the subject matters at hand (building physics, communication solutions, containerised deployment, control theory, database solutions, hardware-related solutions, HVAC, machine learning, mathematics, statistics, UI/web development, etc.). This is not realistic, and the challenge has to be addressed in some other way.

One way of addressing this challenge can be to foster a non-adversarial and collaborative environment for open-ended technical discussions so that challenges can be discovered and dealt with before they become a problem. The overall spirit of cooperation is still good, and such an effort can still succeed. However, it is complicated by the upfront allocation of tasks and budgets, which constitute a fundamental challenge for the PM and lead project partners.

(*) Opinions may differ, and there are plenty of software consultants willing to sell you the latest and greatest solution.

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Comments: From NODA's point of view, T2.1 focuses on NODA Heat Network and T2.2 focuses on NODA Building. However, these are not independent software solutions, but different use cases of a common software solution. Therefore, the effort to adapt these to COLLECTiEF necessarily interleaves the two tasks.

As was pointed out early on (COLLECTiEF_NODA_2021_07_14.ppt), the commercial NODA solution is not designed for co-simulation and cannot be run in simulated time against DIMOSIM.

Though disappointing not to get things right the first time around, we believe that the suggested architecture constitutes a significant improvement in ease of use and will aid development.

Step 1-2 of IPPR2 T3.1 developed and communicated in code M10. The code has been committed to GitLab/noda-collectief-prototype-2203. Some parts are delayed due to illness and it remains to, firstly, debug integration with the preferred machine learning library (which falls under T2.1 and T2.2) and, secondly, adapt the configuration to DIMOSIM models developed by NTNU and other partners.

The NODA solution works by overriding building outdoor temperature sensors or, what amounts to the same thing, the building side supply side temperature. However, the preferred way to integrate with DIMOSIM is to instead control an indoor temperature set point. This simplifies the integration with DIMOSIM at the cost of abstracting over the challenges of integrating with physical equipment. However, the design of the heating system is surprisingly heterogeneous across Europe, and it is difficult to imagine an equally simple yet more comprehensive solution.

Initiated individual meetings with key personnel from CSTB, CyI, E@W, NTNU (PM), ULUND, and Virtual, on software development and test environment-initiated discussion on how to set up an efficient and effective software development environment and suggested the use of the NODA self-host (an open-source solution) as a means to that end.

Virtual

Difficulties/problems: We hoped to be able to start the development against some real data and API. However, it seems like we are a bit too early in the project yet.

Comment: Please keep Gaurav.Garg@virtual.se in the email loop as well, he has been missing as a recipient in some emails.

CSTB

Difficulties/problems: Due to the need for the deliverable of a calibrated model of G2Elab, some delays in the simulation of other pilot site models. However, no official deadline for the delivery of these models has been set in the proposal. For the next GA in June, some other pilots will be modelled and calibrated.

ÅKE

Difficulties/problems: ÅKE has difficulty finding time for the third meeting. Meetings are now planned for week 16.

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GEO:

Difficulties/problems: We did not experience major problems affecting the efficient implementation of GEO activities. The analysis of the first 6 months of D&C implementation made clear that the success of the content posted on social media differs based on the channel (LinkedIn is more successful than Twitter). Nevertheless, the project managed to smoothly accomplish all the activities and progress towards the achievement of KPIs. The success of the communication efforts is a combination of the different factors:

- High content quality and powerful graphics
- Correct tags and hashtags
- Event attendance
- Collective efforts

Furthermore, the energy quiz was not as successful as we believed it would be. Therefore, we will not pursue such activities in the future.

Corrective actions: We are not planning any corrective measures. We acknowledge that some partners are more active on Linkedin, and therefore we will continue posting on the platform the content that our audience on this platform appreciates the most.

5.9. Changes in the project team

In this period of the COLLECTiEF project, among all partners, the following minor change in the project teams was reported.

- **E@W**: Engineer Daniele Mattia who was supposed to work on the development activities foreseen in WP3 left Energy@Work at the end of March 2022. E@W has already identified and hired starting from the first of May 2022 the Engineer Marco Antonio Insabato who will replace Daniele Mattia in the WP3 activities that will start at M12.
- **CyI:** On 15th March 2022, Panayiotis Papadopoulos joined our team as a Post-Doctoral Research Associate.
  NTNU: Medya Temelli Fenerci has been added to the management team as administrative project manager.

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6. Risk updates and mitigation plan

Risk No.	Risk	WPS	Mitigation Plan	Likelihood (1-3)	Impact (1-3)	Risk Category	Contingency Plan	Progress on action	Status (open – waiting – closed)
R1	One of the partners leaves the consortium	all	Partner's expectations will be continuously verified in order to ensure their commitment to the project	1	3	medium	Depending on project progress, finish the project with the remaining partners or add a new partner	*Update 01/11/2021:* *Partner Virtual was lagging behind at the beginning of the project due to the leave of the employee who was the main contributor in the proposal writing phase. Therefore, extra efforts were put into several meetings to clarify tasks and expectations* for the newly assigned personnel of Virtual. *Update 21/04/2022:* *All the partners have been actively participating in the tasks and no lack of contribution has been observed in this period.*	Open
R2	Tools and methodologies do not work for all cases/applications: e.g., trained on a specific pool of data	2, 3	Close monitoring of project progress for that aspect	2	2	medium	Train the model again, find another modelling approach	*Update 01/11/2021:* *Extra needed efforts and tools have been identified. For example, upgrading of BMS systems in some of the pilot buildings in Norway. Required actions to access hourly energy metered data for the pilots in Italy and Cyprus.* *Update 21/04/2022:* *This has been an ongoing risk and a continuous list of actions has been taken to reduce the risks. In this period, the focus has been on ensuring a rich pool of data will be generated from Sphensors, BMS data and POE questionnaires.*	Open

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R3	Implementation phase: • Waiting for building permission (administrative and procedural) • Risks of damage to the building/the building management during installation • Decisions of owner take too long (regulatory)	3, 4	● The COLLECTiEF partners will work closely with the building partners to foresee any complications. ● Engaging pilots partners and involved stakeholders in time during the project actions.	2	3	high	Replace the demo building if necessary. However, the plan of activities entails sufficient time for implementing the innovative solution before the implementation in the pilot cases.	*Update 01/11/2021:* Extra meetings with building managers/owners have taken place to clarify expectations and required help/access for the monitoring and demonstration phase of the project. In addition, two workshops are planned for building owners/users who are going to contribute to the project to ensure a strong engagement and therefore reduce implementation risks *Update 21/04/2022:* Two workshops were held for buildings owner engagement in Italy and Norway, and several meetings with the building users during this period were part of the effort in reducing this "high" risk category. Details of actions are provided in section 3. Engagement strategy.	Open
R4	Delays in the implementation in the pilots due to restrictions for the COVID situation	4	The coordinator and the involved partners will monitor the COVID situation in the context.	1	3	medium	If necessary, some implementation actions could be anticipated respect others, for example, to reduce the contact with the occupants of the building.	*Update 01/11/2021:* COVID restrictions have been reduced or removed in the pilot sites. This created the chance to visit the buildings and meet in person with building managers and establish the connection that will facilitate future communication if the COVID restrictions return. *Update 21/04/2022:* This risk has been reduced significantly due to the current COVID situation and the severity of the pandemic is fading. But it remains relevant in case of the situation change back again.	

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R5	Monitoring: ● The data from the buildings may not be correctly acquired; lack of data; missing data ● Failure in placing the sensors at appropriate locations in buildings. ● Damages or faults of the installed components.	5	● The Sphensor™ system has a Border-Router with data logging features to solve online data communication issues. ● The sensors and the electronic components will be placed following mounting guidelines and recommendations in published literature.	2	2	medium	For missing building data: use trend analysis/extrapolation to close the gaps; compare to historical values.	*Update 01/11/2021:* An extensive effort has been put in place in the first semester of the project with the involvement of all the relevant partners to plan in detail the data acquisition during the monitoring period. This included communication protocols for devices, type of sensors, number of sensors, placement of sensors, zones to be monitored, methods for post-occupancy evaluation (POE), technical and physical limitations, user interface, data management and storage, etc. Update 21/04/2022: The following factors have been clarified in this period to ensure a successful lunch of the monitoring campaign from June 2022 in all the pilot buildings. Factors included: communication SW/HW for the Sphensors, specific zones for monitoring, type of sensors for each zone, number of sensors, placement of sensors, methods for post-occupancy evaluation (POE), technical and physical limitations in each zone, data management and storage, robust communication for collecting data from BMS, etc.	Open
R6	Evaluation: KPIs and methods for assessment not being adequate	5	Our experts from academy and industry in the consortium will ensure the development of appropriate KPIs and assessment methodologies	2	2	medium	KPIs will be adjusted based on the feedback from the small-scale test period at the living lab as well as during the large-scale demonstration phase.	*Update 21/04/2022:* Deliverable D5.1specefically addresses this risk and will be submitted by M12. In this deliverable, the concepts and methods for performance evaluation of COLLECTiEF solutions, which are developed in this period by the experts in the consortium, are presented.	Open

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R7	Data protection ● Low participation of occupants in the surveys. ● Low internal validity of survey responses	5	Standardized and already tested questionnaires will be used.	2	2	medium	For lack of response to surveys or low validity of survey data: select interview candidates instead and conduct structured interviews.	*Update 01/11/2021:* POE questionnaire has been planned to be used for thermal comfort assessment before and after implementation of COLLECTiEF solutions. In this regard, the POE process has been introduced to the building managers and with their help, potential participants have been identified who will facilitate filling of the POE questionnaires. For example, certain teachers for the school buildings, and certain nurses for the elderly health care centres are identified and invited to join the engagement workshop in December and February. *Update 21/04/2022:* The two engagement workshops have been held In Italy and Norway. The zones and the location of sensors have been identified with the direct help of the building users (owners, teachers, nurses, managers,…). The POE questions and a mock-up of the Sphensors have been shown to them and feedback received. The local technicians have been present during the visits to locate the best spot to place the Sphensors. For example, the issue of providing electricity for the sensors was solved.	Open

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R8	Failure to demonstrate a sustainable business model for the COLLECTiEF system due to equipment costs/willingness to pay or high customization costs based on the climatic situation or the occupants' needs	6	In the demo projects, different climate zones will be taken into account, and the variety of buildings on which the solutions will be demonstrated will reflect a good representation of occupants' needs.	2	3	high	The business models can take these aspects into account and can be adapted, e.g. to specific building typologies, thus reducing the need for customization.	*Update 21/04/2022:* Reducing the need for customization has been a topic of discussion with the technical experts at NODA, E@W and R2M. This was directly connected to the prospect of commercialization and scalability of the solutions.	Open
R9	Conflicts in intellectual property rights (IPR)	6	Proper analysis will be conducted in the dedicated task 6.5, starting from the background declarations from the Consortium Agreement and based on the contributions and activities performed during the projects.	2	2	medium	Support for IPR strategies and agreements will be delivered in the framework of task 6.5.	*Update 21/04/2022:* R2M has initiated the Identification and assessment of the exploitable results via an "Exploitable Results (ER) template" distributed to the relevant partners. The work and discussions in the first year might have brought up other potential ERs not initially considered. In our opinion, it's good to start thinking early from an exploitation perspective and use it to help shape and guide future products/services.	Open
R10	Failure to reach and engage a sufficient number of stakeholders at the COLLECTiEF events	7	All consortium partners have extensive professional networks in their respective countries that will be engaged. The dissemination plan will set several verification moments to early identify deviations and develop contingency plans.	1	2	low	Work with "multipliers" in the respective countries (e. g., associations) and equip them with the material needed to inform the stakeholders via their channels; discuss metrics to track attention	*Update 01/11/2021:* The engagement strategy described in section 3, is used to mitigate this risk. *Update 21/04/2022:* In the last two engagement workshops, the building owners and users have shown strong interest. A sufficient number of research participants has been identified. In Italy, participants (private building owners) were additionally encouraged by the possibility of keeping the smart valves and smart plugs after the end of the project.	Open

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