Ref. Ares(2024)4589926 - 26/06/2024

ABraytCSPfuture

Air-Brayton Cycle **C**oncentrated **S**olar **P**ower **future** plants via redox oxides-based structured thermochemical heat exchangers / thermal boosters

Deliverable D1.3.

First version of revised project management plan.

Dissemination Level: Public

WP1 Project coordination and management

Date: 26.06.2024

https://www.abraytcspfuture.eu/

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no 1010845.

Disclaimer

The work described in this document has been conducted within the ABraytCSPfuture project that is co-funded by the European Union. Views and opinions expressed herein are however those of the author(s) only and do not necessarily reflect those of the European Union or of the granting authority, European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Grant Agreement Number:	**101084569**	**Acronym:**	**ABraytCSPfuture**	
Full Title	**A**ir-**Brayt**on Cycle **C**oncentrated **S**olar **P**ower **future** plants via redox oxides-based structured thermochemical heat exchangers/thermal boosters			
Call Topic Identifier:	HORIZON-CL5-2021-D3-03			
Funding Scheme	HORIZON EUROPE, RIA – Research and Innovation Actions			
Project start date:	01.11.2022			
Project duration:	48 months			
Project URL	https://www.abraytcspfuture.eu/			
EU Project Officer	Clara Astudillo Llorente			
Project Coordinator	DLR – German Aerospace Center			
Deliverable	D1.3 –First version of revised project management plan.			
Date of Delivery	Contractual	29.02.2024	Actual	26.06.2024
Nature	Report			
Dissemination Level	Public			
Lead Beneficiary	DLR – German Aerospace Center			
Document History				
Version	**Issue Date**	**Change History**	**Authors**	**Organisation**
1.0	22.02.2024	Document drafted	Christos Agrafiotis	DLR
1.1	27.02.2024	Updated with final partner feedback	Christos Agrafiotis	DLR
1.2	28.02.2024	Final Review	George Karagiannakis	CERTH
1.3	26.06.2024	Resubmission	Christos Agrafiotis	DLR

About the Project

ABraytCSPfuture sets forth an innovative, carbon-neutral way for implementing the highly efficient air-Brayton gas turbine power generation cycles into future air-operated Concentrated Solar Power (CSP) plants. Air-Brayton cycles are used in traditional power plants where, however, involve fossil fuels combustion via pressurized air. *ABraytCSPfuture*'s carbon-neutral approach aims at achieving higher solar-to-electricity efficiencies, vital for competitiveness of CSP and non-reachable by either PVs or molten salts and thermal oils, increasing in parallel significantly the plants' storage capability. The project will develop and demonstrate a first-of-its-kind compact, dual-bed thermochemical reactor/heat exchanger unit that will transfer heat from a non-pressurised air stream to a pressurised one, while also operating as a thermal booster, raising the temperature of the pressurized stream to the level required for Brayton cycles. Furthermore, the volumetric solar energy storage density of air-operated CSP plants will be significantly increased by rendering their current sensible-only regenerative storage systems to hybrid sensible-thermochemical storage ones within the same storage volume. Both these functionalities will be materialized by thermochemical reactor/heat exchanger units comprised of non-moving, flow-through porous ceramic structures (honeycombs or foams) based on earth-abundant, cost-efficient, non-toxic oxide materials and exploiting reversible reduction/oxidation reactions of such oxides in direct contact with air, accompanied by significant endothermic/exothermic heat effects. The proposed technology is set forth by an interdisciplinary partnership spanning the entire CSP value chain, comprised of leading research centres, universities, innovative SMEs and large enterprises, including ancillary services providers and technology end-users.

Deutsches Zentrum fuer Luft- und Raumfahrt e.V., **DLR**	DE	
Centre for Research & Technology Hellas, **CERTH**	EL	
University of Twente, **UT**	NL	
Fundación CENER, **CENER**	ES	
Fundación TEKNIKER, **TEKN**	ES	
Fraunhofer Gesellschaft zur Foerderung der angewandten Forschung e.V., **FHG (IWKS)**	DE	
OPRA Turbines, **OPRA**	NL	
KRAFTBLOCK GmbH, **KB**	DE	
LANDSON Emission Technologies A/S, **LET**	DK	
COBRA Instalaciones y Servicios S.A., **COBRA**	ES	

Table of Contents

This deliverable is part of a project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no 101084569.

Executive Summary

The present document constitutes Deliverable D1.3 "First version of revised project management plan" developed within WP1 of the HORIZON EUROPE 2020 ABraytCSPfuture project, according to the project current progress. The document lists the modifications that had to be implemented in administrative aspects due to the developments in the project during the first 16 months and is an update to Deliverable D1.1 ''Project Management Plan with Gantt chart and Work Breakdown Structure'' submitted in M4. With respect to the technical aspects, the work already performed in the project has proceeded according to schedule and the currently available results provide strong evidence that the milestone targets set will be met within the initially foreseen timeframe. Therefore, at least until the submission of the current deliverable, no revisions are needed with respect to the management of the technical part of the project.

Changes with respect to the DoA

As elaborated below **an Amendment of the Grant Agreement** was initiated on 24.10.2023, requesting the termination of participant OPRA due to its insolvency and inclusion of a new entity, Destinus-Energy the successor of OPRA, as a replacement. Except replacing the acronym "OPRA" with "DEST" throughout the Amendment text, no other changes with respect to the DoA have taken place.

A deviation from the DoA with respect to the dissemination & exploitation activities has to do with the number of Newsletters foreseen, namely a total of 6 newsletters (1 every 8 months). Currently, the 1st Newsletter is under preparation; the delay is due to the fact that during the first 16 months of the project the Consortium devoted intense efforts on the materialization of the S/T targets rather than in dissemination of results through Newsletters. As a matter of fact, as elaborated below, this commitment has actually paid off by generation of real tangible experimental results that will facilitate more effort on dissemination for the remaining part of the project.

1. Introduction

Deliverable 1.2 describes the current status of the project at the end of Month 16 and assesses this status vs. the initial project planning based on the Description of Work (DoW) in the proposal and its modifications during the Grant Agreement preparation procedure. It is produced within the Management and Coordination work package (WP1) in order to outline a clear picture of the project status at the end of its first reporting period (RP1) from Month 1 to Month 16, i.e. from November 1, 2022 to February 29, 2024. A detailed description of the technical results during this period will be presented in the respective 1st Progress report due within 60 days from the end of RP1, i.e. on April 30, 2024 (Project Month 18). The current document's purpose is to concisely evaluate the work plan and the overall management approach adopted so far in order to ensure that tasks are completed on time, resources are allocated appropriately, and high performance/quality of results of the project is guaranteed vs. the initial targets set at the beginning of the project and describe any corrective actions already set forth or further needed. In this respect, it contains on the one hand an overview of the administrative issues encountered and the mitigation actions assumed to overcome them and on the other hand a brief outline of the technical progress achieved so far and its assessment vs. the foreseen upcoming Milestones, in order to serve as a roadmap for the first periodic report, the respective progress review meeting and the course of the project during the next years.

2. Consortium: changes and Grant Agreement Amendment request

The initial ABraytCSPfuture consortium (Table 1) was comprised of 10 entities: 6 Research & Technology Organisations (RTOs) - 5 research centers and one University -, two innovative, highly specialized SMEs and two large enterprises (LE).

Table 1: ABraytCSPfuture project's Consortium.

No	Participant organisation name	Country	Type
1	Deutsches Zentrum fuer Luft- und Raumfahrt e.V., **DLR**	DE	REC
2	Centre for Research & Technology Hellas, **CERTH**	EL	REC
3	University of Twente, **UT**	NL	HES
4	Fundación CENER, **CENER**	ES	REC
5	Fundación TEKNIKER, **TEKN**	ES	REC
6	Fraunhofer Gesellschaft zur Foerderung der angewandten Forschung e.V., **FHG (IWKS)**	DE	REC
7	OPRA Turbines, **OPRA**	NL	PRC
8	KRAFTBLOCK GmbH, **KB**	DE	PRC
9	LANDSON Emission Technologies A/S, **LET**	DK	PRC
10	COBRA Instalaciones y Servicios S.A., **COBRA**	ES	PRC

However:

- on 22.02.2023 OPRA informed the ABraytCSPfuture Project Coordinator (PC) that on 15.02.2023 OPRA ENGINEERING SOLUTIONS BV (OPRA ES) have declared bankruptcy, but also that all efforts were being made to restart OPRA.
- Indeed, the appointed trustee organized a bidding of the IP and assets, and these were acquired by Destinus, an important player in the European hydrogen propulsion industry, specializing in aerospace and energy solutions (https://www.destinus.ch/), on 12.04.2023.
- As part of this transition the OPRA company name was changed to Destinus Energy.
- On 26.04.2023, the coordinator was informed on the will of Destinus Energy to replace OPRA in the Project assuming the tasks foreseen for them.

Impact and mitigation plan:

Several options were extensively discussed among the PC, the EU Project Officer (PO) and the successor scheme of OPRA, Destinus Energy after this development. One option for the consortium would have been to terminate old OPRA and reshuffle the activities and budget among the remaining partners, provided they have had the necessary expertise and available resources, not including any new partner. However, given on the one hand the will of Destinus Energy to replace OPRA in the Project assuming the tasks foreseen for them and on the other hand that this was the only partner in the consortium with experience in gas turbine technology, this approach was opted out.

Instead, the Project Coordinator and the consortium considered that by including Destinus Energy in the ABraytCSPfuture consortium as a partner undertaking the work originally allocated to OPRA, the impact on the overall work and development of the project would be the minimum possible and could easily be mitigated. Indeed, Destinus Energy is an appropriate replacement of OPRA to carry out those tasks, since its competences include gas turbine technology and its applications.

Hence, after consultancy with the PO, the mitigation plan was to compensate for this issue with inclusion of Destinus Energy in the ABraytCSPfuture consortium as a partner undertaking the work originally allocated to OPRA, a procedure requiring an **Amendment of the Grant Agreement.** A considerable period of time elapsed during which details of the bankruptcy/acquisition/pre-financing/remuneration procedures were clarified with the required supporting documents submitted to EU services, during which a change of the project's PO on behalf of the funding authority took place as well. Eventually, an Amendment of the Grant Agreement was initiated on 24.10.2023, requesting the **termination of partner OPRA due to its insolvency and inclusion of a new entity - Destinus-Energy - as a replacement,** to which the original allocated budget, tasks and responsibilities of prior partner OPRA would be transferred. Then EU has to ask from OPRA a refund from the pre-financing already transferred to them, and the "new" partner, Destinus Energy would receive the rest.

The new beneficiary has sufficient operational capacity to carry out the tasks originally foreseen for OPRA. Destinus Energy employs more than 50 people and their in-house R&D processes enable them to be leading in providing solutions involving gas turbine design, including combustion, flow-path, rotary parts and controls design. In fact, as part of the Destinus family, they are now a major European hydrogen propulsion industry player. The OPRA OP16 product name, which is considered the most relevant to the project's concept and had been considered as reference component during proposal preparation and submission, remained unchanged and will continue to be used to identify the new beneficiary's gas turbine products in the oil & gas, industrial & commercial, waste to energy and marine Volatile Organic Compounds (VOC) destruction markets.

No changes to the number, content or delivery schedule of Deliverables and Milestones are to be made. OPRA was removed from the project with exit date of 15.02.2023. The new beneficiary will start to work for the project as soon as the amendment is finalised and approved; an indicative such date is April 2024, corresponding to Project Month 18. **This will have practically no impact on the project's course** since the tasks wherein OPRA was and Destinus Energy will be mainly involved are scheduled to be implemented mostly during the second half of the project. These tasks concern namely:

- Input regarding the integration of the developed within the project dual bed Thermal Energy Storage (TES) system in a solar thermal power plant, considering possible upgrade of plant's operation with Brayton gas turbine cycles in **Task 4.5. Overall process simulation, possible plant operation scenarios and systems integration strategies.** <u>CENER,</u> DLR, CERTH, TEKN, KB, **OPRA,** COBRA **(M3-48).** It is noted that during the first half of the project the task focuses on the TES system itself and its efficient combination/integration with the solar receiver rather than the downstream part, main part of which is the gas turbine
- Contribution in the evaluation of the dual bed regenerator/thermal booster test campaign results with respect to securing continuous supply of air heated to the temperature levels required for the Brayton gas turbine cycle in **Task 6.1. Extended cyclic test assessment of dual-bed unit of porous structures as thermal booster.** <u>DLR</u>, CERTH, CENER, TEKN, UT, KB, LET, **OPRA (M40-48).**
- Expertise on identifying advantages, possible drawbacks and further actions needed to investigate the perspectives of the proposed concept's integration in real-size, combined power cycle solar thermal power plants, outlining the relevant criteria for technology scale-up to industrial levels and identifying suitable solutions to be applied therein, in **Task 6.3. Technical evaluation of test campaigns.** <u>DLR</u>, CERTH, UT, FHG, TEKN, CENER, KB, LET, **OPRA**, COBRA, **(M43-48).**
- Contribution in **Task 7.3: Techno-economic assessment, scale-up roadmapping and relevant future policy framework** COBRA, DLR, CERTH, UT, FHG, TEKN, CENER, KB, LET, **OPRA**, **(M40-48)** with respect to the effect that the higher efficiencies of the particular power cycle achieved will have on the future down-scaling and consequent cost reduction potential of the solar field.
- Contributions in the activities of all partners within **WP1. Project coordination and management** and **WP8. Knowledge and innovation management, dissemination, communication and European innovation base development.**

All the necessary documents were submitted through the SYGMA Portal in February 2024. The Amendment request is currently under evaluation from the relevant EU services.

3. Project management and governance structure

3.1 General Assembly (GA)

The only vacant position in the GA, namely that of Deputy/Proxy on behalf of UT was filled with Dr. Zhen Cao, who joined UT on July 2023 as a post-doctoral fellow. Thus, the current GA is currently 100% complete and comprised as shown in Table 2.

Table 2: ABraytCSPfuture General Assembly.

No.	Organisation	Member	Deputy / Proxy
1	DLR	Christos Agrafiotis	Martin Roeb
2	CERTH	George Karagiannakis	Chrysa Pagkoura
3	UT	Abhishek Kumar Singh	Zhen Cao
4	CENER	Javier Baigorri	Xabier Rández
5	TEKN	Saioa Herrero López	Iñigo Muñoz
6	FHG	Emanuel Ionescu	Wenjie Xie
7	*OPRA/Destinus Energy*	*Lars-Uno Axelsson*	*Alexander Haselhoff*
8	KB	Dimitrina Lang	Martin Schichtel
9	LET	Johnny Marcher	Linfeng Yuan
10	COBRA	Daniel Pereira	Daniel Rayo

4. Project Reports

4.1 Official reporting

According to Article 21.2 of the Grant Agreement, the project is divided into three reporting periods (RPs) as follows:

- RP1: from Month 1 to Month 16 (i.e. November 1, 2022 – February 29, 2024).
- RP2: from Month 17 to Month 32 (i.e. March 1, 2024 – June 30, 2025).
- RP3: from Month 33 to Month 48 (i.e. July 1, 2025 – October 31, 2026).

Within 60 days from the end of each RP, a Report must be submitted to the granting authority by the PC, i.e. two Periodic Reports and one Final Report are due in total. The Reports are mandatory and linked to interim and final payments by the granting authority. Their requirements and contents are described in the Grant Agreement and also elaborated in D1.1. The submission of the present Deliverable coincides with the end of RP1 and initiation of the preparation of all aspects necessary for the completion and submission of the 1st periodic report.

4.2 Internal reporting

In *D1.1. Project Management Plan,* the internal submission to the Project Coordinator of an internal technical report with contributions from all partners describing their activities during this first 12-month period of the Project was foreseen on Month 12 of the Project (October 2023). This was not judged necessary then because the period September 2023 – February 2024 was one with a particularly heavy workload in the framework of completing all necessary activities to be ready in time and document the main objectives and project's milestone (MS1, see section 5) due by end of RP1. At the current point in time (February 2024), the 1st Periodic Report due date is only 60 days away; therefore, the task of preparing a first annual internal report was cancelled.

Another such internal report from the partners to the PC, is tentatively foreseen in Month 26, in -between the first two "official periodic reports" to be submitted to the EU. However, depending on the technical progress realized at that point, the achievement of the relevant Milestones and the timely submission of the relevant Deliverables, this internal report might not be judged necessary. A final such decision will be made after completion of the evaluation process of the 1st RP of the project.

4.3 Project Review Meetings

As already described in D1.1, at the end of each reporting period and in association with the submission of the relevant progress reports, the Project Coordinator will organize three respective Project Review Meetings among all partners, the EC officer and possibly external experts invited by the EC. Taking into account the 60-days maximum period allowed for the submission of the periodic reports and a reasonable time for the EU officer and any external reviewer(s) to assess them, such Project Review Meetings are tentatively foreseen for M19, M35 and M48 from the date of the Project's commencement.

4.4 Project Deliverables

The list of the project deliverables, their level of dissemination (e.g. public, confidential), and their due dates are listed in Annex 1 of the Grant agreement (GA-A1). Overall, 34 Deliverables are foreseen. The respective timelines with the due dates of all Deliverables, wherein the ones already submitted are indicated and the due dates of all reports (official and internal) as well as the Project review meetings, are shown schematically in Figure 1 on the same timescale.

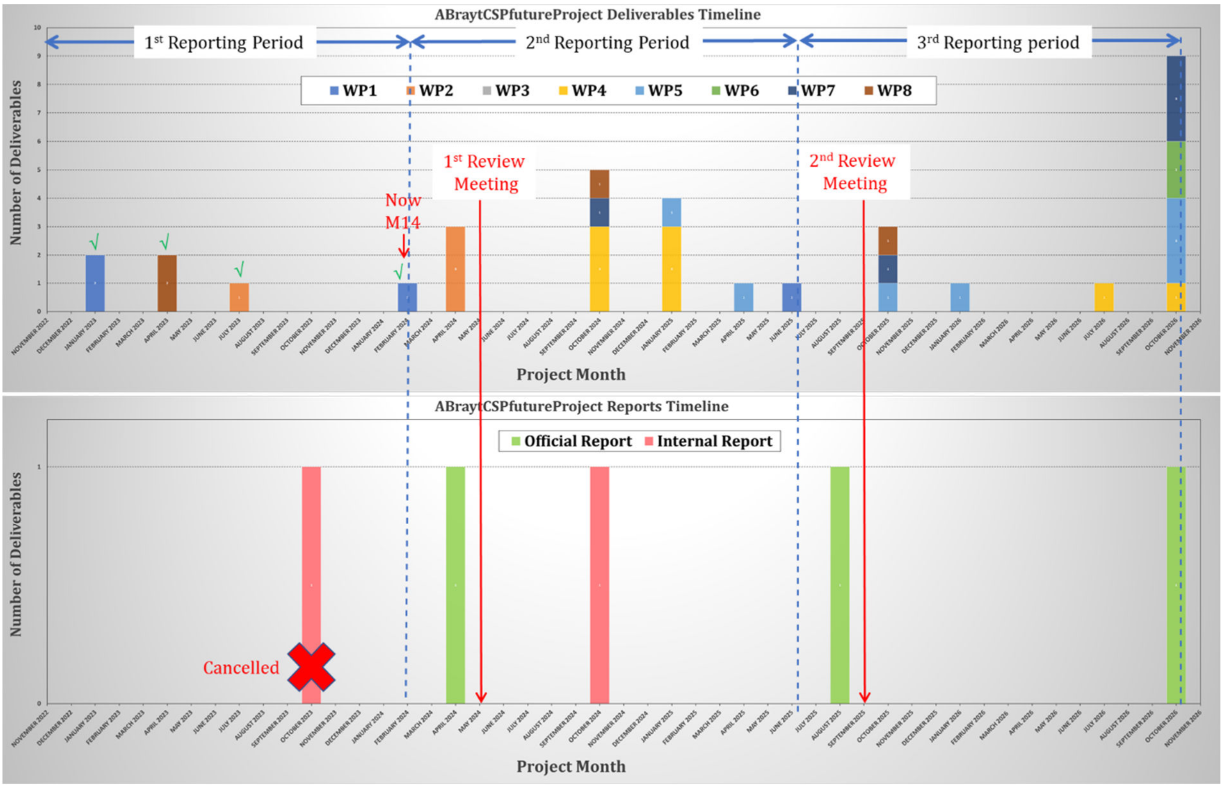


Figure 1: ABraytCSPfuture's Deliverables per WP (submitted and due), reports and progress review meetings timeline.

5. Project Milestones

The Milestones set to assess the progress of the project as described in the Grant Agreement are also summarized here in Table 3. Crucial Milestones have been set for before all Assessment Meetings to be used as a measure for such decisions. Milestones 1 and 2 are relevant in particular for the 1st Review Meeting and MS1 (in italics and underlined) is due by the end of RP1.

Table 3: ABraytCSPfuture Milestones.

MS no	Milestone name	WP No	Lead Beneficiary	Means of verification	Due date
1	*At least one composition with minimal or no expensive/critical/ health harmful materials, capable of long-term cyclic TCS operation and thermal boosting.*	*WP2*	*2. CERTH*	*Results of lab-scale test campaigns with mixed oxides qualifying at least one composition in powder form achieving: sensible + TCS energy density ≥ 300 kWh/m³ for at least 500 cycles in the temperature range 300-1100 °C.*	*M18*

2	Structured objects made of optimized material compositions with maximum active material content selected for manufacture of the proof-of-concept unit.	WP3	2. CERTH	Manufacturing protocols and results of lab-scale test campaigns with structured objects, identifying at least one structure geometry with structural integrity & tolerable dimensional changes for at least 200 cycles, and: TCS + sensible energy density ≥ 300 kWh/m^3.	M24
3	Proof-of-concept unit dimensions finalised; test site layout defined.	WP4	5. TEKN	Corresponding 3D integration layout including devices, piping, sensors, dimensions, location etc.	M27
4	Completion of proof-of-concept-unit-scale porous structured redox -material ceramics manufacture and qualification.	WP5	9. LET	Powder shaping/sintering protocols leading to structured objects based on the developed materials. All required structures for proof-of-concept unit manufactured, passed quality tests and delivered.	M36
5	Completion of components manufacture, unit assembly and installation on test platform.	WP5	10. KB	Full proof-of-concept prototype system delivered and installed on test platform; all required peripherals coupled, ready for start of operation.	M39
6	Validation of extended operation, post-service components examination and technology proof-of concept.	WP6 WP5	1. DLR	Results of WP5 for at least 100 cycles indicating that developed materials meet operation, thermomechanical stability/lifetime targets of energy density ≥ 300 kWh/m^3 and pressuried air temperature > 950 ^{o}C.	M48
7	Targeted concept and relevance for commercial-scale	WP4 WP7	4. CENER	Completion of validated full-scale system model for at least 1 plant integration	M48

	integration demonstrated through qualified scenarios.			scenario and feasibility analysis indicates operation/cost targets are met: materials production cost ≤ 2€/kg; LCOE < 7 c€/kWh_e	

With respect to the first two upcoming Milestones:

- MS1: 500 cycles in the temperature range 300-1100 ^oC with a composition in powder form have already been performed by CERTH. The data are currently evaluated in conjunction with thermophysical properties measurements currently ongoing, to determine whether the target of *sensible + TCS energy density ≥ 300 kWh/m*^{3} has been achieved. The targeted value has already been surpassed as explained below.
- MS2: Figure 3 shows batches of several lab-scale porous structured objects, namely honeycombs made by extrusion (CERTH) and foams made by the sacrificial template method (DLR) of various sizes and geometries (wall thickness, pore density, etc.). The specimens possess structural integrity and can be safely handled. Specimens made out of two promising perovskite compositions (i.e. $CaMnO_3$ and Sr-doped $CaMnO_3$) have been already prepared.

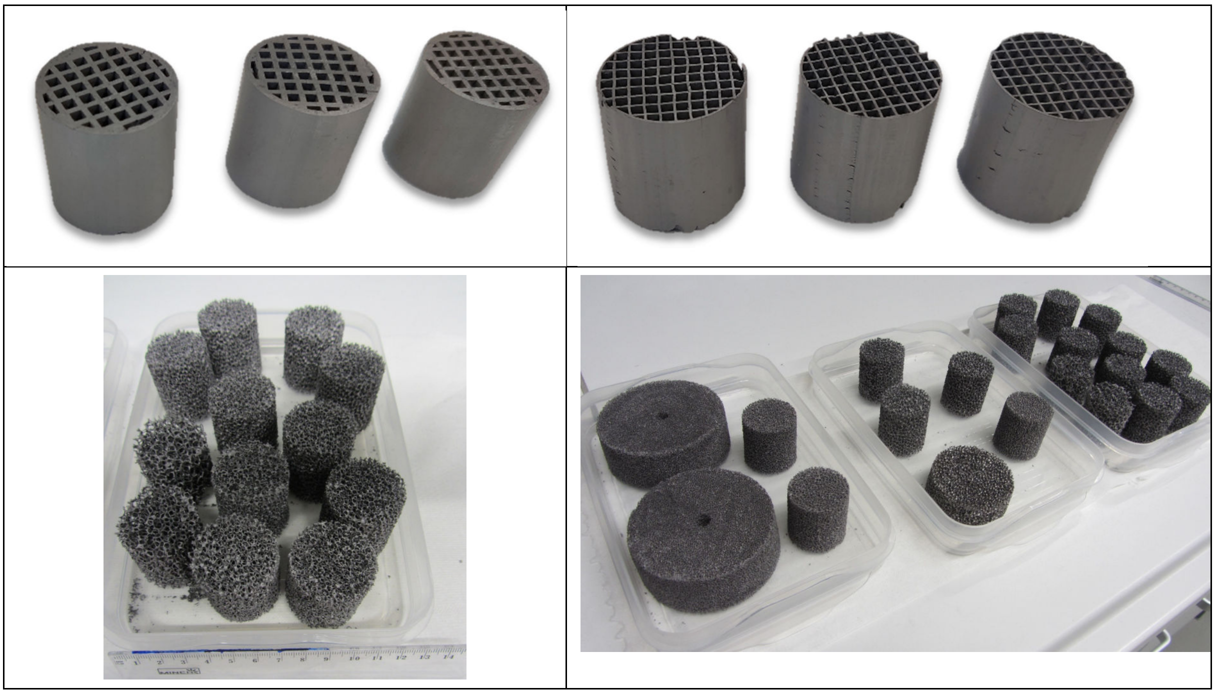


Figure 2: Representative in-house manufactured all-perovskite honeycombs by CERTH (top row) and foams by DLR (bottom row).

The first tests with extruded honeycombs by CERTH have demonstrated the capability of these perovskite-made structures to reversibly store and release heat during cyclic heating/cooling and materialize it **as a clearly manifested temperature rise of an air stream flowing through them during discharging. As a matter of fact, to the best of the consortium's knowledge this is the first time that the ability of a**

perovskite to generate repeatable heat effects upon cyclic redox operation is demonstrated experimentally. The current value, calculated from lab-scale experimental data, is close to 400 kWh/m³ and there is indication (experimental validation is pending) that it can be increased further. Preliminary quantitative calculations of the heat effects look very encouraging and provide strong evidence for the accomplishment of the milestone target of "*identifying at least one structure geometry with structural integrity & tolerable dimensional changes for at least 200 cycles, and: TCS + sensible energy density ≥ 300 kWh/m³.*" even before its' due date (i.e. M18 vs. M24).

Based on the above, the consortium considers that no revision of the initially scheduled project plan is required. The course of the work until now advocates for the achievement of the targets set within the foreseen timeframe (i.e. M1-M18).

6. Project meetings

6.1 In-presence Meetings

The project bi-annual in-presence meetings of the whole consortium with participation and representation of each project partner took place as scheduled:

- Kick-off Meeting, 11.2022 (M1), DLR, Cologne, Germany
- 6-Month Meeting, 06.2023 (M8), University of Twente, Enschede, Netherlands
- 12-Month Meeting, 12.2023 (M14), Fraunhoffer IWKS, Alzenau, Germany.

The next in-presence meeting will be the 1st Progress review meeting, tentatively scheduled for May 2024 (M19), i.e. the following month after submission of the 1st Periodic Report for RP1 (from M1 to M16), due on April 30, 2024, in Brussels.

6.2 Remote Meetings

Regular remote meetings within each ongoing WP were implemented as scheduled, i.e. every 3 months or even more often as per specific needs, for the effective cooperation and communication among the WP partners and the materialisation of the requirements within each WP. The actions discussed and agreed are documented in meeting minutes. Trans-WP remote meetings, e.g. between the LCA, powder synthesis and powder shaping-relevant WPs also took place, to exchange necessary information and clarify any issues.

7. Project planning

The overall project planning consists of the work breakdown structure (WBS) and the Gantt chart presented in sections 7.1, 7.2 respectively. This planning is and will be continuously updated in the course of the project and used by the coordinator to control the progress of the work tasks as well as the timely preparation of deliverables and achievement of milestones. Updates with respect to the initial plan are elaborated below.

7.1 Work break down structure (WBS)

ABraytCSPfuture is scheduled as a 48-month project, comprised of 6 Research/ Innovation Workpackages (WP2-WP7), covering the technical activities necessary to develop the project's novel ideas, complemented by two WPs addressing its coordination and management (WP1) and actions for exploitation of the project's outcome, dissemination and communication of its results (WP8), respectively. The interrelation among the WPs is visualized in the respective Pert diagram and their implementation in three phases as elaborated in D1.1, remains unchanged and as shown in Figure 3.

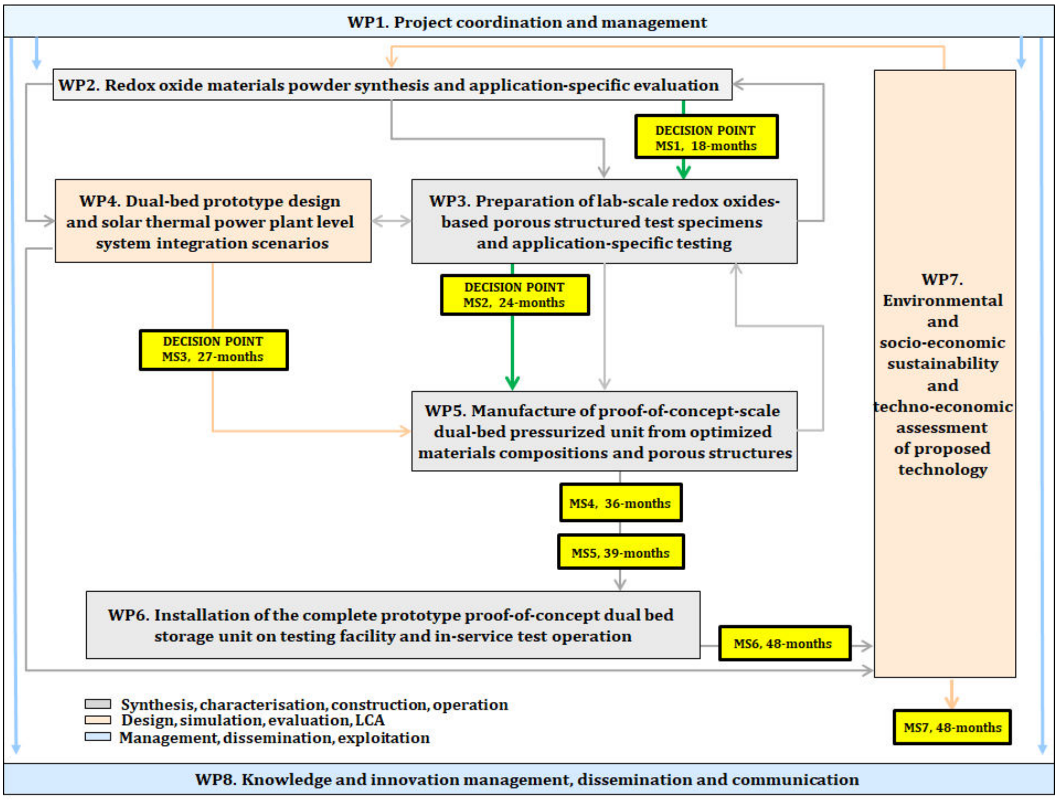
The WBS shown in Figure 4 is based on the Pert diagram. Among the Research/Innovation Workpackages (WP2-WP7), four concern mainly experimental work. This work starts from WP2 with the synthesis of a large palette of redox powder compositions and their relevant characterisation and evaluation and proceeds to WP3 addressing the shaping and manufacture of lab-scale porous structures out of several shortlisted powder compositions and their testing in lab-scale test rigs; it then escalates to the construction and assembly of a modular, dual-bed Proof-of-Concept (POC) thermochemical reactor/heat exchanger/thermal boosting unit (WP5) and culminates with integration of the PoC unit in a test platform for the demonstration of the ideas set forth in the project (WP6). Throughout the project, this work is guided and supported by extensive design and simulation work, spanning the entire range from atomistic scale to the entire solar plant operation simulation level (WP4). In parallel the socioeconomic and environmental impacts of the proposed technology and its potential commercialization roadmap are addressed in WP7. The contents of each WP have been analysed in more detail in D1.1 and the GA.

As also elaborated in D1.1., the project's rationale is to build and operate a proof-of-concept demonstrator of the thermal boosting concept set forth out of material(s) with in principle satisfactory properties, even though these materials turn out eventually not to be necessarily the best possible ones. In this perspective, studies in WP2 and WP3 will continue after their respective milestones up to M42 investigation the possibilities to develop "even better" compositions and structures through further optimization.

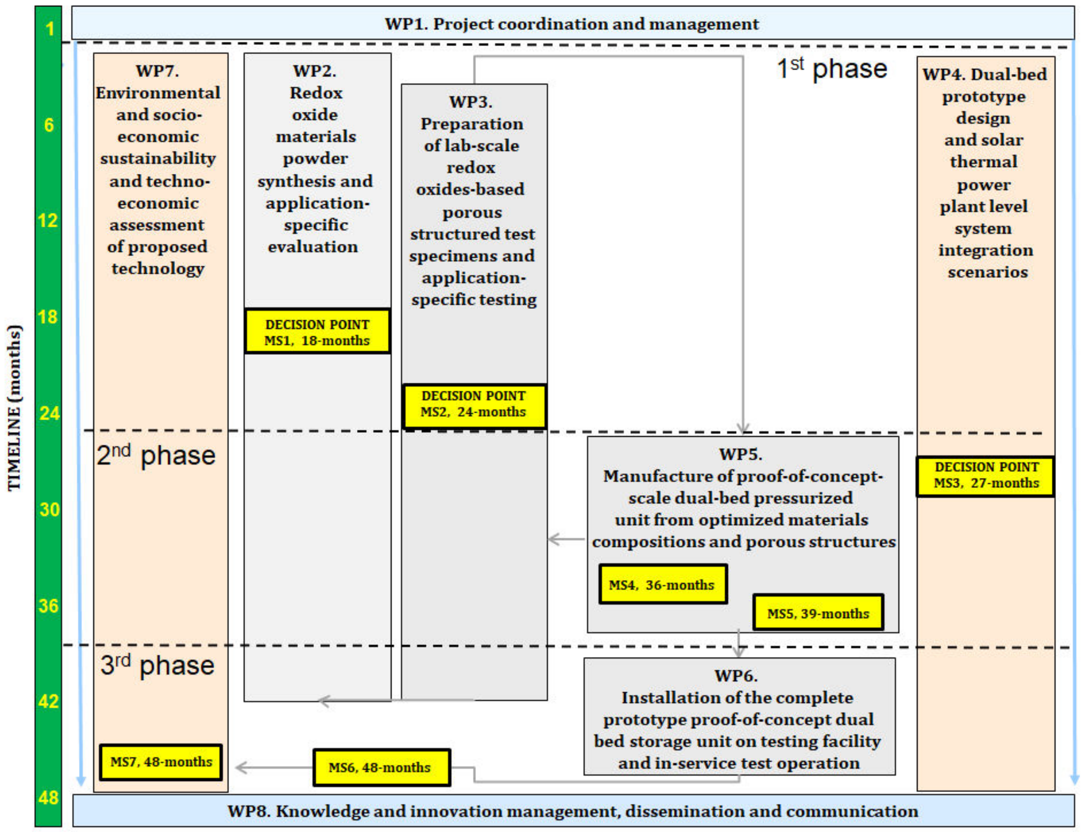
7.2 Updated Gantt chart

Between the submission dates of deliverables *D1.1 Project management plan with Gantt chart and Work Breakdown* and the current one *D1.3 First version of revised project management plan,* work within WPs 1, 2, 3, 4, 7 and 8 was ongoing, as scheduled.

The main issue within WP1 during this period was the actions needed to address the bankruptcy of partner OPRA, that however, fortunately was followed by the acquisition of the brand and assets from company Destinus and the will of Destinus Energy (the successor of OPRA) to replace OPRA in the Project assuming the tasks foreseen for them. The Project Coordinator and the consortium, after consultancy with the PO, decided to include Destinus Energy in the ABraytCSPfuture consortium as a partner to which the original allocated budget, tasks and responsibilities of prior partner OPRA would be transferred, a procedure requiring an **Amendment of the Grant Agreement, which** was initiated on 24.10.2023. The Amendment of the Grant Agreement did not result any changes with respect to the DoA, since OPRA was not participating in the technical part of the WPs running so far.



(a)



(b)

Figure 3: (a) Pert diagram and (b) conceived phases of *ABraytCSPfuture* project.

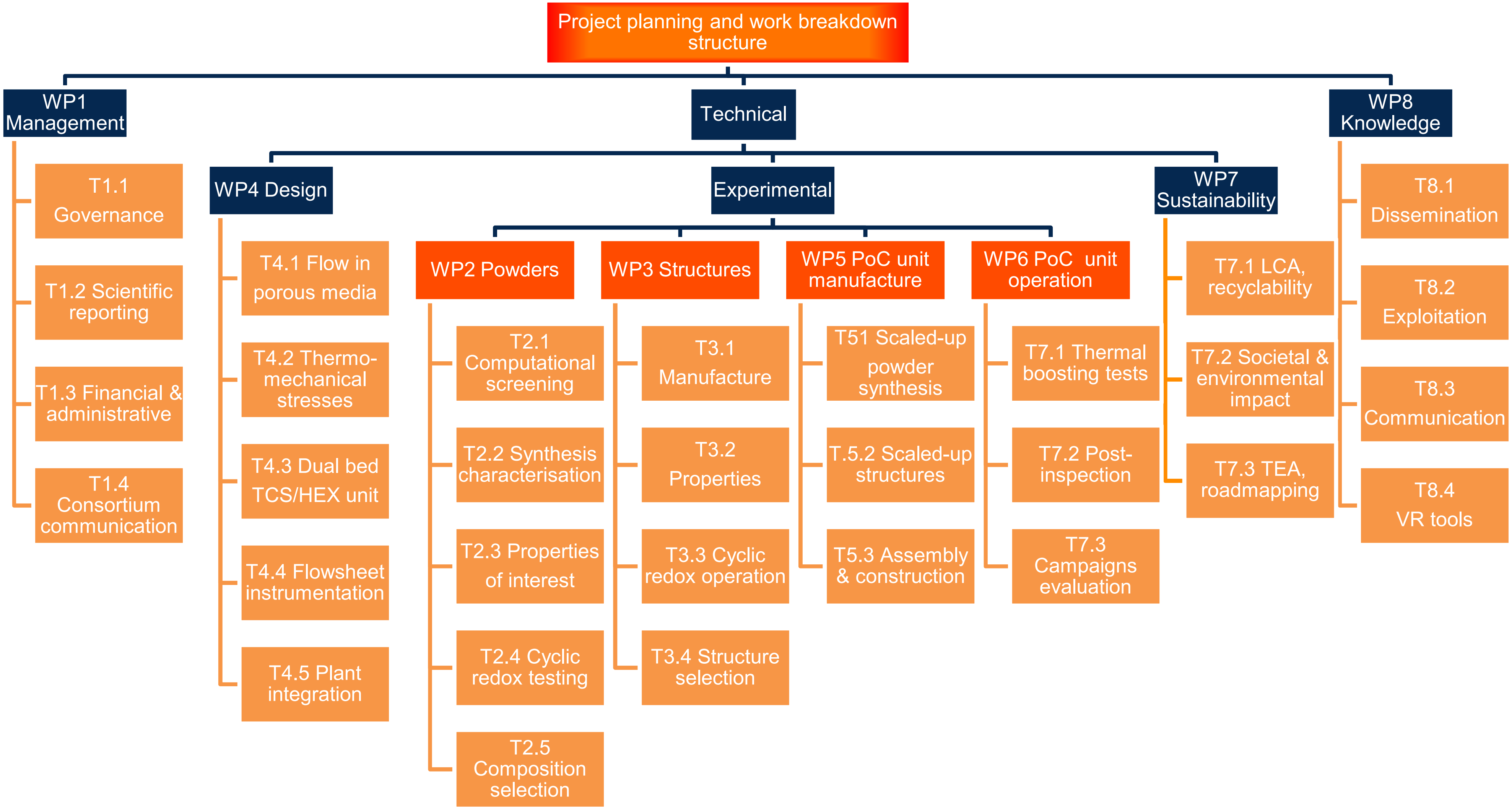


Figure 4: *ABraytCSPfuture* work breakdown structure (Acronyms: TCS/HEX: ThermoChemical Storage / Heat Exchanger, PoC: Proof-of-Concept, LCA: Life-Cycle Assessment, TEA: Techno-Economic Analysis, VR: Virtual Reality).

There was no deviation from the work plan in the framework of WP2.

Furthermore, there is no major deviation or critical issue from the work plan in the framework of WP3. The work proceeds as planned and current status of the project indicates that all WP3 objectives and the associated milestone (MS2) will be successfully fulfilled in time. However, the duration of Task 3.4 must be extended for 4-6 months in order to have time and solid results to conclude more safely on the heat storage potential of a variety of structures and compositions as well as on their microstructural and thermomechanical performance. This will facilitate the multi-cyclic study of as many as possible different structures and compositions in order to obtain the maximum possible volume of information regarding the behaviour of such structures to ultimately define the optimum structure(s)-composition(s) combination and to interact with WP4 in terms of modelling input/outputs (i.e. kinetics, further advise on operational modes etc). Meanwhile, by the time that M2 is due, a suitable – and not necessarily optimum – composition will have been defined for the needs of WP5.

In this context, the planning suggested and agreed among the involved partners during the Kick-off meeting, to shift the due date of *Milestone 2: "Structured objects made of optimized material compositions with maximum active material content selected for manufacture of the proof-of-concept unit",* occurring from this WP as the outcome of Task 3.4, from its originally foreseen due date of Month 24 earlier to Month 18, cannot be implemented; the due date of Milestone 2 has to remain Month 24. The results so far advocate strongly that this Milestone will be met if not surpassed in Month 24.

There is also no major deviation from the work plan in the framework of WP4. However as mentioned above, even though the Deliverable of Task 3.4, *D3.3. Optimized redox oxide formulations and structured objects for proof-of-concept-scale unit* is due Month 27, the Consortium agreed in the Kick-off-Meeting of the project to try to have "definitive decision about materials and structures selected for the proof-of-concept-scale unit", temperature and mass dependent properties and kinetics of the reaction by month 18 (30/04/2024) with this "internal deliverable" to feed WP4 (Task 4.3) from WP3. Since, as stated in the relevant section for WP3 above, Task 3.4 must be extended for 6 months, the end of Task T4.3 and due date of relevant deliverable D4.3 must consequently be extended by 3 months i.e. from Month 24 to month 27. This delay could affect Task 4.4 and deliverable D4.4 scheduled for month 27. The rest of the WP4 tasks will not be affected as they are scheduled until the end of the project.

Finally, there is no major deviation from the work plan in the framework of WP7.

The accordingly modified, current updated version of the project's Gantt Chart is shown in Figure 5.

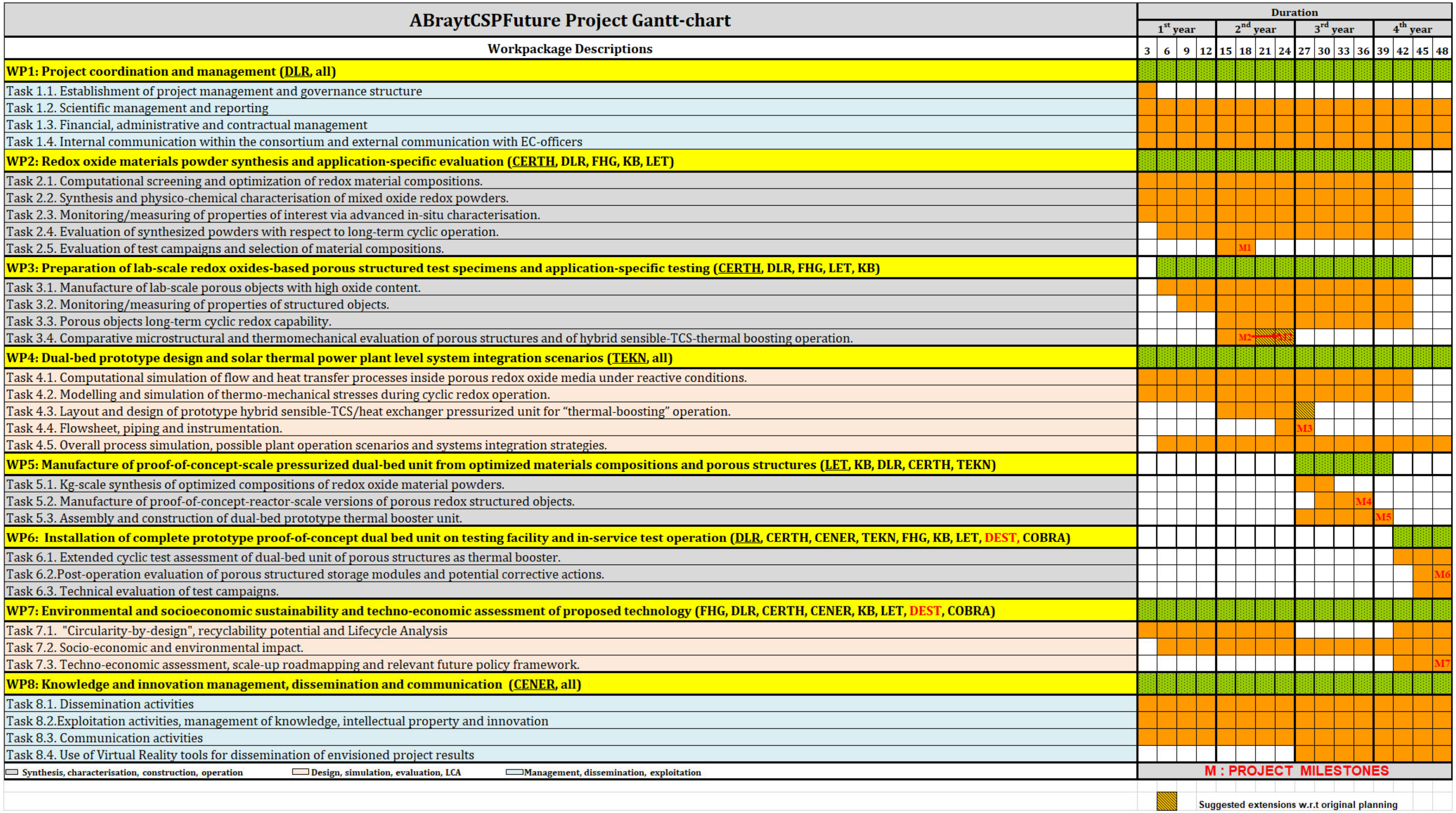


Figure 5: *ABraytCSPfuture* updated Gantt chart.

8. Conclusions

The revised Project Management Plan essentially contains the actions undertaken in order to initiate an Amendment of the Grant Agreement at the end of the 1st project year, requesting the termination of participant OPRA due to its insolvency and inclusion of a new entity, Destinus-Energy the successor of OPRA, as a replacement. The Amendment request is currently under evaluation from EU officers.

On the technical part, the work performed so far has proceeded according to schedule. The recent results advocate that the targets of the two chronologically first milestones will be met within the initially foreseen timeframe. Therefore, no essential revisions are currently needed with respect to the management of the technical part of the project.

With respect to the foreseen dissemination & exploitation activities until this date, accordingly to what was foreseen in the DoA the 2nd Newsletter should have been ready for publication; instead the 1st one is currently under preparation. The delay is due to the intensification of efforts of the consortium on achieving the technical targets of the first two Milestones, an approach that actually proved worth pursuing. This commitment has actually paid off by generation of real tangible experimental results that will facilitate more effort on dissemination for the remaining part of the project. In fact, in the meantime members of the Consortium participated with two oral and 1 poster presentations in the SolarPACES conference held on October 2023, and already plan to submit abstracts relevant to the recent experimental results to upcoming conferences like the 10th International Congress on Ceramics, ICC10 to be held in 2024. In parallel, drafting of the first manuscripts for submission to International Scientific Journals for publication is under way.