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Ministero dell'Università e della Ricerca
Direzione generale dell'internazionalizzazione e della comunicazione

Avviso per la *"Concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione"* da finanziare nell'ambito del PNRR

Piano Nazionale di Ripresa e Resilienza, Missione 4, *"Istruzione e Ricerca"* - Componente 2, *"Dalla ricerca all'impresa"* - Linea di investimento 3.1, *"Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione"*, finanziato dall'Unione europea - NextGenerationEU

Proposta definitiva

Intervention field 6: Investment in digital capacities and deployment of advanced technologies
DESI dimension 4: Integration of digital technologies + ad hoc data collections
055 - Other types of ICT infrastructure(including large - scale computer resources / equipment, data centres, sensors and other wireless equipment)

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Spett.le
Ministero dell'università e della ricerca
Direzione Generale dell'internazionalizzazione e della comunicazione
Via Michele Carcani, 61 – 00153 ROMA

OGGETTO: Proposta definitiva in esito alla fase negoziale per l'accesso alle agevolazioni previste dall'Avviso per la concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione, da finanziare nell'ambito del PNRR – Progetto identificato con il codice 87E8EB50 – DES-PARK

Il sottoscritto Ferruccio Resta, nato a BERGAMO il 29/08/1968, nella sua qualità di legale rappresentante (ovvero, procuratore speciale, in forza di idonea e adeguata procura speciale) del Soggetto Proponente Politecnico di Milano, con sede legale in MILANO, alla via Piazza Leonardo da Vinci , 32,

DICHIARA

- che la proposta definitiva è coerente con gli esiti della fase negoziale espletata a norma dell'art. 11 dell'Avviso in parola;

DICHIARA, altresì

- di confermare tutto quanto già dichiarato in sede di presentazione della Domanda recante Codice 87E8EB50
- di essere consapevole che, in caso di dichiarazioni mendaci, ovunque rilasciate nel contesto della presente proposta e nei documenti ad essa allegati, potrà incorrere nelle sanzioni penali richiamate dall'art. 76 del D.P.R. 445/2000, oltre alla decadenza dai benefici, come previsto dall'art. 75 del D.P.R. in parola, conseguenti il provvedimento emanato in base alle dichiarazioni non veritiere;
- di consentire al trattamento dei dati personali per le finalità e con le modalità di cui al decreto legislativo 30 giugno 2003, n. 196, e successive modifiche ed integrazioni.

PRESENTA

la proposta progettuale identificata nella piattaforma GEA con il codice ITEC0000004, di cui alla presente. Costituiscono parte integrante e sostanziale della proposta tutti gli allegati indicati nella Sezione Allegati, che si intendono sottoscritti in uno alla presente, nonché gli Allegati trasmessi in sede di presentazione della domanda, come modificati in questa sede.

Firmato digitalmente

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Proposta definitiva

Avviso per la "Concessione di finanziamenti destinati alla realizzazione o ammodernamento di Infrastrutture Tecnologiche di Innovazione" da finanziare nell'ambito del PNRR – Proposta progettuale definitiva in esito alla fase negoziale – Codice 87E8EB50

Soggetto proponente

- **Anagrafica Soggetto Proponente**
  - Denominazione: Politecnico di Milano
  - Codice CAR: F179040D
  - CF: 80057930150
  - Pec: pecateneo@cert.polimi.it
  - Tipologia soggetto: Università e Scuole Superiori a Ordinamento Speciale
  - Sede legale:
    - CAP: 20133
    - Via/Piazza: Piazza Leonardo da Vinci
    - Civico: 32
    - Comune: MILANO
    - Provincia: MILANO
    - Regione: Lombardia
- **Anagrafica Rappresentante Legale**
  - Nome: Ferruccio
  - Cognome: Resta
  - Codice fiscale: RSTFRC68M29A794Y
  - E-mail: ricerca@polimi.it
  - Data di nascita: 29/08/1968
  - Comune di nascita: BERGAMO
  - Sesso: Maschio
- **Anagrafica Referente del progetto**
  - Nome: Federico
  - Cognome: Colombo
  - Telefono: 0223993923
  - Cellulare: 3804799103
  - E-mail: ricerca@polimi.it

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Dati di sintesi della proposta progettuale

Titolo del Progetto: Digital Energy Storage Park

Acronimo del Progetto: DES-PARK

Settori e ambiti prevalenti dell'iniziativa:

- Digitale, industria, aerospazio:

  - High performance computing e big data
  - Intelligenza artificiale
  - Innovazione per l'industria manifatturiera
  - Materiali avanzati

- Clima, energia, mobilità sostenibile:

  - Mobilità sostenibile
  - Cambiamento climatico, mitigazione e adattamento
  - Energetica industriale
  - Transizione energetica totale

Keywords:

energy storage; energy transition; hydrogen; e-fuels; batteries; thermal storage; CO2 battery; energy management; digitalized energy;

Livelli di maturità tecnologica prevalente (TLR): 6; 7; 8; 9;

Data di avvio del progetto: 01/01/2023

Durata del progetto (in mesi): 36

Costo complessivo del progetto: 28.301.500,00 €

Tipologia intervento: Realizzazione/Creazione

Localizzazione

Infrastruttura distribuita: Si

Numero sedi: 2

Sede 1

- CAP: 29121
- Via/Piazza: Via Nino Bixio
- Civico: 27
- Comune: PIACENZA
- Provincia: PIACENZA
- Regione: Emilia Romagna

Sede 2

- CAP: 73100
- Via/Piazza: Piazza Tancredi
- Civico: 7
- Comune: LECCE
- Provincia: LECCE
- Regione: Puglia

Piano economico

Costi complessivi di progetto

Spese ammissibili	Costi (€) (1)	IVA (€) (2)	Totale (€) (1+2)
a) Spese Manager Infrastruttura ed altre figure manageriali	737.704,96	162.295,09	900.000,05
b) Strumentazione scientifica, apparecchiature e macchinari	13.114.754,22	2.885.245,93	16.000.000,15
c) Impianti tecnici generici	2.622.950,68	577.049,15	3.199.999,83
d) Licenze software e brevetti	245.901,65	54.098,36	300.000,01
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	4.098.360,66	901.639,34	5.000.000,00
g) Spese per progettazione e altre spese tecniche	860.655,78	189.344,28	1.050.000,06
h) Costi indiretti	1.517.622,87	333.877,03	1.851.499,90
Totale (€)	23.197.950,82	5.103.549,18	28.301.500,00

Articolazione costi di progetto per localizzazione

Sede/Sito 1			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	652.062,30	143.453,70	795.516,00
b) Strumentazione scientifica, apparecchiature e macchinari	11.592.218,03	2.550.287,97	14.142.506,00
c) Impianti tecnici generici	2.318.443,44	510.057,56	2.828.501,00
d) Licenze software e brevetti	217.354,10	47.817,90	265.172,00
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	3.995.901,64	879.098,36	4.875.000,00
g) Spese per progettazione e altre spese tecniche	760.739,34	167.362,66	928.102,00
h) Costi indiretti	1.341.436,89	295.116,11	1.636.553,00
Totale (€)	20.878.155,74	4.593.194,26	25.471.350,00

Sede/Sito 2			
Spese ammissibili	**Costi (€) (1)**	**IVA (€) (2)**	**Totale (€) (1+2)**
a) Spese Manager Infrastruttura ed altre figure manageriali	85.642,66	18.841,39	104.484,05
b) Strumentazione scientifica, apparecchiature e macchinari	1.522.536,19	334.957,96	1.857.494,15
c) Impianti tecnici generici	304.507,24	66.991,59	371.498,83
d) Licenze software e brevetti	28.547,55	6.280,46	34.828,01
e) Fabbricati e terreni	0,00	0,00	0,00
f) Recupero, ristrutturazione, riqualificazione e ampliamento immobili	102.459,02	22.540,98	125.000,00
g) Spese per progettazione e altre spese tecniche	99.916,44	21.981,62	121.898,06
h) Costi indiretti	176.185,98	38.760,92	214.946,90
Totale (€)	2.319.795,08	510.354,92	2.830.150,00

Cronoprogramma di attuazione

Obiettivi intermedi: una sintesi

Codice identificativo	Mese di avvio (dalla data di avvio progetto)	Durata (in mesi)	Stima dei costi (€)
1	01/01/2023	18	5.392.456,00
2	01/05/2023	29	10.048.059,00
3	01/05/2023	26	3.491.809,00
4	01/01/2024	21	3.841.809,00
5	01/01/2024	21	3.466.808,00
6	01/03/2024	22	2.060.559,00
		Totale (€)	28.301.500,00

Obiettivo intermedo: 1

- Descrizione

Intermediate Objective 1 (IO1): Ex-Centrale Emilia Regeneration
Within WP1 - Recovery of ex-centrale Emilia and personnel selection, IO1 (Ex-Centrale Emilia Regeneration) is divided into two sub-objectives such as IO1.1 and IO1.2.
IO1.1: A2A company, owner of Ex-Centrale Emilia, has already defined a recovery plan to remove areas and components coated with asbestos. Once achieved IO1.1, suitable contractor in charge of asbestos removal will be identified., together with most suitable locations for equipment installation and the targeted asbestos-affected areas. Moreover, additional contractors to support T1.2 will be selected.
IO1.2: Newly reclaimed, asbestos-free areas will be subject to infrastructural and civil works by ad hoc specialized contractors. New platforms and connections with relevant commodities will be installed. Achieved IO1.2, the site will be ready to host new equipment.

- Mese di Avvio

1

- Durata in Mesi

18

- Deliverables

Report of Ex-Centrale Emilia Regeneration completion

Obiettivo intermedo: 2

- Descrizione

Intermediate Objective 2 (IO2): Chemical Storage (Hydrogen & e-fuels) facility set-up
Within WP2 - Chemical Storage (Hydrogen & e-fuels), IO2 (Chemical Storage (Hydrogen & e-fuels) facility set-up) is divided into sub-objectives IO2.1, IO2.2 and IO2.3. Once achieved IO2.1, the chemical storage facility will be conceptualized, suitable contractors will be selected and purchase order will be issued. Once achieved IO2.2, relevant equipment will be installed. Once achieved IO2.3, the facility will be commissioned, started-up and ready for operations.

- Mese di Avvio

  5

- Durata in Mesi

  29

- Deliverables

  Report of Chemical Storage (Hydrogen & e-fuels) facility set-up completion

Obiettivo intermedo: 3

- Descrizione

  Intermediate Objective 3 (IO3): Electrochemical Storage facility set-up
Within WP3 - Electrochemical Storage, IO3 (Electrochemical Storage facility set-up) is divided into sub-objectives IO3.1, IO3.2 and IO3.3. Once achieved IO3.1, the storage facility will be conceptualized, suitable contractors will be selected and purchase order will be issued. Once achieved IO3.2, relevant equipment will be installed. Once achieved IO3.3, the facility will be commissioned, started-up and ready for operations.

- Mese di Avvio

  5

- Durata in Mesi

  26

- Deliverables

  Report of Electrochemical Storage facility set-up completion

Obiettivo intermedo: 4

- Descrizione

  Intermediate Objective 4 (IO4): Thermal Storage facility set-up
Within WP4 – Thermal Storage, IO4 (Thermal Storage facility set-up) is divided into sub-objectives IO4.1, IO4.2 and IO4.3. Once achieved IO4.1, the storage facility will be conceptualized, suitable contractors will be selected and purchase order will be issued. Once achieved IO4.2, relevant equipment will be installed. Once achieved IO4.3, the facility will be commissioned, started-up and ready for operations.

- Mese di Avvio

  13

• Durata in Mesi

21

• Deliverables

Report of Thermal Storage facility set-up completion

Obiettivo intermedo: 5

• Descrizione

Intermediate Objective 5 (IO5): Thermodynamic Storage (CO2 battery) facility set-up
Within WP5 – Thermodynamic Storage (CO2 battery), IO5 (Thermodynamic Storage (CO2 battery) facility set-up) is divided into sub-objectives IO5.1, IO5.2 and IO5.3. Once achieved IO5.1, the storage facility will be conceptualized, suitable contractors will be selected and purchase order will be issued. Once achieved IO5.2, relevant equipment will be installed. Once achieved IO5.3, the facility will be commissioned, started-up and ready for operations.

• Mese di Avvio

13

• Durata in Mesi

21

• Deliverables

Report of Thermodynamic Storage (CO2 battery) facility set-up completion

Obiettivo intermedo: 6

• Descrizione

Intermediate Objective 6 (IO6): Digital Energy Management system set-up
Within WP6 – Digital Energy Management, IO6 (Digital Energy Management system set-up) is divided into sub-objectives IO6.1, IO6.2 and IO6.3. Once achieved IO6.1, pre-design of special hardware for integrated control systems, contractor selection and purchase order will be carried out. Once achieved IO6.2, instrumentation will be installed. Once achieved IO6.3, the energy management system platform will be set-up.

• Mese di Avvio

15

• Durata in Mesi

22

• Deliverables

Report of Digital Energy Management system set-up completion

Allegati

Allegato 1 - Proposal template

Allegato 1: ***Proposal template***

Ministero dell'Università e della Ricerca
Direzione generale dell'internazionalizzazione e della comunicazione

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Missione 4, "*Istruzione e Ricerca*" - Componente 2, "*Dalla ricerca all'impresa*" -
Linea di investimento 3.1, "*Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione",*
finanziato
dall'Unione europea - NextGenerationEU

REFORMS AND INVESTMENTS UNDER THE RECOVERY AND RESILIENCE PLAN

NextGenerationEU

Call for proposals

Intervention field 6: Investment in digital capacities and deployment of advanced technologiesDESI dimension 4: Integration of digital technologies + ad hoc data collections
055 - Other types of ICT infrastructure (including large-scale computer resources/equipment, data centres, sensors and other wireless equipment)

Mission 4 – "Education and Research"
Component 2: from research to business
Investment 3.1: "Fund for the realisation of an integrated system of research and innovation infrastructures

Annex 1 (technical annex)

Proposal template, pursuant to Article 8 of the call for proposals

(To be provided in English only)

DISCLAIMER: This document is aimed at informing potential applicants for call-PNRR funding. It serves only as an example. The actual Web forms and templates, provided in the online proposal submission system under the online proposal submission system, might differ from this example. Proposals must be prepared and submitted only via the online proposal submission system.

Part A – Strategic framework of the initiative

A.1. Objectives of the initiative

Given the non-programmable nature of the renewable energy sources expected to play the major role in the decarbonization of the final energy consumption of our country (i.e., wind and sun), energy storage will play a strategic role in fostering such transition. In this framework, Politecnico di Milano intends to create an innovation center, named "Digital Energy Storage Park" (DES-Park), with headquarter located in Piacenza - via Nino Bixio 27, within a dismissed oil-fired power plant known as Ex-Centrale Emilia.
Energy storage systems still require significant research and development efforts to increase storage performance with reduced cost and a sustainable life cycle. Moreover, their intensive usage will need adequate management systems to efficiently interact with the energy networks. For these reasons, DES-Park aims at developing, testing and certifying components and systems in the fields of (i) energy storage, characterized by medium-to-high maturity level, and (ii) digital management systems of "multi-energy" networks dominated by renewables. As for aspect (i), the infrastructure will focus on different storage technologies (chemical, electrochemical, thermal and thermodynamic). As for aspect (ii), a monitoring, data-collection and optimization hardware/software infrastructure for smart energy management will be implemented.
The requalification of Ex-Centrale Emilia (a neoclassic building designed by Arch. Piero Portaluppi and declared of "cultural interest" - art.4 D.Lgs. 42/2004), will (i) offer large and multi-floor spaces to install and test many different technologies in multiple configurations, (ii) ensure the required security measures, (iii) feature connections to high voltage grid with the possibility to switch to medium and low tension, allowing applications up to 13,5 MW.

A.2. Geographical area of interest

DES-Park headquarter will be in Piacenza, which shows a strategic position given the close and diffused transportation networks (trainway, highway). Piacenza hosts the North-South/East-West railway junction, being along the Milan-Bologna and Turin-Brescia railway line. Moreover, it stands on the intersection of the A1 (Milan-Naples) and A21 (Turin-Brescia) highway.

A.3. Sectors/domains

Details are contained within the final project proposal.

A.4. Keywords

Details are contained within the final project proposal.

A.5. Prevailing levels of TRLs

Details are contained within the final project proposal.

A.6. Coherence with the priorities set in the European, National and Regional strategic agendas

Global warming due to CO_2 emissions and other greenhouses gases has been identified as the main environmental challenge of the humanity according to UN's 2030 Agenda for Sustainable Development[1]. The Agenda, subscribed in 2015 by 198 countries, sets out 17 Sustainable Development Goals (SDGs) to end poverty, protect the planet and ensure prosperity for all individuals by 2030. The 17 SGD[2] refer to areas of social and economic development and environment that must be considered in an integrated way and they have been translated in the European Green Deal[3], the wide-ranging and long-term strategy aiming at transforming the EU economy and addressing the role of digital technologies in achieving a sustainable future and ethically responsible society. The Smart Specialization Strategy (S3) of the Emilia-Romagna Region[4] is in line with the global strategy and sets a targeted approach to achieve the goals. In line with the above-mentioned strategies, the most relevant Objectives (OB), that DES-Park will address are: (OB1) Clean energy – climate neutrality; (OB2) Sustainable industry; (OB3) building and renovation; (OB4) eliminating pollution, (OB5) Sustainable mobility, (OB6) Sustainable Finance. These objectives will be addressed with regards to direct and indirect effects of the Park (Table 1).

Table 1: Direct and indirect impacts

Technological area/Interventions	Direct/indirect effect (and OBs interested)
Recovery of ex-Centrale Emilia	The Recovery of the Centrale Emilia will allow to realize a state-of-the-art centre for energy storage and the regeneration of an important historic building in the city of Piacenza (OB3)
Chemical storage (Hydrogen & e-fuels)	Energy management in complex networks. The main priorities relate to energy efficiency and energy storage making the energy market fully integrated, interconnected and digitized, in compliance with technological neutrality. DES-Park will focus on optimization of energy mix and energy management, bringing to a better use of renewables, reducing energy consumption and greenhouse gas emissions (OB1 and OB4) and contributing a sustainable industry (OB2), mobility (OB5) and finance (OB6) as well as to social welfare at the same time.
Electrochemical storage	
Thermal storage	
Thermodynamic storage (CO2 battery)	

[1] Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs (un.org)
[2] Take Action for the Sustainable Development Goals - United Nations Sustainable Development
[3] EUR-Lex - 52019DC0640 - EN - EUR-Lex (europa.eu)
[4] Strategia S3 2021-2027 — Programma operativo regionale — Fondo europeo di sviluppo regionale (regione.emilia-romagna.it)

A.7. Synergies with other initiatives envisaged within Mission 4 ("Education and research"), Component 2 ("From research to enterprise"), with particular, but not exclusive, reference to Investment 1.1 ("Fund for the creation of an integrated system of research and innovation infrastructures")

The Digital Energy Storage Park" (DES-Park) proposal demonstrates synergies with several research proposals submitted by POLIMI under the Mission 4 - Component 2 of REFORMS AND INVESTMENTS UNDER THE RECOVERY AND RESILIENCE PLAN NextGeneration EU. In particular:

Creation of new research infrastructures, strengthening of existing ones and their networking for Scientific Excellence under Horizon Europe proposals - Action 3.1.1 (Investment 3.1)

> Development of ECCSEL-R.I. ItaLian facilities: usEr access, services and loNg-Term sustainability (ECCSELLENT), led by Istituto Nazionale di Oceonografia e di Geofisica sperimentale and involving mainly POLIMI Department of Energy. Since the proposal aims at promoting the development of scientific research in the full chain of CCUS (CO_2 Capture, Utilisation, Transport and Storage) it is strongly synergic with DES-Park.

Strengthening of research structures and creation of R&D "National Champions" on some Key Enabling Technologies (Investment 1.4)

> Sustainable Mobility Center (Centro Nazionale per la Mobilità Sostenibile – CNMS), led by Politecnico di Milano (POLIMI) and involving several POLIMI structures.

Strengthening of research structures and creation of R&D "Innovation ecosystems" set up of "territorial leaders" in R&D (Investment 1.5)

> ECOSYSTEM FOR SUSTAINABLE TRANSITION IN EMILIA-ROMAGNA led by Alma Mater Studiorum Università degli Studi di Bologna and involving several POLIMI Departments;
>
> MUSA- Multilayered Urban Sustainability led by Università degli Studi Milano-Bicocca and involving several POLIMI Departments.

The highlighted synergies will strengthen the scientific results to be achieved within the measures aimed at financing Research Infrastructures (Investment 3.1), strengthening 'National R&D Champions' (Investment 1.4) and creating 'Innovation Ecosystems' (Investment 1.5).
DES-Park will contribute to the integration of highly innovative technologies in the energy field, enhancing the capability of transferring to market the scientific results reached and reinforcing the technological production chain related to renewables electrification and energy storage.

Additional synergies
University of Bergamo, involved in the present proposal, is the promoter of the project "The manufacturing alliance-TheMA" within the PNRR - INNOVATION ECOSYSTEMS framework aiming at creating territorial leaders of R&D, since energy storage is crucial for the whole manufacturing sector.

A.8. International profile and reach of potential users (with particular reference to SMEs)

DES-Park will boost innovation in energy storage system, thus being a bridge between research and industry. This

configuration is fully in line with the EU Research Infrastructure[5] definition, namely, "Facilities that provide resources and services for research communities to conduct research and foster innovation". In addition, many of the companies interested in this initiative as part of the legal entity under EU law to be formed, are international companies. The international connotation will (i) make DES-Park benefit of all the European and international opportunities for new collaborations and (ii) will be an opportunity for the enterprises (in particular SME) of the northern Italy ecosystem to get in touch with the European reality. The geographical area of DES-Park is characterized by an entrepreneurial landscape largely dominated by SMEs whose role in the economic growth is significant for many reasons. DES-Park, being part of a pan-European network, will go beyond the local context so that companies could also disseminate knowledge, create common projects and share best practices. Being part of an international network will maximize the visibility of DES-Park's infrastructures with cutting-edge applications, open both to large companies and to tests for the components (usually produced by SMEs) of large machinery present in the Park.

A.9. Start date of the initiative

Details are contained within the final project proposal.

A.10. Please choose one of the following options below:

Details are contained within the final project proposal.

[5] European Research Infrastructures | European Commission (europa.eu)

Part B – Initiative features

B.1. Activities

The independence from fossil fuels and the achievement of a fully decarbonized national energy system requires the deployment of an enormous capacity of renewable energy sources. Unfortunately, most of the renewable energy sources available in Italy, such as wind and sun, are typically non-dispatchable. To guarantee the capability of matching the energy requirements of the users (residential, industrial, etc.) and, at the same time, guarantee the sustainability of the energy supply in the forthcoming years, it is necessary to endow our energy system with: (i) a large amount of storage capacity and (ii) suitable energy conversion systems to exploit the possible synergies between the different energy networks. These elements will complicate the planning of the energy dispatch, for which advanced management solutions, based on artificial intelligence, will be fundamental.
In this framework, Digital Energy Storage Park (DES-Park), thanks to its technical features (e.g., the connection to high voltage grid and MWs power-range applications), offers a suitable location for the realization of an innovation infrastructure focus on developing, testing and certifying components and systems in the fields of Energy Storage and Digital Energy Management.
DES-Park will make use of a dismissed oil-fired power plant currently owned by A2A, who is willing to make it available for the realization of the facility. The building is partially used for experimental activities and safety tests on thermos-hydraulic components for power plants by SIET, which has been supporting the initiative. Moreover, LEAP (a private research center participated by PoliMi, based in the close vicinity of the facility) has been promoting the set-up of the public-private partnership.
Prior to the beginning of the actual realization of the infrastructure, a series of ex-ante verifications are to be performed. Such activities will entail the assessment of: (i) the ex-post energy performance, the nature of the materials to be used, the safety conditions to be guaranteed; (ii) the ecological labelling of the electronic equipment to be installed; (iii) the economic sustainability and technological neutrality of the financed activities; etc. The analysis of the details regarding such activities is postponed, in case of success, to the negotiation phase.
The activities foreseen in the project have been organized in 8 Working Packages.

WP n.	**1**
WP Title	**Recovery of ex-centrale Emilia and personnel selection.**
Start	M1
End	M18
Description	The recovery of Ex-Centrale Emilia (1929) gives a new life to an old and currently largely unused neoclassical building. Thanks to the removal of the old power plant equipment and the renovation works, the facility offers up to 10000 m² of multi-floor spaces to organize the activities within the different storage technology branches and ensure proper safety measures.
Tasks (T)	**T1.1 – Asbestos removal (M1-M8)** A2A, owner of Ex-Centrale Emilia, has already defined a recovery plan to remove areas and components coated with asbestos. The new manager of the infrastructure will identify the contractor in charge of asbestos removal. The contractor, managed by the infrastructural manager and SIET personnel, will identify the most suitable location for equipment installation and the targeted asbestos-affected areas. At the end of M8, the site will be decontaminated and ready for

	T1.2 (**IO1.1**). Within this task and corresponding time-window, suitable contractor to support T1.2 will be identified. **T1.2 – Removal of old facilities and civil works (M7-M18)** Newly reclaimed, asbestos-free areas will be subject to infrastructural and civil works: ad hoc specialized contractors selected in T1.1 will oversee the removal of the pre-existing and unused equipment considering interactions with current operating facilities administered by SIET and already in place. Under the supervision of DES-Park personnel, new platforms and ad hoc connections with relevant commodities will be installed. At the end of M18, the site will be ready to host new equipment (**IO1.2**).
Effort	1 full time equivalent person for 25 months
Means of verification	Commissioning start-up tests data available.

All the WPs related to storage technologies (WP2 to WP5) include 3 tasks: in the first one, DES-Park staff will define the exact location, equipment specification and preliminary design of the facility. Contractors in charge of equipment manufacturing will be selected and purchase order will be issued. In the second task, contractors will oversee equipment installation under the supervision of the infrastructure manager. In the third task, the equipment will undergo commissioning and start-up to become fully operating and available for utilization. Therefore, task description reported in WP2 to WP5 will be limited to task title and associated intermediate objective (IO).

WP n.	**2**
WP Title	**Chemical Storage (Hydrogen & e-fuels)**
Start	M5
End	M33
Description	Power-to-Hydrogen (P2H) offers a way to store electrical energy, in the form of chemical energy of a fuel, and provide ancillary services to the electric grid. P2H potential is triggering the attention in the deployment of multi-MW modular or containerized solutions and perspective GW-scale installations. DES-Park will make available hydrogen for testing gas-based and liquid-based storage systems and for experimenting reactors to produce e-fuels. The main components are: - A 2 MW electrolysis unit (e.g., PEM technology, 36 kg/h of H_2 at 20-30 bar). - A gas compression unit (40 kg/h) feeding a centralized 200 bar storage system (two 40ft racks for a capacity of nearly 2200 kgH_2). - A gas compression unit (hydraulic piston-type) testing high pressure (700-900 bar) storage systems and tanks in a dedicated high-pressure bunker. - A liquefaction system (e.g., based on inverse Stirling cycles generating a cold helium loop available for gas liquefaction) with a capacity of 30 kgH_2/day, feeding a cryogenic tank, allowing to test and develop innovative liquid hydrogen tank designs and innovative low temperature insulation materials. - A local network for hydrogen-natural gas mixtures, equipped with a variable mixing station to test and develop grid components and appliances able to operate with H2-NG mixtures. - A dedicated test bay for the installation and testing of containerized multi-MW electrolyzers (1-10 MW). - A test area for **e-fuels** production reactors (e.g., methanol and methane), comprising a CO_2 storage and supply facility and heat exchange loops for reactors cooling/heating.

	The facility will allow to develop, qualify and test large scale electrolyzers, either of low temperature type (alkaline, PEM, AEM) or of high temperature type (solid oxide technology), exploiting the steam generation facilities which are also already existing in the installation site. Besides the headquarter facility in Piacenza, based on the interests manifested by some potential private partners, the set-up of a smaller facility for mechanical tests (tensile, fractures, fatigue, etc.) in H_2-rich environment up to 1000 bar for the characterization of the interaction between H_2 and metals will be considered during the negotiation phase.
Tasks	**T2.1 – Pre-design, contractor selection and purchase order (M5 – M16) → (IO2.1).** **T2.2 – Facility installation (M15 – M27) → (IO2.2).** **T2.3 – Facility commissioning and start-up (M28 – M33) → (IO2.3).**
Effort	1 full time equivalent person for 23 months
Means of verification	Commissioning start-up tests data available.

WP n.	**3**
WP Title	**Electrochemical Storage**
Start	M5
End	M30
Description	Battery storage is going to play a significant role in the Italian Power System, both at utility scale and on User (Prosumer) side. The expected exponentially increasing penetration of Battery Electric Vehicles and stationary applications will provide, on one hand, big opportunities of synergies (e.g., "second life" of car batteries, still usable for stationary applications), on the other, a big risk, for Italy and Europe, of raw materials shortage and technology supply criticalities, being the biggest battery manufacturers located in Far East. To this end, a "bridge" is urgently needed to cover the gap between basic and applied research and high TRL, industrial development and pre-commercial prototyping, testing and certification phases, both for new and "second life" storage systems. The equipment for battery stacks testing is: - battery cycling; - climatic chamber; - Electrochemical Impedence Spectroscopy The equipment for battery systems testing is: - MV node up to 2 MW useful power - Monitored distribution board (LV) to test storage systems up to 1 MW - Monitored distribution board (LV) for microgrid systems up to 2 MW - LabView systems for acquisition and automation - Grid simulator, minimum nominal power 300 kW - Regenerative electronic load, nominal power 300 kW The listed equipment covers a wide range of power, capacity and voltage, from some kW to some MW scale; it enables to expose storage system to complex functional tests, covering very different application cases: (small, isolated grids, large, interconnected grids, high and/or low inertia grids, depending on presence of synchronous machinery or inverter-based generation etc.). the presence of a piloting line for manufacturing of new conductors will enable the investigation of HV and MV level lines, to ensure a safe and resilient connection between storage systems and main grid.
Tasks (T)	**T3.1 – Pre-design, contractor selection and purchase order (M5 – M16) → (IO3.1).** **T3.2 – Facility installation (M15 – M26) → (IO3.2).** **T3.3 – Facility commissioning and start-up (M27 – M30) → (IO3.3).**
Efforts	The entire amount budgeted have been allocated considering 1 full time equivalent person for 22 months

Means of verification	Commissioning start-up tests data available.

WP n.	**4**
WP Title	**Thermal Storage**
Start	M13
End	M33
Description	Thermal Energy Storage (TES) promotes the integration of waste heat and heat from renewables in the District Heating Networks (DHNs), including the 5th generation DH/DC networks. TES is meant to become the core/hub of thermal plants, allowing to smooth the heat load peaks requested to the plants, to optimize the design and reduce over-sizing. There are many fields of use of thermal energy storage, such as: storage tanks of district heating/cooling networks; hydraulic storage (hot/cold) of heating/cooling systems (small/medium/large size); storage tanks for solar thermal systems, solar cooling plants, Concentrated Solar Power (CSP) plants; thermal storage systems for industrial processes and power generation plants. The various fields of application require different temperature levels (100°C / 300°C for heating system, -150°C / 10°C for refrigeration and cryogenic systems), different fluids (hot water, pressurized water, chilled water, ice, diathermic oils, molten salt mixtures, phase change materials (PCM)) and different time scale operation (daily, weekly, seasonal). In this framework, the entire plant-energy sector (including the Italian district of air conditioning) will find in this facility a reference point for research, experimentation, and development of innovative technological solutions. The equipment to be installed at DES-Park consists in: - a climatic cell (100 kW) - a series of cells for testing different types of storage approaches based on stratification, thermocline, molten salt, phase-change materials and ice (each one of 100 kW) - a PASSLINK-protocol cell and a Guarded-Hot-Plate test system for material and components certification. - a piloting line for synthesis of thermochemical storage materials - a 500 kW electric water/water heat pump and an innovative TES system (e.g., based on thermos-chemical technology) to test the production/storage integration in different operating scenarios.
Tasks (T)	**T4.1 – Pre-design, contractor selection and purchase order (M13 – M21) →(IO4.1).** **T4.2 – Facility installation (M22 – M29) → (IO4.2).** **T4.3 – Facility commissioning and start-up (M30 – M33) → (IO4.3).**
Efforts	1 full time equivalent person for 18 months
Means of verification	Commissioning start-up tests data available.

WP n.	**5**
WP Title	**Thermodynamic Storage**
Start	M13
End	M33
Description	ThermoDynamic Energy Storage (TDES) hinges on a sequence of thermodynamic transformations aimed at creating a stock of fluid that can generate power when its thermodynamic state moves toward equilibrium with ambient conditions. This is the case of Compressed Air Energy Storage, Liquid Air Energy Storage or the "CO_2 battery" recently proposed by the Italian startup *Energy Dome*.

	The activity of this WP will focus on TDES with phase change since it offers good energy density, flexible siting (no need for underground reservoirs), potential competitiveness over a range of storage capacities and expected round trip efficiencies in the range 60-70%. In addition to storage capacity it can provide frequency and voltage regulation services. The infrastructure envisaged for the DES-Park aims at addressing the issues yet to be overcome to make phase change TDES a key player in the future energy storage market, such as: (a) identify the best plant configuration; (b) refine the design and improve the performances of turbomachines and the liquefaction system; (d) optimize the design of storage tanks; (e) verify the potential of working fluids other than air and CO_2. To such end, the following equipment will be designed and installed. - Flexible rig for the testing of a range of heat regeneration configurations: - Test rig for compressors and expanders - Test rig for the liquefaction system (most of the equipment of this rig will be the same or shared with the rig for H_2 liquefaction - see WP2) - Test rig for storage tanks, including a vessel for the storage of the low-pressure fluid discharged by the expander in power generation mode.
Tasks (T)	**T5.1 – Pre-design, contractor selection and purchase order (M13 – M23) → (IO5.1).** **T5.2 – Facility installation (M24 – M30) → (IO5.2).** **T5.3 – Facility commissioning and start-up (M30 – M33) → (IO5.3).**
Efforts	1 full time equivalent person for 10 months
Means of verification	Commissioning start-up tests data available.

WP n.	**6**
WP Title	**Digital Energy Management**
Start	M15
End	M36
Description	The energy transition will require a paradigm shift towards a fully integrated and interoperable model, in a distributed energy generation set-up. To this purpose, it will be necessary to endow the energy production and storage units with digital automation tools for their optimal management. Being able to schedule in advance their charging/discharging profile will: (i) avoid unfeasible operation and energy supply shortage, (ii) ensure a reliable and safe operation of the unit, (iii) enable an efficient interaction with the energy networks, (iv) guarantee the provision of flexibility services to the grid (see Annex O/T CEI 0-16, Central Plant Controller/Monitor Del. 540/2021). To support the technological advancement in this field, DES-Park will feature a series of advanced automation and control systems, connected to all testing facilities to collect/elaborate monitoring data and simulate relevant operating scenarios. They will be based on: - A cloud platform capable of handling all major data transmission protocols (MQTT, Modbus, Bacnet, etc.), exchanging data with third-party cloud platforms and proprietary equipment control systems (Scada, PLC, etc.) via API and dedicated communication channels. - Monitoring equipment/infrastructure and Gateway for the acquisition and collection of field parameters. - AI algorithms for the optimization of the energy management, working both remotely (cloud computing) and locally (edge computing), based on machine learning and optimization models. - The grid simulator mentioned in WP3 will be connected to all the energy systems present in the facility, to work as a bidirectional network simulator for the generation of

	consumption/production profiles, with adjustable voltage and frequency, to reproduce the operating conditions of various applications and test third party energy management systems. Thanks to this set-up, DES-Park will be: (i) suitable for interoperability protocol testing and development; (ii) compliant with constraint 055 reported in Annex VII of Reg. (EU) 2021/241, thanks to the deployment of: large-scale IT resources, sensors for data collection and data handling systems.
Tasks (T)	**T6.1 – Pre-design of special hardware for integrated control systems, contractor selection and purchase order (M15 – M23)** Conceptual design of the control system (hardware, software) for integrated plant management exploiting synergies among different units and equipment-network interaction. Contractor selection and purchase order issued (**IO6.1**). **T6.2 – Instrumentation installation (M24 – M30)** Control system installed (**IO6.2**). **T6.3 – Energy management system platform set-up (M31 – M36)** Platform set-up and ready for development work (**IO6.3**).
Efforts	1 full time equivalent person for 21 months
Means of verification	Commissioning start-up tests data available.

WP n.	**7**
WP Title	**Project Management and Coordination of DES-Park Activities**
Start	M1
End	M36
Description	The overall project management, including the DES-Park's start up activities, monitoring, networking, and sustainability will aim to: 1) establish an efficient management structure to guarantee effective coordination and communication within the members of the partnership and appropriate involvement of end-users; 2) efficiently start-up the project activities; 3) constantly monitor the project progress, with the highest quality standards, according to well-defined KPIs; 4) ensure efficient risk-management; 5) manage DNSH, IPR and ethics related issues; 6) identify adequate mechanisms to ensure the long-term sustainability of the Park.
Tasks (T)	**T7.1 - Setting-up of the project governance and start up activities (M1-M3)**: (i) operational management structure established by M1 (see Sect. B.2.1). (ii) Rules and procedures for the supplier's selection agreed among partners in compliance with the national law by M3. **T7.2 - Overall project management and monitoring (M1-M36)**: ensure a sound management of the project along its entire duration by: (i) Organisation of regular operational meetings of the management boards (see Sect. B.2.1); (ii) project monitoring aimed at ensuring that the project is implemented according the envisaged contents and schedules (see B.1); (iii) Risk management: the Infrastructure Manager together with PMO and SciC (See B.2.1) will regularly assess the possible emergence of any risk so as to put in place relevant contingency measures. (iv) Financial management: the IM together with the SteC and PMO will regularly monitor Park's expenditure. **T7.3 – Sustainability (M12-M36)**: As of M12, the partnership will start working on a sustainability plan to ensure that the Park is able to continue its operativity after the end of the project for at least 15 years. This will entail the performance of fundraising, end users mapping and networking, participation in international networks to attract international clients.
Effort	1 full time equivalent person for 15 months

Means of verification:	1) Key documents for suppliers' selection (M3); 2) DES-Park sustainability plan (M24 + updates)

WP n.	**8**
WP Title	**Knowledge Transfer and Business Creation**
Start	M1
End	M36
Description	Great relevance will be given to promote the technological activities that will be carried out within the DES-Park laboratories (see B.5 for a detailed description). The WP aims to: 1) guarantee knowledge transfer to relevant end users and stakeholders; 2) create durable, strategic partnerships among all end users and stakeholders; 3) promote business creation; 4) raise awareness in the general public.
Tasks (T)	**Tasks: T8.1 Project website and promotion materials (M1 – M6)**: (i) preparation of a dissemination strategy plan to be agreed among partners by M1; (ii) preparation of promotional materials describing the services that will be offered; (iii) setting up and launching of the website. **T8.2 Knowledge transfer activities (M5 – M36)**: The DES-Park knowledge sharing activities will mainly consist in the followings: (for more details, see "Means of verification" and Sect.B.5): (i) Organisation of events with end-users and stakeholders; (ii) Representation of the Park in external events of interest or conferences with respect to its operative technological areas; (iii) targeted activities with key stakeholders; (iv) adequate promotion to the general public.
Effort	1 full time person for 10 months
Means of verification:	1) Launching event (M1); 2) Dissemination strategy plan (M1); 3) Stakeholders Meetings (M1, M12 and M24); 4) Website in place (M2); 5) Promotional material in place (M6 + updated); 6) Promotion events (M12 and M24) with the involvement, when possible, of general public dedicated sessions; 7) Closing event with use cases presentation(M36).

B.2. Governance model

B.2.1. Infrastructure and operational management

A Memorandum of Understanding (MoU) will be signed among partners prior to the project start-date, defining the governance and the decision-making mechanisms of the Park, as well as management of financial flows. The approach and the contents of this paragraph will inspire and be included into the MoU to be signed.
As requested by the Guidelines of MUR, Politecnico di Milano will recruit a highly qualified Infrastructure Manager (IM) with aa full-time, fixed-term employment contract. The IM, with at least 10 years of experience in the management of research and/or infrastructure projects will be selected through an open call.
The IM will make sure that the project follows the schedule agreed with the Granting Authority and, in line with the content of the MoU, will direct DES-Park operations (administration, monitoring, quality assurance, financial management) so as to allow a prompt, structured cooperation of the partnership.

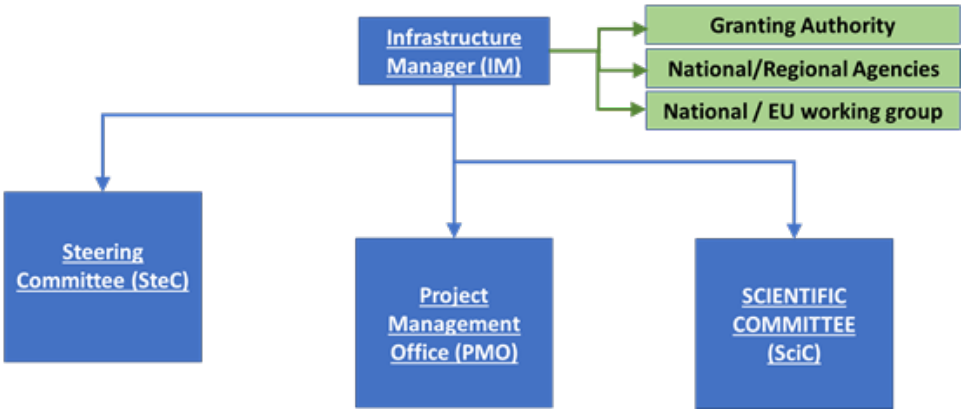

Figure 1: Operational management.

Operational management will be arranged through the governance structure depicted in Figure 1, namely:

1. The **Infrastructure Manager (IM)**, in charge of supervising the entire implementation of the project activities (among others, the internal communication and the smooth running of the project) chairing the SteC, the PMO and the SciC. The IM will be the interface with Granting Authority and any National/Regional (executive) Agencies involved in DES-Park and with any network / working groups that may be organised at national/EU level.
2. The **Steering Committee (SteC)**, constituted by 1 representative for each partner and chaired by the IM, will be the ultimate decision-making body of the DES-Park. It will deliberate on all matters related to: 1) strategic orientation changes and definition/changes in boards composition; 2) definition of yearly programme of activities; 3) risk and conflict resolution; 4) any decision related to financial management. SteC meetings will be organised at least once a year. Consensus will always be sought to take any decisions. Should that not be attained, majority voting rules will apply, with each member representative having one vote and the IM the casting vote in case of parity.
3. The **Project Management Office (PMO)**, chaired by the IM and composed of five members appointed by the SteC among experts in the following matters: financial issues (Financial Manager), administrative requirements (Administrative Advisor), legal and contractual issues (Legal Advisor), IPR (IPR Advisor) and DNSH (DNSH Manager). The PMO will collect the document and information by the participants to elaborate the cost statements to be provided to the Granting Authority and will be in permanent communication with the administration of the participants to address and resolve promptly all management and administrative problems. The PMO will also support the SciC in case ethics, security and data treatment will arise in daily operation.
4. A **Scientific Committee (SciC)**, in charge of supporting the SteC and PMO with consultative advice on tech needs, risks, and any other technical issue that may arise. It will be composed by one senior expert per tech area of the DES-Park and it will be chaired by the IM. Meetings will be organised quarterly.

Internal communication strategy: The IM, in close cooperation with the boards, will be responsible of the entire communication flow, ensuring timely delivery of relevant information so to ensure maximum transparency and increase

synergies. Special attention will be paid in keeping the partners informed about project status and planning. Communication will rely mainly on e-mail exchange, conference calls and periodic meetings in presence or virtually, according to Covid-19 evolving situation. The IM will also be in charge of coordinating communication flow towards stakeholders and DES-Park' (potential) users in general.

Decision-making and conflict resolution. The MoU to be signed in the project stat-up phase will address conflict resolution procedures in detail.

An independent external expert will control the observation of the financial rules and principles established by the European Union Law (especially by the legal base of Erasmus + and the Regulation (EU, EURATOM) 2018/1046). The external independent auditor will be qualified under the Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006

B.2.2. PPP operation

In case the proposal will be selected, Politecnico di Milano will launch a call for expression of interests in order to select the private participants. The candidates to the participation of the selection will provide the following information:

- Technical capacity to participate to the Project;
- Absence of situation of conflicts of interests (which will be identified in the call)
- Absence of the exclusion grounds to the public contracts, as provided by the Article 57 Directive 2014/24/EU
- Proposal of the technical activities and the financial commitment within the Project

A Selection Committee of 3 members (appointed by Politecnico di Milano and the other Universities/Research Public Bodies) will select the other participants on the ground of the proposal and of an interview of the representative of the candidates. Between Politecnico di Milano and the other Universities/Research Public Bodies a collaborative agreement will be signed.

The reference model of collaborative relationship between the participants is the Joint Research Unit (JRU - "research laboratories/infrastructures created and owned by two or more different legal entities in order to carry out research. They do not have a separate legal personality, but form a single research unit where staff and resources from the different members are put together to the benefit of all. Though lacking legal personality, they exist physically, with premises, equipment, and resources that belong to them") well known in the practice of the EU funded Projects[6].

The JRU has to meet all the following conditions:

- scientific and economic unity
- last a certain length of time
- recognised by a public authority.

The JRU will be established by an agreement, the MoU, which have the following main contents and features:

- the appointment of the Politecnico di Milano as mandatory of the consortium;
- The day-by-day management of the project will be ensured by the PMO (see B.2.1);
- The duration will be longer than the duration of the project
- The parties will collaborate between them in order to carry out the project and to manage the project infrastructure
- The SteC will be established composed by the representative of the participants; other governing and consulting bodies may be set out if requested by the Granting Authority;
- The JRU agreement will establish the rules concerning the financial, IPR, access rights, confidentiality rules;
- In addition, the MoU will provide dispositions concerning the entering of the new parties, the exclusion of the parties, the termination, the competent judge, etc.

[6] EU Grant Annotated Grant Agreement, for the period 2021-2027, p. 96

The provisions of the JRU, and the decision of the governing bodies, must not be in contrast with the EU and Italian legislations applicable to the project.

B.3. Budget plan

Details are contained within the final project proposal.

B.4. Project time schedule

The present project proposal is divided into 8 work packages (WPs). Two of them are transversal (WP7. Project Management and Coordination of DES-Park Activities and WP8. Knowledge Transfer and Business Creation) and support the six technical work packages aiming at the recovery of Ex-centrale Emilia and installation of the facilities grouped per family of energy storage technologies (chemical, electrochemical, thermal, thermodynamic energy storage) and digital energy management. After ex-ante verifications to be carried out together with DES-Park staff recruiting, the initial part of the project consists in recovering the Ex-centrale Emilia with specific attention to asbestos removal, removal of old facilities already existing within the site, and regeneration of the internal structure (civil work). The site is expected to be fully operating and ready to host new equipment at the end of month 18 (M18). During site recovery, equipment conceptual design, contractor selection and purchase orders will be issued. Equipment installation will start from M15, when civil works of selected areas of Ex-centrale Emilia are expected to be completed. Installed facilities will be commissioned and started-up by M36. At the end of M36 the site will be fully operating and ready to work. A Summary of the activities is included in the following Pert and Gantt diagrams.

B.4.1. Intermediate objectives

Details are contained within the final project proposal.

B.4.2. Timeframe envisaged for the implementation of the procedure aimed at setting up a PPP

The envisaged timeframe (Figure 4) for the setting up of the PPP is:

1. Call for expression of interests (EoI): prepared in strong interaction with the Granting Authority and launched in 2 weeks from the notification by the Granting Authority that the project has been selected for funding. Candidates will have 2 weeks to apply;
2. Reviewers: selected in one month from the notification by the Granting Authority;
3. Evaluation of the applications: carried out by the reviewers in one month from the deadline for the EoI call;
4. Draft for the MoU: prepared in strong interaction with the Granting Authority from day-one after the notification by the Granting Authority.
5. Selected private partners will be asked to review the MoU. Any comment/observation has to be submitted in 2 weeks and Politecnico di Milano will have 1 week to implement any change.
6. The MoU must be signed by the partners of the JRU within 6 weeks from the selection of the selected candidates.

Total = 3,5 months.

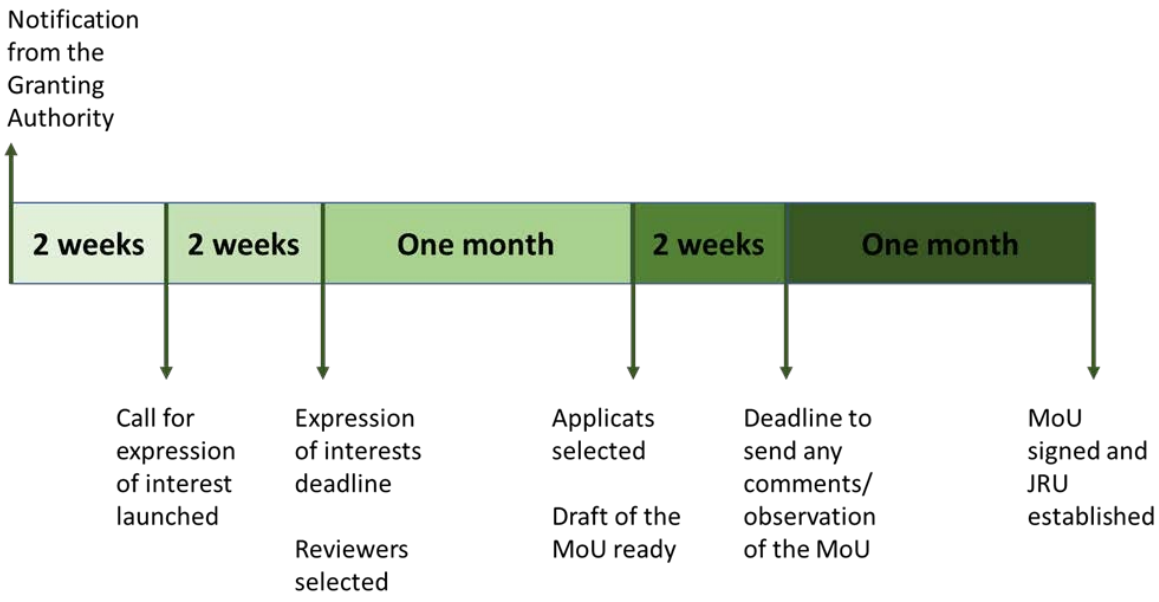

Figure 4:Timeframe for PPP constitution.

B.5. Promotion of knowledge transfer and business creation activities.

In line with the DES-Park vision and mission and with DES-Park sustainability strategy beyond the time envisaged for this call, great relevance will be given to the promotion of knowledge transfer and business creation. In addition to enterprises, particular attention will be given to spin off whose creation often occurs as a way of marketing the results of the research conducted, primarily, at the universities/research centres.
During the negotiation phase, while setting up the JRU and the management structure, organizations part of the JRU will

agree on means and channels to be exploited for knowledge transfer and business creation promotion activities, mainly consisting in what follows:

1. Setting-up and maintenance of the project website that will display information regarding DES-Park and the modalities to access it. In parallel, promotional and information materials will be prepared, both printed and in electronic format to be uploaded in the web-site. The promotional material will contain full list of the DES-PARK technologies and opportunities of testing together with the related timing and access modalities. They will be updated whenever needed.
2. Knowledge transfer. DES-PARK dissemination activities will encompass the following:
    a. Meetings and events, namely: a) a launching event at M1 aimed at presenting to the key stakeholders the DES-Park vision, mission, timing for realization and the envisaged service offer; b) information workshops and open days (organised in multiple locations to reach the highest number of interested enterprises, large companies and SMEs); the events will be organised on an annual basis allow participants to visit the premises, checking the progresses achieved; c) closing event in M36, for presenting the achievement of the DES-Park and the modality to continue its operations.
    b. Representation of the Park in external events or fairs of interest with respect to the operative technological areas. In addition, the organizations involved in JRU will promote DES-Park in events/fairs/conferences/EU projects or initiatives in which the Park can be promoted.
    c. Targeted activities with key stakeholders. High attention will be devoted towards the following key groups: a) *policy-makers*, and in particular national and regional authorities and especially those in charge of implementing the NRPP; b) *investors and banks*, ensuring that all investors and banks potentially interested in offering funding for particularly innovative solutions/ideas are appropriately monitored so as to be put in contact with the Park' users; c) *industry associations* and d) *business accelerators*, so as to boost the involvement of business support providers; e) *local communities* so as to take into account and respond to local concerns and needs.
    d. Liaison activities with other initiative of interest. The consortium will seek synergies with other infrastructure funded by PNRR in similar and complementary areas (including those funded by Horizon Europe or other EU initiatives and projects).
    e. High attention will be devoted to ensure that DES-Park will be promoted to the general public through different means, mainly: a) media relations, through press conferences and/or issuing of press releases; the use of radio and TV; b) use of social media; c) the drawing up of a dedicated periodic newsletter.
    f. Executive PhD(s) are envisaged. This will maximise knowledge transfer and will promote international cooperation, increasing DES-Park visibility abroad at the same time.
    g. Building on experience of the organizations that will constitute the JRU, envisaged use cases will be written to demonstrate practical applications of DES-Park equipment and key exploitable results. They represent powerful tools to showcase what will be achieved during the project.

Incrementing knowledge transfer and boosting the business creation thanks to the abovementioned activities, will bridge the gap between research and innovation and will contribute to take advantage of the innovation potential of enterprises (mainly SMEs) based on a better cooperation with researchers, transferring and using knowledge resulting from research.

Part C – Expected impact

C.1. Expected outcomes of the intervention

The proposed infrastructure aims at becoming a reference center for applied research, development, testing and possibly certification of energy storage technologies and systems. Given that energy storage is an essential feature of energy systems dominated by renewables, the main impact of DES-Park is **making more likely and accelerating the ecological transition**. As such, there will be inherent synergies with the productive and research domains of a large number of energy areas: from batteries to hydrogen, from fuel cells to district heating, from synthetic fuels to turbomachinery, etc. Since the ecological transition is posing unprecedented challenges that make new ideas and innovation a must, the likelihood of generating spin-offs and new patents is high (see Annex A for proposed guidelines on how to handle these outcomes)

3 years Project (introduction)

Within the project timeframe, the realization of DES-Park will generate four types of outcomes.

1) Gain knowledge and competence on equipment / systems relevant to the development and the commercial readiness of sustainable energy storage systems. This is mainly connected to the need to conceive, design, install and commission the test rigs dedicated to the four proposed energy storage lines.
2) Given the presence of LEAP and SIET in the same industrial area, create a complex focused on research and development crucial for the ecological transition. Not only the proposed infrastructure will enhance the skills and the potential of LEAP and SIET, but it will open new perspectives to both of them. Through LEAP, which is part of the High Technology Network of Regione Emilia-Romagna, links and opportunities will also be created with companies, universities and research entities of Emilia-Romagna.
3) Grow a group of skilled professionals (the infrastructure manager, his team, personnel of LEAP, SIET and PoliMI involved in the project) who could later take care of the operation of the infrastructure and guarantee its economic sustainability.
4) Recover and make available an industrial complex (centrale Emilia) with particularly valuable architectural features, which can become an icon of how dismissed industrial sites can offer the occasion to project our economic system toward a sustainable future.

15 years beyond the project

The long-term impact of the proposed infrastructure lies in its capability to accelerate the technological and commercial progress of energy storage by targeting three basic goals:

1) reduce specific capital costs;
2) increase roundtrip efficiency;
3) increase the capability to provide auxiliary network services.

The achievement of these goals will generate three types of benefits:

a) Reduce the overall cost of energy storage.
b) Reduce the energy consumption for energy storage, which translates into lower overall energy needs.
c) Reduce CO_2 emissions and, more generally, the impact generated by storage.

The potential gains achievable through three reductions are dramatic. An order of magnitude for the storage serving the electric grid can be estimated by referring to the electricity consumption of Italy. For the sake of simplicity let's round it to 300 TWh/yr and let's say that the average consumption of a week-day is 1 TWh. The corresponding average power consumption over a week-day is about 40 GW and the storage needed to allow a prevailing contribution of intermittent sources like wind and solar can be estimated around 400 GWh. At a cost of 500 €/kWh (in the ballpark of electrochemical

storage), the corresponding capital cost is 200 billion € and the dissipation of energy for 67% round-trip efficiency is 200 GWh/day. The overall capital cost reduction made possible by a 1% decrease of specific capital cost is therefore some billion €, while a 1 percentage point increase of the average roundtrip efficiency would reduce energy dissipations by nearly 10 GWh/day. For an average value of electricity (auxiliary services included) of 150 €/MWh[7,8], such reduction of energy dissipation is worth around 1.5 M€/day.
These numbers give a feeling of the economic and energy relevance of the gains possibly generated by the proposed infrastructure, which aims at being an accelerator of both the development and the market penetration of energy-efficient, environmentally benign, cost-competitive storage technologies.
Notice that the estimates above refer to the electricity market. Adding the heat market (residential, industrial, district heating, which are all within the realm of DES-Park) further enhances – possibly doubles - the long-run beneficial impacts.

C.2. Long-term sustainability profile

A preliminary estimate of the revenues envisaged for the proposed infrastructure can be generated by referring to the size of the market targeted by DES-Park. As shown above, on order-of-magnitude estimate of the capital cost of the energy storage needed by the Italian electric grid leads to 200 billion €. For the average life and the maintenance requirements of the systems we know now, such capital cost translates into a market size of about 20 billion € per year. Most likely, more than 5% of such figure (1 billion M€/yr) goes to R&D. The range of activities targeted by DES-Park (medium-to-high TRL testing, pilot experimentation, scale-up, verification of simulation tools, etc.) will be a fraction of such amount, although its extent varies a lot from one technology to another and it is hard to predict. In addition, many of the activities targeted by DES-Park will be carried out by technology and system providers themselves, as well as by entities other than DES-Park. But should DES-Park capture just 1% of the estimated market, revenues would be of the order of 10 M€. Much more when including the market for heat storage.
In summary, based on the size of the energy storage market targeted by DES-Park, potential revenues can be 10 M€/yr and more.
On one hand, the attainment of such revenues requires:

- coverage of all energy storage modes (electrochemical, chemical, thermal, thermodynamic, see WPs in Part B);
- highly qualified and experienced personnel;
- an appropriate, efficient operation of infrastructure operation (for which DES-Park will draw from the expertise of industrial partners);
- proper market exposure, so to capture the needs of technology providers and industrial operators;
- Proper positioning in national and international research and industrial networks.

On the other hand, the level of revenues estimated above would give a generous margin over the costs expected for the infrastructure, which at this stage are envisaged as follows (approximate, rounded figures).

- 2 M€/yr for the amortization of the investment for equipment and building renovation (approximately 24 M€, see budget in Part B).
- 2 M€/yr for personnel (30 people with an average total cost of 70 k€/yr, which implies a group with high qualification and skills).
- 1.5 M€/yr for scientific and technical collaborators, including researchers and technical professionals from PoliMI, LEAP, SIET and members of the partnership.
- 1.5 M€/yr for utilities, consumables, administrative, IT and technical support, insurances, general expenses, contingencies. This is based on a combination of the experience developed at LEAP, SIET and in a number of experimental projects carried out at PoliMI, LEAP and other partners that have expressed interest in this proposal. All

[7] Electricity price statistics - Statistics Explained (europa.eu)
[8] Monthly Report on the Electricity System_May 2019 (terna.it)

this sums up to about 7 M€/yr, which is the also the minimum level of revenues to be achieved to guarantee economic sustainability. Should this proposal be accepted, **a more accurate cost break-down** will be generated in the subsequent phase, **based on a more detailed specification of the equipment to be installed and the targeted activity**. In turn, this **can be done once the composition of the partnership and the interests / commitments of each single partners will be clear**.

In addition to the minimum level of revenues (achieved as above-mentioned), given the structure and the positioning of DES-Park, additional investments can be successfully triggered mainly thanks to the (i) synergies with other financial instruments available at regional, national or EU level; (ii) potential investors and banks interested in financially sustain DES-Park's activities; (iii) participation in national and international research projects. To pursue these goals, a specific task (T7.3) has beeen forseen in the implementation plan and related promotion activities have been described in WP8 and in section B.5.

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