IANOS
SUSTAINABLE SOLUTIONS
for islands' decarbonisation

D10.10 - IANOS Exploitation Plan (PUDF and identification of project KERs) (T10.4) _v3

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Supplementary notes	-

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DISCLAIMER

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Executive Summary

The present deliverable D10.10 has been developed in the framework of WP10 activities related to the "Dissemination, Exploitation, Promotion & Knowledge Transfer" of IANOS project results and it is the third release of the main outcome of T10.4 "Exploitation Strategy & IPR Management".

Indeed, this deliverable represents the third draft version of the Plan for Use and Dissemination of Foreground (PUDF) for the IANOS project consortium, thus aimed at updating the second release of the exploitation strategy supported by a lean approach to market outreach and reliable routes to market to make sure that IANOS outcomes are tangible and sustainable once the project and the funding are over.

In this framework, this third version provides an overview of the main Key Exploitable Results (KERs) under a market perspective as well as an analysis of the IANOS partners responsible for their development, focusing on the related IPR management. In this way, the document clarifies the main roles and responsibilities of the project partners towards personal and/or joint exploitation of project results.

D10.10 will be then updated along the project duration; the next final version (D10.11) is foreseen at the end of the project (M48).

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Abbreviations & Acronyms

Abbreviation	Definition
KER	Key exploitable result
PR	Project Result
SGAM	Smart Grid Architecture Model
BEMS/HEMS/CEMS	Building/Home/City Energy Management System
BFMULO	Background (B), Foreground (F), Making (M), Using (U), Licensing (L), Other (O)
CA	Consortium Agreement
CHP	Combined Heat and Power
DSM	Demand Side Management
DSO	Distribution System Operator
ETT	Energy Transition Track
EV	Electric Vehicle
FI	Follower Island
GA	Grant Agreement
HHP	Hybrid Heat Pump
IE	Innovative Element
INEA	Innovation and Networks Executive Agency
IVPP	Intelligent Virtual Power Plant
LEC	Local Energy Community
LH	Lighthouse
LV/MV	Low Voltage/Medium Voltage
P2P	Peer-to-Peer
PC	Project Coordinator
PCM	Phase Change Materials
PEB	Positive Energy Building
PV	Photovoltaic
PUDF	Plan for Use and Dissemination of Foreground
RES	Renewable energy sources
SGAM	Smart Grid Architecture Model
TRL	Technology Readiness Level
UC	Use Case
V2G	Vehicle to Grid
VPP	Virtual Power Plant
WP	Work Package

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1 Introduction

IANOS brings together two Lighthouse (LH) islands (Terceira-PT, Ameland-NL), and three Fellow islands (FI) (Lampedusa-IT, Bora-Bora-FR, Nisyros-GR), all sharing a common vision of decarbonizing their energy systems and be energy independent until 2050. Thirty-four (34) strongly experienced partners from nine (9) European countries, join forces to deliver smart technological, economic, and social innovations, providing systemic optimization starting from an Energy Community-centric approach. IANOS adopts an Island Energy Transition Strategy built around three (3) Island Energy Transition Tracks that focus on: a) Energy efficiency and grid support for extremely high-RES penetration, b) Decarbonization through electrification and support from non-emitting fuels, c) Empowering Local Energy Communities (LEC).

Within this context this deliverable was prepared within the framework of Work Package 10 "Exploitation of the project Results and Impact assessment" and refers to activities carried out by RINA-C within Task 10.4 "Plan for Exploitation of Key Exploitable Results and IPR Management".

The purpose of this document is to provide a first draft of the Exploitation Strategy developed at Consortium as well as at individual partner level, based on the previous version of the same document submitted in M24. Furthermore, together with the dissemination activities managed in WP10, it is forthcoming to guarantee the maximum visibility to the Key Exploitable Results, ensuring their exploitation by the partners and to reach the maximum share of knowledge out of the project foreground. In this context, it is of utmost importance to support the partners in the development of the most appropriate strategy for exploiting the IANOS results.

To this aim, the commercially exploitable outcomes within the project shall be screened and the possible exploitation routes and actions to be undertaken shall be recommended, ensuring at the same time the compliance with the IPR rules laid down in detail within the Consortium Agreement.

In this framework, activities have been focused on the definition of the IANOS Key Exploitable Results. The list of Key Exploitable Results proposed at the proposal stage and reported in the previous version of the document (M24) was thus updated accordingly and to each result a partner/more partners identified as main leader and responsible for the results' development and in coherence with the WP1 adopted SGAM methodology from T1.2 that was adapted for the specific purpose of this task. Once defined the main KERs and related responsible partner/s, the characterization of each result, in terms of description of competitive advantages, market perspective and IPR management, has been updated with respect to the previous version in order to provide a more detailed

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description of the identified results. The TRL of each project result was defined in accordance with the lead partners and will be continuously monitored during the entire project duration. This activity was fundamental to select the most advanced results to develop the related business model to support the exploitation of each individual marketable project technology outcomes, devising strategies and tactics. In this way, it was possible to select the most promising Exploitable Results based on their TRL and partners' intentions to go to the market on which develop the Business Model.
In addition, preliminary exploitation strategies at partner and consortium level have been investigated together with exploitation routes of project results.

Regarding IPR management, background and foreground information together with exploitation claims have been updated according to the partners' intentions and to the project development. Finally, IPR protection measures have been investigated for each project result with the aim to understand the protection intentions for each of them.

The IANOS project represents a unique opportunity for the project partners to reinforce their market positions or enter new markets, properly exploiting the results developed within the project. For this reason, a proper exploitation plan is crucial to maximize the potential benefits for each project partner.

This document represents a "living document" that will be updated along the project as long as the results are developed and validated, and partners define the related exploitation perspective according to the developments they have been involved in.

IANOS project has 19 key exploitable results and for each of them we need to receive a characterization table to finalize the exploitation strategy. In this document we collected 18 characterization tables, the last one will be included in the next version of this document.

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2 IANOS Exploitation model

As a first step towards exploitation, a definition of Key Exploitable Results has been provided to help the consortium in their clear identification. Based on the initial version of the present document, these Key Exploitable Results have been identified and preliminarily characterized, according to their actual development status, with the aim to evaluate their readiness towards the market. Then, the analysis of the main expectations of project partners with respect to their main developments has been updated with the aim of evaluating roles and single or joint market intentions.

The final goal of this analysis is the identification of the exploitation framework, towards the definition of proper strategies for market penetration including all aspects related to the IPR management.

2.1 Definition and identification of IANOS Key Exploitable Results

Firstly, a definition of Project Result (PR) as defined by the European Commission is provided:

"A Project Result is defined as any tangible or intangible output of the action, such as data, knowledge and information whatever their form or nature, whether or not they can be protected."

Thus, PR is the outputs generated during the project which can be used and create impact, either by the project partners or by other stakeholders. Project results can be reusable and exploitable (e.g., inventions, prototypes, services) as such, or elements (knowledge, technology, processes, networks) that have potential to contribute to further work on research or innovation.

Figure 2-2-1: Project Results[1]

[1] https://ec.europa.eu/research/participants/data/ref/h2020/other/events/2018-09-21/9_dissemination-exploitation-activities_en.pdf

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Dealing with the exploitation of results means evaluating the utilization of results in developing, creating and marketing a product or process, or in creating and providing a service, or in standardization activities.

As explained by mean of an extract from the European Commission slides on Dissemination and Exploitation activities in figure below, it is important to:

- Make use of the results for scientific, societal and economic purposes, or for improving public knowledge and action (e.g., recommendations for policy making); recognizing exploitable results and their stakeholders, as group of entities that are making concrete use of results.
- Concretize the value and impact of the Research & Innovation activity for societal challenges; with this respect, partners shall make best efforts to exploit the results it owns, or to have them exploited by another legal entity (e.g., through making results available under open licenses).

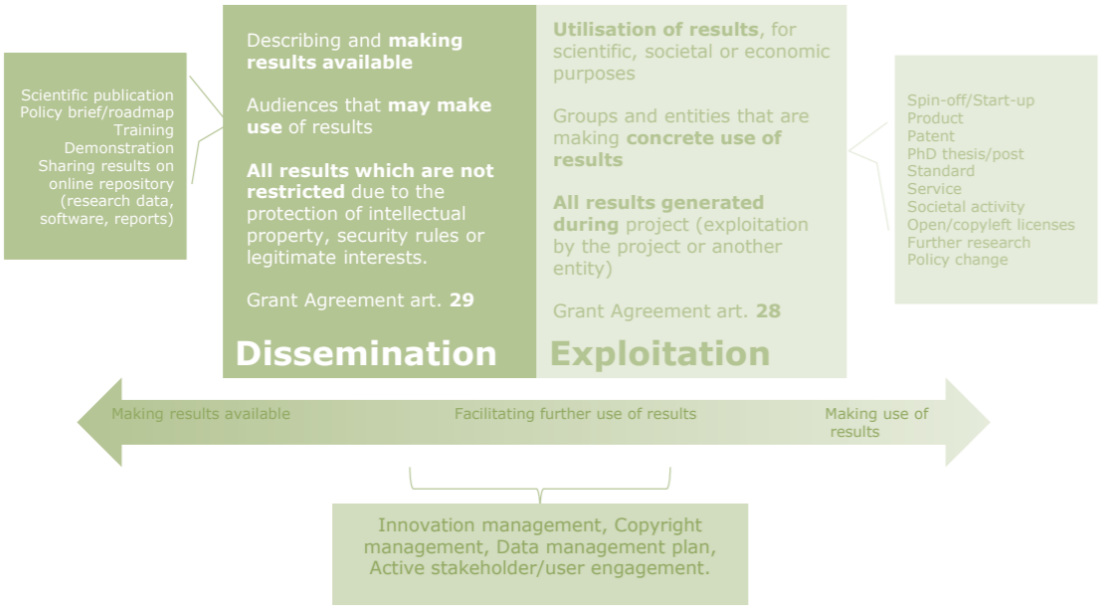

Figure 2-2: Dissemination and Exploitation of Project Results[2]

Given the list of Key Exploitable Results (KERs) presented in D10.9 and the input provided by partners, an updated list of Key Exploitable Results is reported below. Nevertheless, changes would be considered over time because of the project advancements where a duly update will be performed. Indeed, since this deliverable serves as the third version of the Plan for Use and Dissemination of Foreground, the PRs may still change in the final version of the document.

[2] https://ec.europa.eu/research/participants/data/ref/h2020/other/events/2018-09-21/9_dissemination-exploitation-activities_en.pdf

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Table 2-1: IANOS Key Exploitable Results overview

#	Key Exploitable Results	Responsible Partner(s)
1	iVPP platform: Centralized Dispatcher [Terceira]	CERTH & CW
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa
3	iVPP platform: Forecasting Engine	CERTH
4	iVPP platform: - Intelligent Segmentation & Clustering Engine	CERTH
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH
6	iVPP platform: - P2P Transactive Energy Trading Framework	ENG
7	iVPP platform: - Virtual Energy Console	CW
8	iVPP platform: Enterprise Service Bus	ETRA
9	FEID PLUS	CERTH
10	PCM Thermal Storage Heat Batteries	SUNAMP
11	V2G Charging & Services on Terceira	EFAEM
12	DefPi Platform	NEROA
13	Smart Energy Router	UNINOVA
14	Flywheel	TERALOOP
15	Tidal Kite	SQH
16	Hybrid Transformer	EFACEC
17	PVs with microinverter	BEON
18	Biobased saline batteries	SWT
19	IANOS Energy Planning and Transition suite (IEPT)	UBE

In the following paragraphs, each KER has been preliminary characterized according to the information available, with particular focus on the innovation, potential customers and exploitation perspectives (including IPR management).

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2.2 Preliminary characterization of Key Exploitable Results

An exploitation model shall contain adequate exploitation strategy, which will ensure successful implementation and the market entry of the identified project results. It is, however, crucial to know the characteristics of each of the results.

Table 2-2: IANOS Key Exploitable Results Overview summarizes the list of KERs together with a short description and the related ownership including the involved partners within the project.

Table 2-2: IANOS Key Exploitable Results overview

#	Key Exploitable Results	Description	Responsible Partner(s)
1	iVPP platform: Centralized Dispatcher [Terceira]	The Centralized Dispatcher is part of the IANOS iVPP Operative Orchestration Toolkit (iVPP) that contains functionalities to provide energy flexibility services and foster island self-consumption according to each use case specification. CERTH optiMEMS component is utilized to evaluate the optimal dispatch scheduling on the island of Terceira, in the cases i) of the large-scale BESS, ii) of several residential controllable devices such as SUNAMP heat batteries and electrochemical batteries, iii) of EV charging stations charge/discharge setpoints	CERTH & CW

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#	Key Exploitable Results	Description	Responsible Partner(s)
2	iVPP platform: Centralized Dispatcher [Ameland]	Ameland's iVPP platform integrates flexible energy assets at the island and implements an optimal dispatch plan that deals with grid congestion while integrating as much renewable energy sources as possible. Ameland's iVPP utilizes ReFlex technology to create the optimal dispatch plan.	TNO & Neroa
3	iVPP platform: Forecasting Engine	By creating forecasting algorithms for both energy consumption and generation, this component generates the essential inputs for the decision support system (Centralized Dispatcher), assisting in the optimal programming and managing of the grid assets. Furthermore, forecasts will be provided for the energy market prices, and more specifically for the day-ahead price, intraday price, imbalance price, and frequency containment reserves (FCR).	CERTH

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#	Key Exploitable Results	Description	Responsible Partner(s)
4	iVPP platform: - Intelligent Segmentation & Clustering Engine	This tool will be able to provide a detailed overview of the energy portfolio creating clusters of residential users based on various objectives and thus delivering insightful information for the end user. Also, it will be integrated with the Forecasting Engine of the iVPP to assist with the (aggregated) forecasting of residential loads. The Aggregation and Intelligent Segmentation component consists of three different submodules that: examine typical consumption patterns, detect the most appropriate set of customers for demand response schemes and examine the daily variation of the consumption time series. Towards this end, three different clustering algorithms (k-means, Spectral and Hierarchical) are utilized and the best performing one according to certain metrics and domain knowledge will be kept.	CERTH
		VERIFY conducts LCA/LCC analysis, using either synthetic data and/or real-time data, to support islands in their replication activities and foreseen investments, in terms of environmental aspects. This tool will be able to provide a detailed overview of the environmental profile of the	

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#	Key Exploitable Results	Description	Responsible Partner(s)
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	energy portfolio of islands, supporting their SECAP development in the future. INTEMA.grid serves as a fully interoperable with VERIFY, Energy Simulation platform, able to quantify in a dynamic fashion (if deemed as necessary, but for the main scope of IANOS in a quasi-steady fashion) the energy profiling of islands, accounting both for fossil based PPs and RES, integrated with multiple storage options, taking into account the consumption (or demand) profiles. This set of tools, can facilitate the optimisation process and overall long-term cost benefit of a wide repository of solutions in energy grids, able to address the energy balance in the system on short timescales (hours usually) over all infrastructure	CERTH
6	iVPP platform: - P2P Transactive Energy Trading Framework	The iVPP P2P transactive energy framework implements a marketplace that manages the exchange of energy within a community of prosumers leveraging on blockchain technology and smart contracts.	ENG

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#	Key Exploitable Results	Description	Responsible Partner(s)
7	iVPP platform: - Virtual Energy Console	The Virtual Energy Console is an iVPP module that consists of the User Interface (UI) dashboards for monitoring the whole VPP operation	CWD
8	iVPP platform: Enterprise Service Bus	Allows the communication of the different components in the iVPP and other elements in the IANOS architecture.	ETRA
9	FEID PLUS	FEID-PLUS (Fog Enabled Intelligent Devices) is equipped with embedded communication interfaces, either directly on the main unit or in the form of add-ons; it can communicate unobtrusively with most commonly used wired or wireless communication protocols. FEID-PLUS will be utilized as a local energy management system, which will collect and monitor real-time data through deployed smart sensors, plugs and field-level interfaces. In addition, FEID-PLUS will perform optimization procedures for the management and consequently the local control of the building loads.	CERTH

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#	Key Exploitable Results	Description	Responsible Partner(s)
10	PCM Thermal Storage Heat Batteries	Heat Batteries are modern-day, energy saving thermal stores made with a high-performance phase change material (PCM technology) to deliver fast flowing hot water, reliably, safely and efficiently. Sunamp heat batteries are beneficial for multiple reasons, they are four times smaller than the equivalent hot water cylinder, easier to install, kinder to the environment and there is no mandatory annual maintenance. We charge the Heat Batteries in multiple ways, grid electricity, solar PV and/or from heat pumps (HVAC). We enable hot water storage systems to be installed where otherwise they would not fit, so particularly benefiting retrofitting projects.	SUNAMP
11	V2G Charging & Services on Terceira	The EV Charger is constituted by several high efficiency power electronic conversion stages, using the latest technology in terms of semiconductors and conversion topologies for the inclusion of the bidirectional power capability. The charger will incorporate a dedicated interface and control module with the iVPP. Additionally, grid support features will be developed and validated in the Terceira pilot.	EFAEM

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#	Key Exploitable Results	Description	Responsible Partner(s)
12	DefPi Platform	The platform will be able to gather data and to send steering signals to the involved assets. The platform will gather all data and structure it after it can be sent to [1] Energy Bus and [2] the flex algorithm (Repowered / TNO) and receive the steering signals	NEROA
13	Smart Energy Router	The Smart Energy Router is a power electronics device that manages the energy transfer from/to different sources (distribution grid, RES-based distributed generators), loads and electricity storage system.	UNINOVA
14	Flywheel	The Teraloop solution of a flywheel differs from conventional flywheel solutions by using a patented and prototyped hubless outer-rotor design. The flywheel will be integrated to the energy system for power management and fault ride through at a local industrial site.	TERALOOP

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#	Key Exploitable Results	Description	Responsible Partner(s)
15	Tidal Kite electricity integration	TidalKite technology is a renewable energy solution that harnesses energy from tidal streams. This technology is based on an underwater kite operated perpendicular to a water stream that creates a traction force that is converted into electricity. It is unique in its capability to exploit energy from low velocity tidal streams in shallow waters.	SQH
16	Hybrid Transformer	The Hybrid Transformer is an innovative distribution transformer that incorporates new materials, power electronics technology and an advanced monitoring system.	EFACEC

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#	Key Exploitable Results	Description	Responsible Partner(s)
17	PVs with microinverter	BeON's micro inverters allow for individual power generating PVs to directly connect to any electric socket (Pluginverter), just like a common electric appliance, in a safe, reliable, and simple way. This bypasses the need to connect to a switchboard or to an exclusive power line for the PV, cutting down on infrastructure needs, space, and costs. To integrate these highly distributed systems in Smart Grids a communication interface and API protocol will be developed in order to provide demand/response capability thus supporting local grid infrastructure capability and stability.	BEON
18	Biobased saline batteries C1	The Bio Based Battery technology is a unique and Safe, renewable energy solution that stores energy to have better use of local energy harvested from local resources like the sun, hydropower, wind or other means you have to store it locally for local use.	SWT

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#	Key Exploitable Results	Description	Responsible Partner(s)
19	IANOS Energy Planning and Transition suite (IEPT)	A suite that supports the investments of the different stakeholders providing a holistic approach that quantifies both the costs and benefits of the IANOS interventions in the demonstration sites, i.e., Lighthouse and fellow islands of IANOS, as well as providing a tool that facilitates the fundraising campaigns.	UBE

With the aim to better know and understand the characteristics of each of the above-mentioned results, lead partners were asked to answer questions regarding their developments and these outputs were then served as a basis for the formulation of results characteristics. The questions revolved mainly around four key areas:

- General description of Project Result focusing on its innovativeness and competitive advantages.
- Market context in which the product will be introduced.
- IPR management detailing the role of partners involved.
- Exploitation Strategy.

Thus, a description of the above identified results of IANOS project has been provided following the template below. With respect to the previous version, the characterization table template was updated with the aim to include more accurate data and information. These tables will be shared with the partners in the coming months and will be included in the next version of this deliverable.

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Table 2-3: Characterization table template

PROJECT RESULT GENERAL DESCRIPTION	**Exploitable Result # / Title**					
	Short description of the project result/Description of the service provided	*Short description of the project result and of the related service provided*				
	Innovation content/ Competitive advantage/Benefits	*Added value of the project result/service provided from the end-user point of view*				
	Legal, normative or ethical requirements connected to the development of the project result	*Any legal, normative or ethical requirements that shall be taken into account during the development of the project result and potentially after the end of the project (e.g., any legal constraints for the exploitation?)*				
	TRL	**Before IANOS**		**After IANOS**		
MARKET	Targeted Market and Sector(s) of application	*Example of application or scenario for the project result/service, including the target sector and alternative one(s)*				
	Time to market	*When the result developed is expected to reach the market*				
	Potential customers	*End-users/customers that could be interested to purchase/use the result developed*				
	Potential competitors	*Other companies potentially involved in the development of similar results*				
IPR	Owner(s) of Result					
	Other Partners involved					
	Joint ownership	*Is there any need of agreement about the ownership of the result before the end of the project? Yes/No*				
	Status of IPR: Background (B)	*List of partners providing existing knowledge to the development of the result* *B = if you provide your background and existing knowledge (already available at your company before the project start) for the development of the result.*				
	Status of IPR: Foreground (F)	*List of partners involved, and role effectively covered by them in the development of the final result* *F = if you are strictly involved in the development of the result and so your knowledge acquired during the project is essential to reach the final result.*				
	Status of IPR: Exploitation forms (partners interested in the exploitation of the result after the end of the project)	**M = Making the product**	**U = Using the result**	**L = License the result**	**O = Other means of exploitation**	
	Protection measures	**Patent**	**Trademark**	**Copyright**	**Industrial Design**	**Other**
		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
		If not yet, is it expected to protect the result in the future?				
EXPLOITA	Exploitation claim	**Consulting activity**	**License to third parties**	**Making and selling the product**	**Providing a service**	**Internal use** (e.g., R&D, projects)

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		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
	Revenue streams associated to the above exploitation claim	€	€	€	€	€
	Estimated effort to bring the project result to the market	Activities foreseen		Cost		Time

At this stage of the project, the main results identified have been preliminarily characterized, according to their on-going status and to the project timeline. Information provided in the characterization tables have been updated, when possible, based on the data provided in the second version of the present document. These tables, in fact, could be modified and updated, up to the project conclusion, according to the project developments to keep track of the evolution of the results themselves and of the partners intentions of exploitation. The final and full version of the characterization tables for each exploitable result will be provided in the final version of the current deliverable due at the end of the project (M48).

2.2.1 iVPP platform: Centralized Dispatcher - optiMEMS [Terceira]

Project Result general description	Project Result # / Title	iVPP platform: Centralized Dispatcher - optiMEMS [Terceira]	
	Project Result Short description/Service Description	The Centralized Dispatcher is part of the IANOS iVPP Operative Orchestration Toolkit (iVPP) that contains functionalities to provide energy flexibility services and foster island self-consumption according to each use case specification. CERTH optiMEMS component is utilized to evaluate the optimal dispatch scheduling on the island of Terceira, in the cases i) of the large scale BESS, ii) of several residential controllable devices such as SUNAMP heat batteries and electrochemical batteries, iii) of EV charging stations charge/discharge setpoints	
	Innovation content/ Competitive advantage/Benefits	Integration of multiple energy assets and evaluation of optimal schedule according to system technical constraints and cost saving objectives	
	Legal, normative, or ethical requirements connected to the development	Adoption of best practices to protect privacy and personal data, in accordance with EU/national regulations.	
	TRL	Before IANOS	After IANOS
		6	8
Market	Targeted Market	The Centralized Dispatcher and optiMEMS in particular can find application in any kind of energy portfolio management application, when there is a need of applying the optimal schedule	

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		for dispatchable units, based on profit/self-consumption or environmental indices			
	Customer segments and whom to address (inside the client's organization)	Retailers Aggregators, VPP Operators Microgrid operators Building Energy Management Systems Providers			
	Potential competitors	Building Energy Management Systems Providers (partially) VPP solutions providers			
IPR	Owner(s) of Result	CERTH			
	Other Partners involved	CWD			
	Joint ownership (Need of agreement before the end of the project?)	Yes/No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No
	Revenue streams associated to the above exploitation claim	-	-	200 000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
			65k	1yr	

2.2.2 iVPP platform - Centralized Dispatcher [Ameland]

Project Result general description	Project Result # / Title	iVPP platform: Centralized Dispatcher [Ameland]
	Project Result Short description/Service Description	Ameland's iVPP platform integrates flexible energy assets at the island and implements an optimal dispatch plan that deals with grid congestion while integrating as much renewable energy sources as possible. Ameland's iVPP utilizes ReFlex technology to create the optimal dispatch plan.
	Innovation content/ Competitive advantage/Benefits	The system reduces grid congestion and allows the island to incorporate at much renewable energy sources as possible, e.g. by shifting load and use intermediate storage for surplus of energy.

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	Legal, normative, or ethical requirements connected to the development	The system requires energy measurements (e.g., from households when part of the use case) which might contain privacy sensitive information in some situations.			
	TRL	Before IANOS	After IANOS		
		6	8		
Market	Targeted Market	Any region that has to deal with grid congestion or imbalance.			
	Customer segments and whom to address (inside the client's organization)	Municipalities, industry park owners, national governments			
	Potential competitors	Companies with similar technology			
IPR	Owner(s) of Result	TNO			
	Other Partners involved	NEROA			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		Yes	Yes	Yes	No
	Revenue streams associated to the above exploitation claim	Knowledge acquired is used in consultancy (e.g., to governments)	Use of the technology to improve company knowledge position	Currently not feasible to sell this technology as a product in the market.	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		tbd	tbd	tbd	
		It is difficult to estimate at the current stage of the project the effort in terms of timing and costs to bring the project result to the market. More details will be provided by the end of the project.			

2.2.3 iVPP platform - Forecasting Engine

Project	Project Result # / Title	iVPP platform: Forecasting Engine

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<table>
<tr><td rowspan="4"></td><td>Project Result Short description/Service Description</td><td colspan="2">By creating forecasting algorithms for both energy consumption and generation, this component generates the essential inputs for the decision support system (Centralized Dispatcher), assisting in the optimal programming and managing of the grid assets. Furthermore, forecasts will be provided for the energy market prices, and more specifically for the day-ahead price, intraday price, imbalance price, and frequency containment reserves (FCR).</td></tr>
<tr><td>Innovation content/ Competitive advantage/Benefits</td><td colspan="2">The Forecasting Engine is a vital part of the decision-making process as it delivers the necessary forecasts for the consumption, generation and market prices to the Centralized Dispatcher in order to provide the setpoints for the optimal dispatch of the assets.

For the development of the forecasting engine a plethora of machine learning models (tree-based models and SVM), deep learning models (RNN, LSTM), physical models and ensembles were utilized for the forecasting of the energy-based time series. The approach that is followed is heavily based on the feature engineering aspect of the machine learning methodology, utilizing historical values, time features and weather features.

The lightweight, feature-depended methodology that is proposed is proved to achieve highly accurate results without the need of a large dataset or high training time.</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="2">Adoption of best practices to protect privacy and personal data, in accordance with EU/national regulations.</td></tr>
<tr><td>TRL</td><td>Before IANOS</td><td>After IANOS</td></tr>
<tr><td></td><td>6</td><td>8</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="2">The Forecasting Engine can find application in the following sectors, whenever there is a need for forecasting load/generation & price profiles: Renewable Energy Resources, Microgrids, Smart Grids, Architecture, Engineering and Construction (Smart Buildings), and Building Energy Management Systems</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="2">Retailers
Aggregators, VPP Operators
Microgrid operators
Building Energy Management Systems Providers</td></tr>
<tr><td>Potential competitors</td><td colspan="2">Forecasting Services Providers
DR services providers
Building Energy Management Systems Providers</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="2">CERTH</td></tr>
<tr><td>Other Partners involved</td><td colspan="2"></td></tr>
<tr><td>Joint ownership (Need of agreement</td><td colspan="2">No</td></tr>
</table>

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	before the end of the project?)				
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No
	Revenue streams associated to the above exploitation claim	-	-	130 000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
			40k	1yr	

2.2.4 iVPP platform - Intelligent Segmentation & Clustering Engine

Project Result general description	Project Result # / Title	iVPP platform: Aggregation and Intelligent Segmentation	
	Project Result Short description/Service Description	The Aggregation and Intelligent Segmentation component of IANOS iVPP will be used to assist with the decision-making process of the energy portfolio/VPP manager.	
	Innovation content/ Competitive advantage/Benefits	This tool will be able to provide a detailed overview of the energy portfolio creating clusters of residential users based on various objectives and thus delivering insightful information for the end user. Also, it will be integrated with the Forecasting Engine of the iVPP to assist with the (aggregated) forecasting of residential loads. The Aggregation and Intelligent Segmentation component consists of three different submodules that: examine typical consumption patterns, detect the most appropriate set of customers for demand response schemes and examine the daily variation of the consumption time series. Towards this end, three different clustering algorithms (k-means, Spectral and Hierarchical) are utilized and the best performing one according to certain metrics and domain knowledge will be kept.	
	Legal, normative, or ethical requirements connected to the development	Adoption of best practices to protect privacy and personal data, in accordance with EU/national regulations.	
	TRL	Before IANOS	After IANOS
		6	8
Market	Targeted Market	This tool is best suited for managers of energy portfolios of residential clients with smart meters installation. Its main aim is to assist the user with the creation of appropriate Demand Response	

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		schemes and different tariffs for different sets of residential customers.			
	Customer segments and whom to address (inside the client's organization)	Aggregators, VPP Operators, Energy Communities Managers, Energy Retailers			
	Potential competitors	DR Services Providers, ESCOs			
IPR	Owner(s) of Result	CERTH			
	Other Partners involved	-			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No
	Revenue streams associated to the above exploitation claim	-	-	70 000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
			50k	1yr	

2.2.5 iVPP platform - IEPT toolkits (specifically VERIFY and INTEMA.grid)

Project Result general description	Project Result # / Title	iVPP platform: IEPT toolkits (specifically VERIFY-D and INTEMA.grid)
	Project Result Short description/Service Description	The IEPT component of IANOS iVPP will be used to assist with the decision-making process, the IANOS LHs and FIs on their replication activities, integrating selected innovative systems, while also the assessment of the environmental impact of the IANOS solutions in the LHs.
	Innovation content/ Competitive advantage/Benefits	VERIFY-D offers a holistic life cycle tool applicable in energy networks considering both existing energy grid infrastructure and comparisons with planned energy grid interventions. Multiple energy grid sectors, such as power plants production units, energy storage, and public infrastructures (e.g. lighting) can be incorporated to the life cycle analysis, specifically for the case of district level interventions.

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<table>
<tr><td rowspan="4"></td><td></td><td colspan="4">INTEMA.grid offers an Energy Planning & Transition Decision Support Tool able to simulate multi-vector energy systems, integrated, accounting also the grid topologies and interconnections among variable systems.

Both tools are designed to be interoperable with multiple commercial platforms, if deemed as necessary, since are based on open-source algorithms, house developed by CERTH, through appropriately selected APIs offering the ability for instant communication and data exchange. Particularly, the analysis results of the VERIFY-D platform offer an accurate energy intervention planning mechanism through the quantify of environmental and economic impacts and further evaluation through the operation assessment specialized on IANOS demo sites.</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="4">Adoption of best practices to protect privacy and personal data, in accordance with EU/national regulations.</td></tr>
<tr><td rowspan="2">TRL</td><td colspan="2">Before IANOS</td><td colspan="2">After IANOS</td></tr>
<tr><td colspan="2">6</td><td colspan="2">8</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="4">This tool is best suited for managers of energy portfolios on a district and even island level. It can also support ESCOs and power plant operators, for selecting best available technologies, aiming at increasing their renewable share. Moreover, it can facilitate activities of local Municipalities, by assisting them in the definition of most promising interventions in their energy mixture.</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="4">Aggregators, VPP Operators, Energy Communities Managers, Energy Retailers, Municipalities, ESCOs, Engineers, SECAP Planners</td></tr>
<tr><td>Potential competitors</td><td colspan="4">Other Services Providers, ESCOs</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">CERTH</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">-</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="2">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation
(e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
</table>

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	Revenue streams associated to the above exploitation claim	5000 €/simulation case	-	12000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities Direct labour to launch the product commercially. Initial efforts and contacts have been already undertaken	Cost	Time 6 months	
		Maintenance and customer support	3000 €		
		Software updates	1 000 €		

2.2.6 iVPP platform - P2P Transactive Energy Trading Framework

Project Result general description	Project Result # / Title	iVPP platform: P2P Transactive Energy Trading Framework	
	Project Result Short description/Service Description	The P2P Transactive Energy Trading Framework implements a marketplace for prosumers energy within a community.	
	Innovation content/ Competitive advantage/Benefits	It implements a marketplace for prosumers that intend to exchange their energy extra production with those that need some, temporarily limited, extra consumption on respect of their usual baseline. The exchange of energy is operated within a community leveraging on blockchain technology and smart contract for tokens transactions. among prosumers, assuring immutable and accessible transaction.	
	Legal, normative, or ethical requirements connected to the development	Adoption of best practices to protect privacy and personal data, in accordance with EU/national regulations.	
	TRL	Before IANOS	After IANOS
		5	7
Market	Targeted Market	This framework is targeted for regional local communities of prosumers that experiment renewable energy autoconsumption maximization issued. To be proposed to residential clients, but also SME, with smart meters installed. Its main aim is to assist the prosumer with the creation of appropriate energy trading strategy in consideration of different energy tariffs for different sets of prosumers.	
	Customer segments and whom to address (inside the client's organization)	Prosumers, Energy Communities Managers, Energy Retailers	

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	Potential competitors	Aggregators, VPP Operators,			
IPR	Owner(s) of Result	ENG			
	Other Partners involved	It can be proposed as single framework or as part of a comprehensive iVPP platform. Other partners involvement will depend on how the iVPP platform will be commercialized. If it was presented as a joint of the several tools that compose the iVPP platform, it would need to be treated as joint ownership.			
	Joint ownership (Need of agreement before the end of the project?)	Yes. It will depend on how the iVPP platform is commercialized. If it will be presented as a joint initiative of the several tools that compose the iVPP platform, it would need to be treated as joint ownership.			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		Yes	No	Yes	No
	Revenue streams associated to the above exploitation claim	15. 000€/year	-	150. 000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		Personal cost- Direct labour to launch the product commercially	5 000 €	12 months	
		Maintenance and customer support	3.500 €	-	
		Software updates	2 000 €	-	
		Marketing and Commercial activities	8 500 €	-	
		General expenses	3 000 €	-	

2.2.7 iVPP platform - Virtual Energy Console

Project Result	Project Result # / Title	iVPP platform: Virtual Energy Console
	Project Result Short description/Service Description	Consists of the User Interface (UI) dashboards for monitoring the whole VPP operation. It will offer unique linked data exploration,

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<table>
<tr><td rowspan="5"></td><td></td><td colspan="4">perception and knowledge extraction for effective energy flows' assessment.</td></tr>
<tr><td>Innovation content/ Competitive advantage/Benefits</td><td colspan="4">Advances on visual analytics will be used to enable the dynamic connection of different datasets with several types of visualization.</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="4">-</td></tr>
<tr><td rowspan="2">TRL</td><td colspan="2">Before IANOS</td><td colspan="2">After IANOS</td></tr>
<tr><td colspan="2">6</td><td colspan="2">8</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="4">Any kind of VPP portfolio management application, when there is a need to visualize and manage operations of disperse energy assets.</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="4">Energy Community Managers, Aggregators, Retailers, System Operators</td></tr>
<tr><td>Potential competitors</td><td colspan="4">VPP solutions providers</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">CWD</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">None</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="4">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation
(e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>No</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Revenue streams associated to the above exploitation claim</td><td>-</td><td>-</td><td>200 000€</td><td>-</td></tr>
<tr><td>Estimated effort to bring the Project Result to the market (yearly)</td><td>Activities</td><td>Cost</td><td colspan="2">Time</td></tr>
<tr><td></td><td></td><td>65k</td><td colspan="2">1yr</td></tr>
</table>

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2.2.8 iVPP platform - Enterprise Service Bus

<table>
<tr><td rowspan="6">Project Result general description</td><td>Project Result # / Title</td><td colspan="4">iVPP platform: Enterprise Service Bus</td></tr>
<tr><td>Project Result Short description/Service Description</td><td colspan="4">Allows the communication of the different components in the iVPP and other elements in the IANOS architecture.</td></tr>
<tr><td>Innovation content/ Competitive advantage/Benefits</td><td colspan="4">Added value of the project result/service provided from the end-user point of view</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="4">-</td></tr>
<tr><td rowspan="2">TRL</td><td colspan="2">Before IANOS</td><td colspan="2">After IANOS</td></tr>
<tr><td colspan="2">6</td><td colspan="2">8</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="4">Multi-protocol and multi-format scenarios which require a common language to perform the communication. These scenarios are typically composed by multiple applications which need an effective communication. Industries in the field of financial services, insurance, manufacturing, retail, telecom, energy utility, food distribution network require the use of ESB in their software architecture.</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="4">Loosely coupled business units and business partners automating supply chains.</td></tr>
<tr><td>Potential competitors</td><td colspan="4">Oracle, Microsoft, IBM, Jboss, Phoenix, Apache, WSO2 ESB</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">ETRA</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">It will depend on how the iVPP platform is commercialized. If it was presented as a joint of the several tools that compose the iVPP platform, it would need to be treated as joint ownership.</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">Yes. It will depend on how the iVPP platform is commercialized. If it was presented as a joint of the several tools that compose the iVPP platform, it would need to be treated as joint ownership.</td></tr>
<tr><td rowspan="2">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation (e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
</table>

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	Revenue streams associated to the above exploitation claim	2 000€	-	9 000€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		Personal cost- Direct Labour to launch the product commercially	5 000 €	5 months	
		Maintenance and customer support	500 €	-	
		Software updates	2 000 €	-	
		Marketing and Commercial activities	1 500 €	-	
		General expenses	1 000 €	-	

2.2.9 FEID Plus - Fog Enabled Intelligent Devices

Project Result general description	Project Result # / Title	FEID PLUS
	Project Result Short description/Service Description	FEID-PLUS (Fog Enabled Intelligent Devices) is equipped with embedded communication interfaces, either directly on the main unit or in the form of add-ons; it can communicate unobtrusively with most commonly used wired or wireless communication protocols. FEID-PLUS will be utilized as a local energy management system, which will collect and monitor real-time data through deployed smart sensors, plugs and field-level interfaces. In addition, FEID-PLUS will perform optimization procedures for the management and consequently the local control of the building loads.
	Innovation content/ Competitive advantage/Benefits	For the real time monitoring and controlling of the local loads, the FEID-PLUS supports the most common wired and wireless communication protocols such as: • WiFi • Bluetooth • Enocean • Ethernet • RS-485/Modbus RTU • RS-232/UART • Zigbee For on-the fly decision-making, the FEID-PLUS is also enhanced with cutting-edge intelligence, including prediction and optimization algorithms.
	Legal, normative, or ethical requirements	None

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	connected to the development				
	TRL	Before IANOS		After IANOS	
		6		8	
Market	Targeted Market	Building Energy Management / wired and wireless monitoring and control applications			
	Customer segments and whom to address (inside the client's organization)	Building Managers, Building Users, Retailers, Aggregators, ESCOs, Energy Community Managers, Microgrid Operators			
	Potential competitors	IoT & Smart Meter Vendors, BMS/ Building Automation providers			
IPR	Owner(s) of Result	CERTH			
	Other Partners involved	-			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No
	Revenue streams associated to the above exploitation claim	-	-	60k€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
			40 000	1yr	

2.2.10 PCM Thermal Storage Heat Batteries

Project Result general	Project Result # / Title	PCM Thermal Storage Heat Batteries - Thermino
	Project Result Short description/Service Description	Innovative thermal storage solution that immerses a powerful heat exchanger into the PCM storage and therefore maximizing its thermal power will be included in the iVPP, along with SoC monitoring controllers for optimal storage utilization.

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<table>
<tr><td rowspan="4"></td><td>Innovation content/ Competitive advantage/Benefits</td><td colspan="4">The forecast of</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="4">Depending on the regulations of each market around the globe, hot water storages or devices have different constraints concerning certification. Before any deployment with that application, mandatory certification must be double checked.</td></tr>
<tr><td rowspan="2">TRL</td><td colspan="2">Before IANOS</td><td colspan="2">After IANOS</td></tr>
<tr><td colspan="2">9</td><td colspan="2">9</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="4">Construction companies</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="4">Construction companies usually do wide range of construction buildings, utilities, etc. The main customer segment is residential high rise buildings in big cities where the space is limited. These customers expect high comfort and a lot of space. Thermino delivers both.</td></tr>
<tr><td>Potential competitors</td><td colspan="4">Hot water tanks that work under pressure, conventional hot water tanks, instant heaters</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">SUNAMP</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">No</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="4">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation (e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>No</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Revenue streams associated to the above exploitation claim</td><td>0 €</td><td>0 €</td><td>1,000,000.00 €</td><td>0 €</td></tr>
<tr><td>Estimated effort to bring the Project Result to the market (yearly)</td><td colspan="2">Activities</td><td>Cost</td><td>Time</td></tr>
<tr><td></td><td colspan="2"></td><td></td><td></td></tr>
<tr><td></td><td colspan="2">Standardizing the solution and make it market ready</td><td>100.000</td><td>4 months</td></tr>
</table>

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

2.2.11 V2G Charging & Services on Terceira

Project Result general description	Project Result # / Title	V2G Charging & Services on Terceira			
	Project Result Short description/Service Description	The EV Charger is constituted by several high efficiency power electronic conversion stages, using the latest technology in terms of semiconductors and conversion topologies for the inclusion of the bidirectional power capability. The charger will incorporate a dedicated interface and control module with the iVPP. Additionally, grid support features will be developed and validated in the Terceira pilot.			
	Innovation content/ Competitive advantage/Benefits	The bidirectional power capability allied with grid support features allow the development of new business models that will benefit and enhance the role of the EV user			
	Legal, normative, or ethical requirements connected to the development	The regulation for the bidirectional charging is still on progress in terms of electrical safety of installations and the interface to the grid. Also, the creation of a market regulation for the valorization of the bidirectional capability and the contribution for the grid support is still under discussion. On the EV side, presently, the offer of EV models with bidirectional capability is limited.			
	TRL	Before IANOS		After IANOS	
		5		7	
Market	Targeted Market	North and Central Europe/Portugal/Spain			
	Customer segments and whom to address (inside the client's organization)	EV charging for commercial fleets			
	Potential competitors	ABB/Tritrium/Hypercharger			
IPR	Owner(s) of Result	EFAEM			
	Other Partners involved	-			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No

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	Revenue streams associated to the above exploitation claim	-	-	Product sales in (2024-27) 6,1 M€	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost		Time
		Industrialization	75 000€		4 months (in the first year)
		Third party Certification program covering different markets	80 000€		8 months (in the first year)
		Product launch commercial and dissemination activities	21 000€		-

2.2.12 DefPi Platform

This input has not yet been received. The information will be included in the latest version of the document if available.

PROJECT RESULT GENERAL DESCRIPTION	**Exploitable Result # / Title**		
	Short description of the project result/Description of the service provided	*Short description of the project result and of the related service provided*	
	Innovation content/ Competitive advantage/Benefits	*Added value of the project result/service provided from the end-user point of view*	
	Legal, normative or ethical requirements connected to the development of the project result	*Any legal, normative or ethical requirements that shall be taken into account during the development of the project result and potentially after the end of the project (e.g., any legal constraints for the exploitation?)*	
	TRL	**Before IANOS**	**After IANOS**
MARKET	Targeted Market and Sector(s) of application	*Example of application or scenario for the project result/service, including the target sector and alternative one(s)*	
	Time to market	*When the result developed is expected to reach the market*	
	Potential customers	*End-users/customers that could be interested to purchase/use the result developed*	
	Potential competitors	*Other companies potentially involved in the development of similar results*	
IP	Owner(s) of Result		

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	Other Partners involved					
	Joint ownership	*Is there any need of agreement about the ownership of the result before the end of the project? Yes/No*				
	Status of IPR: Background (B)	*List of partners providing existing knowledge to the development of the result* *B = if you provide your background and existing knowledge (already available at your company before the project start) for the development of the result.*				
	Status of IPR: Foreground (F)	*List of partners involved, and role effectively covered by them in the development of the final result* *F = if you are strictly involved in the development of the result and so your knowledge acquired during the project is essential to reach the final result.*				
	Status of IPR: Exploitation forms (partners interested in the exploitation of the result after the end of the project)	**M = Making the product**	**U = Using the result**	**L = License the result**	**O = Other means of exploitation**	
	Protection measures	**Patent**	**Trademark**	**Copyright**	**Industrial Design**	**Other**
		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
		If not yet, is it expected to protect the result in the future?				
EXPLOITATION STRATEGY	Exploitation claim	**Consulting activity**	**License to third parties**	**Making and selling the product**	**Providing a service**	**Internal use** (e.g., R&D, projects)
		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
	Revenue streams associated to the above exploitation claim	€	€	€	€	€
	Estimated effort to bring the project result to the market	Activities foreseen	Cost	Time		

2.2.13 Smart Energy Router

Project Result general description	Project Result # / Title	Smart Energy Router
	Project Result Short description/Service Description	The Smart Energy Router is a power electronics device that manages the energy transfer from/to different sources (distribution grid, RES-based distributed generators), loads and electricity storage system.
	Innovation content/ Competitive advantage/Benefits	The Smart Energy Router (SER) allows a holistic integration of local renewable energy production along with the integration of local energy storage, with proven effectiveness in managing the building's energy flux and improving the self-consumption ratios, while reducing electricity costs to end-users.
	Legal, normative, or ethical requirements connected to the development	If the DSO demands certification of the Smart Energy Router it may impact its installation. The prototype is planned to achieve TRL7 and is not expected to become a certified product during the lifetime of the project.

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	TRL	Before IANOS		After IANOS	
		5		7	
Market	Targeted Market	Research and development at university level			
	Customer segments and whom to address (inside the client's organization)	PhD students to support/develop their research work based on the Smart Energy Router technology; training/demonstration actions in energy efficiency field for university students and researchers.			
	Potential competitors	NA			
IPR	Owner(s) of Result	UNINOVA			
	Other Partners involved	No			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	Yes	No	No
	Revenue streams associated to the above exploitation claim	-	NA	-	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		--	--	--	
		--	--	--	

2.2.14 Flywheel

Project Result general description	Project Result # / Title	Flywheel
	Project Result Short description/Service Description	The Teraloop solution of a flywheel differs from conventional flywheel solutions by using a patented and prototyped hubless outer-rotor design. The flywheel will be integrated to the energy system for power management and fault ride through at a local industrial site.
	Innovation content/ Competitive advantage/Benefits	The end user suffers voltage sags events, which are mainly caused by more than 200 kW of power difference at the load side. Those escalate sometimes to a domino effect making more machines shutting down despite their voltage drop tolerance for more than 25%. Teraloop 100 kW flywheel will be ready to supply or absorb

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		100 kW of the power difference, the power tolerance range is increased by 100 kW added to the 200 kW. Based on this added tolerance, and the data provided by the end user, the end user will be able to mitigate about 74% of the voltage sags.	
	Legal, normative, or ethical requirements connected to the development	The flywheel solution must be safely installed. This requires Teraloop to perform numerous safety tests ahead of the deployment, and active monitoring upon deployment.	
	TRL	Before IANOS	After IANOS
		6	8
Market	Targeted Market	Example of application or scenario for the project result/service	
	Customer segments and whom to address (inside the client's organization)	Teraloop can be deployed as a 'power on demand' solution to reduce reliance on Li-Ion batteries for energy storage; for end-users it provides protection against fluctuation and revenue from extending the utility of distributed energy assets. It integrates with a client's electrical power infrastructure, either on AC or DC supply, and provides power or protection as needed.	
	Potential competitors	Beacon Power, Active Power, Zooz, Adaptive Balancing Power	
IPR	Owner(s) of Result	TERALOOP	
	Other Partners involved	None	
	Joint ownership (Need of agreement before the end of the project?)	No	
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation O&M	Other
		No	No	Yes	No
	Revenue streams associated to the above exploitation claim	-	-	5 000 €	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time
		O&M	5 000 €	2 weeks / year

2.2.15 Tidal Kite

Project	Project Result # / Title	TidalKite electricity integration

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	Project Result Short description/Service Description	TidalKite technology is a renewable energy solution that harnesses energy from tidal streams. The TidalKite technology is based on an underwater kite operated perpendicular to a water stream that creates a traction force that is converted into electricity. The TidalKite technology is unique in its capability to exploit energy from low velocity tidal streams in shallow waters[3].	
	Innovation content/ Competitive advantage/Benefits	The IANOS project scope related to the TidalKite focuses on the integration of the TidalKite produced electricity in the Ameland island electricity grid. A huge benefit of tidal energy is its continuous availability. This makes it a major component in a 100% renewable, reliable and affordable energy system. Studies show that adding tidal energy to the islands energy mix enables substantial cost reductions towards a 100% renewable energy system.	
	Legal, normative, or ethical requirements connected to the development	Key requirements requiring consideration relate to the environmental impact. Given the predictable and near-continuous availability of tidal energy, the TidalKite will likely be used to balance energy supply and demand for islands. The related quick stopping and (re)starting of TidalKite operation needs to be done in such a way not to harm nature's (protected) species. Developing the knowledge to do this in a safe and environmentally fitting way is part of the TidalKite activities in the IANOS project.	
	TRL[4]	Before IANOS	After IANOS
		6	8
Market	Targeted Market	Island energy cooperatives and islands energy systems	
	Customer segments and whom to address (inside the client's organization)	Various stakeholders are key to realising future TidalKite energy projects, including: - Island energy system policy makers and marine spatial planning specialists - Island energy system cooperatives and/or island energy companies	
	Potential competitors	Given the unique characteristics of the TidalKite, in cases there are no competing tidal energy solutions available, certainly in lower velocity shallow waters areas. The main alternative to tidal energy is the combination of other renewables, complemented with energy storage, to provide for a constant supply of renewabe energy to meet demand. Depending on the local tidal resources available, a TidalKite project will not be able to provide for all the energy needed to fully decarbonise an island's energy system.	

[3] The ocean energy strategic research and innovation agenda recognizes (on page 32) that: "Tidal kite devices are being developed for medium to low velocity currents". See: https://www.oceanenergy-europe.eu/wp-content/uploads/2020/05/ETIP-Ocean-SRIA.pdf

[4] The TRL refers to the integration of electricity produced in the islands energy system. The TRL enhancement of the total TidalKite system is realised in other projects.

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<table>
<tr><td></td><td></td><td colspan="4">Alternative solutions are:
- Alternative tidal energy technologies.
- Renewable energy technologies complemented with storage for continuous electricity supply.</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">SQH</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">-</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="4">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation
(e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>No</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Revenue streams associated to the above exploitation claim</td><td>-</td><td>-</td><td>It will depend on the number of TidalKite units [5] that can be placed in a project. This in turn depends on the local energy demand and Tidal resource available.
Cost indication of units is 3500 €/kW.</td><td>-</td></tr>
<tr><td>Estimated effort to bring the Project Result to the market (yearly)</td><td>Activities</td><td>Cost</td><td>Time</td><td></td></tr>
<tr><td></td><td>tbd</td><td>tbd</td><td>tbd</td><td></td></tr>
</table>

[5] The TidalKite unit needed, depends on the water velocity locally available (higher velocities enable more energy capture per unit and lower total costs). Higher velocities will typically enable more power generation, from higher capacity units. Also local conditions are key in determining costs of mooring systems and grid connections (a.o. determined by cable length) as well as cost to obtain permits and consents (e.g. seabed lease).
Also installation costs depend on locally available facilities (vessels, harbour cranes, workshops, etc).

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2.2.16 Hybrid Transformer

Project Result general description	Project Result # / Title	Hybrid Transformer			
	Project Result Short description/Service Description	The Hybrid Transformer is an innovative distribution transformer that incorporates new materials, power electronics technology and an advanced monitoring system.			
	Innovation content/ Competitive advantage/Benefits	Low losses and more sustainable design, with the capacity to continuously adjust the voltage during operation, in each phase, with unlimited number of operations and with other innovative features such as the contribution to reactive power compensation, voltage unbalance correction and improvement in the voltage profile quality. The transformer control unit will integrate advanced sensoring and diagnostic function blocks for processing the status and the condition of the transformer and the grid that is fed by this asset.			
	Legal, normative, or ethical requirements connected to the development	During the development stage, international standards (IEC 60076) and DSOs (EDA) specification must be respected.			
	TRL	Before IANOS		After IANOS	
		TRL 5		TRL 7	
Market	Targeted Market	DSOs with distributed renewable generation and high level of voltage quality profile.			
	Customer segments and whom to address (inside the client's organization)	DSOs (Distribution system operators of energy distribution grids) Procurement.			
	Potential competitors	ABB, Siemens, Schneider, General Electric Company, …			
IPR	Owner(s) of Result	EFACEC Energia			
	Other Partners involved	No other partners involved			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No

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	Revenue streams associated to the above exploitation claim	-	-	5 M€ (2024-2027)	-
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		Promotion and dissemination of results	~50 000€	2024	
		Product industrialization	~500 000€	2024	

2.2.17 PVs with microinverter

Project Result general description	Project Result # / Title	Smart Grid interactive PV systems, with plug inverters
	Project Result Short description/Service Description	BeON's microinverters allow for individual power generating PVs to directly connect to any electric socket (Pluginverter), just like a common electric appliance, in a safe, reliable, and simple way. This bypasses the need to connect to a switchboard or to an exclusive power line for the PV, cutting down on infrastructure needs, space, and costs. To integrate these highly distributed systems in Smart Grids a communication interface and API protocol will be developed in order to provide demand/response capability thus supporting local grid infrastructure capability and stability.
	Innovation content/ Competitive advantage/Benefits	The current mainstream technology with voluminous and size inflexible units of energy conversion (string inverters) do not offer adequate solutions, in any of the aspects. even the need for batteries removes the only advantage, cost. Therefore, there is right now, a definite need for microinverters integrated in a self-contained, self-consumption system. There is also the need to democratize power production and green thinking. This can be done by avoiding lengthy procedures to large installations and a purchase of a DIY kit (panel plus inverter with socket plug) will be ideal, and suitable for several situations. For the end users' point of view. An empowering feeling of contribution, of modernity or independence, leading to an exemplary and contagious feeling to friends and close ones. The difference in the offer proposed is a microinverter that is simpler, smaller, more reliable, and more affordable. Filling in all the gaps that exist for the introduction of microinverters into affordable DIY kits, formed in combination between the panel and the conversion unit - the microinverter. These kits can be directly connected to a wall socket for total convenience (BeON plug inverter). In order for these systems to interact with a smart-grid, and since these mini and highly distributed systems can be spread in many locations and a large area, a robust communications system will

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<table>
<tr><td></td><td></td><td colspan="2">need to be implemented in order to connect millions of such systems, creating energy communities and enabling that a central grid controller, can increase the power output dynamically in very localized points of the grid, with very high granularity, precisely targeting any grid point which maybe be under electrical stress.

Besides the communication between the BeON PV systems creating a community network, APIs will be created in order for the controlling central to be able to interact with each PV system, assisting demand/response algorithms, target precisely which areas are necessary to be intervened.</td></tr>
<tr><td></td><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="2">No legal constraints for the exploitation.</td></tr>
<tr><td></td><td rowspan="2">TRL</td><td>Before IANOS</td><td>After IANOS</td></tr>
<tr><td></td><td>TRL 2
A complete second-generation prototype is ready at M24. Several test batches have been completed.</td><td>TRL 8
The outcomes expected are the production of the best solution for the installation of a self-consumption photovoltaic system, consisting of a panel, a micro-inverter and a fixing structure, which means that a house or company will only install the adequate power to the satisfaction of its average consumption, with the objective of not buying (or reducing the purchase) of energy to the network saving money. The development of a smart microinverter integrated in module and prepared for an integrated system perfectly adapted to the self-consumption is the result of a long research work of 3 years.
The outcome post IANOS will be the most grid responsive and dynamic renewable power source in the world, being able to create energy communities on its own and allowing for panel by panel, house by house, the precise energy increase and reduction helping to keep grid stability without high impact on a large area.</td></tr>
</table>

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Market	Targeted Market	The potential customers are, energy retailers and energy solutions providers, distributors of solar products as well as Large solar installers and also end customers (homeowners and business owners will purchase from these clients for energy production). In case of making combination DIY Kits the clients can also be hardware/furniture stores like IKEA or B&Q. European panel makers may also be interested in partnering to make a Euro made PV kit with BeOn microinverters. The cost of producing photovoltaic energy at home is less than the cost of purchasing from the distributor.			
	Customer segments and whom to address (inside the client's organization)	'Do It Yourself' (DIY) Kits can be sold in home appliances or local appliance stores, either for electricians who are not PV specialists or even for homeowners with no specific training, since the facility can be as installation of any equipment. On the other hand, the idea of a self-consumption kit induces a change in thinking about energy production and consumption. The owner of the photovoltaic plant not only produces energy from a renewable and potentially inexhaustible source - the sun - but also induces the reduction of energy consumption, motivating the consumer not to waste it.			
	Potential competitors	While inverter manufactures may have a basic way to control the inverter, they lack grid operator integrability, Currently the landscape of grid integrated distributed PV systems is practically inexistent. To address this we intend to have a product during this project which can immediately be used and set the standard for distributed PV smart-grid interaction algorithms and technologies. Besides the highly complex state of the art technologic implementations during the project, this highly integrated system, transcends even technology and goes in to the area of collaborative co-development and value co-creating, making it difficult for companies developing either inverters or microinverters to follow, without going through the same process as we are doing with IANOS and all the partners.			
IPR	Owner(s) of Result	Bemicro LDA			
	Other Partners involved	-			
	Joint ownership (Need of agreement before the end of the project?)	No			
Exploitation Strategy	Exploitation claim	Consultancy service	Academic exploitation	Commercial exploitation (e.g., selling licenses)	Other
		No	No	Yes	No
	Revenue streams associated to the	-	-	TBD	-

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	above exploitation claim				
	Estimated effort to bring the Project Result to the market (yearly)	Activities	Cost	Time	
		Dissemination results	25 000€	5 years	
		Communication to the potential market. Marketing campaign	75 000€	5 years	

2.2.18 Biobased saline batteries C1

Project Result general description	Project Result # / Title	Bio Based Battery C1	
	Project Result Short description/Service Description	Bio Based Battery technology is a unique and safe renewable energy solution that stores energy to have better use of local energy harvested from local resources like the sun, hydropower, wind or other means you have to store it locally for local use.	
	Innovation content/ Competitive advantage/Benefits	The IANOS project scope related to the Bio Based Battery C1 focuses on the island integration. This unique concept battery is developed for electricity storage in a simple, safe and affordable way. Not using valuable resources like lithium and Kobalt. This recyclable battery has many advantages above lithium solutions for stationary applications. It is safe in use no risk of fires and thermal runaways. Has a unique Natural Self Cooling system. No energy loss for process cooling. It is very flexible and mobile. Can be transported and assembled on remote sites. flexible for input and output AC and DC. Fully recyclable. Currently in 120 KWh capacity per battery and scalable to multiple MWh.	
	Legal, normative, or ethical requirements connected to the development	The BBB C1 solution must be safely installed. This requires SuWoTec to perform numerous safety tests ahead of the deployment, and active monitoring upon deployment.	
	TRL[6]	Before IANOS	After IANOS
		6	8
Market	Targeted Market	Island energy cooperatives and islands energy systems	
	Customer segments and whom to	SuWoTec can be deployed as a safe 'power on demand' solution to reduce reliance on Lithium and Kobalt batteries and other systems	

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<table>
<tr><td rowspan="2"></td><td>address (inside the client's organization)</td><td colspan="4">for energy storage; for end-users it provides protection against fluctuation and revenue from extending the utility of distributed energy assets. It integrates with a client's electrical power infrastructure, either on AC or DC supply, and provides power or protection as needed.</td></tr>
<tr><td>Potential competitors</td><td colspan="4">Given the unique characteristics of the Bio Based Battery, there are no real competitors for the several applications. Like the Natural Self Cooling System. And the safe recyclable 120 kWh setup.</td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">SuWoTec</td></tr>
<tr><td>Other Partners involved</td><td colspan="4">None</td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="4">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation
(e.g., selling licenses)</td><td>Other</td></tr>
<tr><td>No</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Revenue streams associated to the above exploitation claim</td><td>-</td><td>-</td><td>It will depend on the number of SuWoTec units that can be placed in a project. This in turn depends on the local energy demand and resource available.
Cost indication of units is 450-600 €/kW.</td><td>-</td></tr>
<tr><td rowspan="2">Estimated effort to bring the Project Result to the market (yearly)</td><td>Activities</td><td colspan="2">Cost</td><td>Time</td></tr>
<tr><td>tbd</td><td colspan="2">Tbd</td><td>tbd</td></tr>
</table>

2.2.19 IANOS Energy Planning and Transition suite (IEPT)

Project	Project Result # / Title	IANOS Energy Planning and Transition suite (IEPT)

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<table>
<tr><td rowspan="5"></td><td>Project Result Short description/Service Description</td><td colspan="4">A suite that supports the investments of the different stakeholders providing a holistic approach that quantifies both the costs and benefits of the IANOS interventions in the demonstration sites, i.e., Lighthouse and fellow islands of IANOS, as well as providing a tool that facilitates the fundraising campaigns.</td></tr>
<tr><td>Innovation content/ Competitive advantage/Benefits</td><td colspan="4">This tool satisfies the need of the decision-makers across the energy value chain by offering a tool that can provide quantifiable insights supporting their potential investments decisions in clean and smart energy interventions</td></tr>
<tr><td>Legal, normative, or ethical requirements connected to the development</td><td colspan="4">Sensitive data from the end-users shall be kept confidential without relieving them to unauthorized third parties.</td></tr>
<tr><td rowspan="2">TRL</td><td colspan="2">Before IANOS</td><td colspan="2">After IANOS</td></tr>
<tr><td colspan="2">4</td><td colspan="2">7</td></tr>
<tr><td rowspan="3">Market</td><td>Targeted Market</td><td colspan="4">Example of application or scenario for the project result/service</td></tr>
<tr><td>Customer segments and whom to address (inside the client's organization)</td><td colspan="4">Renewable owners
DSOs
TSOs</td></tr>
<tr><td>Potential competitors</td><td colspan="4"></td></tr>
<tr><td rowspan="3">IPR</td><td>Owner(s) of Result</td><td colspan="4">UBE, CERTH, TNO</td></tr>
<tr><td>Other Partners involved</td><td colspan="4"></td></tr>
<tr><td>Joint ownership (Need of agreement before the end of the project?)</td><td colspan="4">No</td></tr>
<tr><td rowspan="4">Exploitation Strategy</td><td rowspan="2">Exploitation claim</td><td>Consultancy service</td><td>Academic exploitation</td><td>Commercial exploitation</td><td>Other</td></tr>
<tr><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes/No</td></tr>
<tr><td>Revenue streams associated to the above exploitation claim</td><td>€</td><td>€</td><td>Selling licensing</td><td>€</td></tr>
<tr><td></td><td>Activities</td><td>Cost</td><td colspan="2">Time</td></tr>
</table>

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	Estimated effort to bring the Project Result to the market (yearly)	More actions needed for the platform generalization to make it automatic to the different technologies. Demonstration to different environments	100.000€	2yr.

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2.3 IANOS Draft Exploitation Strategy

2.3.1 Assessment of Exploitable Results Technology Readiness Level (TRL)

The TRL, Technology Readiness Level, scale is a metric for describing the maturity of a technology[7] which consists of 9 levels. Each level characterizes the progress in the development of a technology, from the idea (level 1) to the full deployment of the product in the marketplace (level 9), as described in Table below.

[7] https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annees/h2020-wp1820-annex-g-trl_en.pdf

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Table 2-4: Technology Readiness Levels (TRLs)[8]

[8] https://acqnotes.com/acqnote/tasks/technology-readiness-level

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Level 1	Basic Research: basic principles are observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include fundamental investigations and paper studies
Level 2	Applied Research: technology concept and/or application formulated	Once basic principles are observed, practical applications can be formulated. Examples are limited to analytic studies and experimentation.
Level 3	Critical function, proof of concept established	Active research and development are initiated. Laboratory studies aim to validate analytical predictions of separate components of the technology. Examples include components that are not yet integrated or representative.
Level 4	Laboratory testing of prototype component or process	Design, development, and lab testing of technological components are performed. Here, basic technological components are integrated to establish that they will work together. This is a relatively "low fidelity" prototype in comparison with the eventual system.
Level 5	Laboratory testing of integrated system	The basic technological components are integrated together with realistic supporting elements to be tested in a simulated environment. This is a "high fidelity" prototype compared to the eventual system.
Level 6	Prototype system verified	The prototype, which is well beyond that of level 5, is tested in a relevant environment. The system or process demonstration is carried out in an operational environment.
Level 7	Integrated pilot system demonstrated	Prototype is near, or at, planned operational system level. The final design is virtually complete. The goal of this stage is to remove engineering and manufacturing risk.
Level 8	System incorporated in commercial design	Technology has been proven to work in its final form under the expected conditions. In most of the cases, this level represents the end of true system development.

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Level 9	System ready for full scale deployment	Here, the technology is in its final form is ready for commercial deployment.
Beyond 9	Market introduction	The product, process or service is launched commercially, marketed to, and adopted by a group of customers (including public authorities).

In order to access IANOS technology readiness levels, an estimation has to been given by the leaders of each of the exploitable results. It is important to note that following technology readiness levels are estimated and might change in line with the project development.

With respect to the first version of the Plan for Use and Dissemination of Foreground, the TRL of most of the KER was assessed comparing the level before the IANOS project and that expected after the project end, as reported in the figures below. The final and completed TRLs of each KER will be provided in the next version of the document.

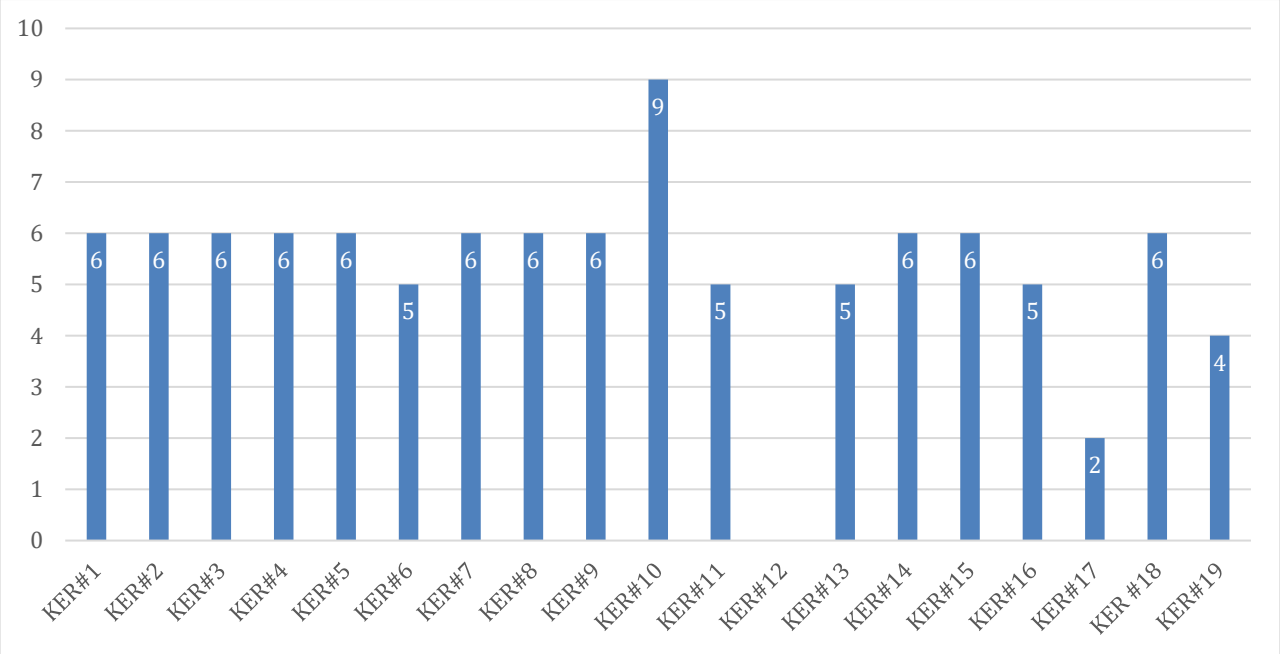

Figure 2-3: Technology KERs before the project

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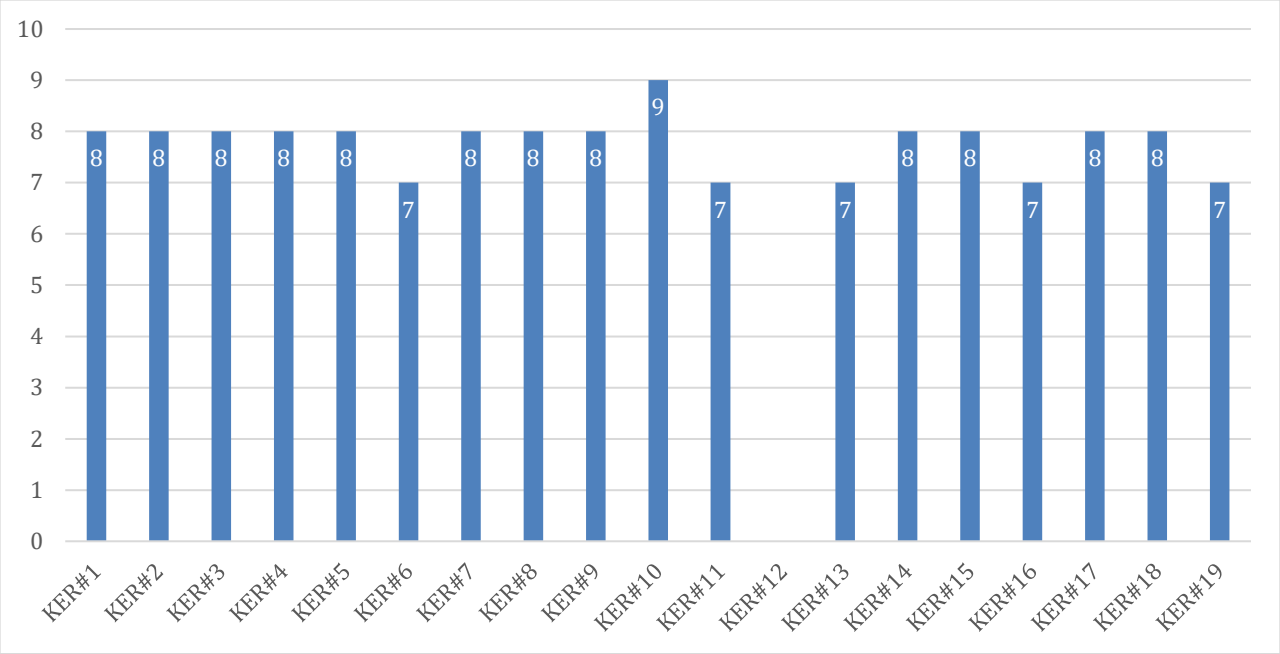

Figure 2-4: Technology KERs after the project

2.3.2 Methodology for exploitation routes

As detailed in previous section 2.1 exploitation means that project results can be used in further research activities, other than those covered by the project, or in developing, creating, and marketing a product or process, or providing a service. Therefore, the possible exploitation routes options adoptable for each PR identified can be divided into several categories, such as:

- Use for further research (e.g., use of the newly gained knowledge in further research activities, projects or even in enhancing products for the market uptake to find new exploitation perspectives).
- Consultancy services (e.g., professional service providing expert advice for a fee).
- Academic exploitation (e.g., development of specific research topics, participation and/or organization of seminars and, in the case of universities, new bachelor, master and PhD thesis development).
- Commercial exploitation (e.g., direct sale of products/services, selling licenses).
- Spin-off activities
- Cooperation agreement/Joint Ventures
- Standardization activities (e.g., contribution to new standards or their revision).

Each of the above specified possible route will define the exploitation route for each specific PR. These routes will be developed with the cooperation of the Key Exploitable Results lead partner during the next months of project.

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2.3.3 Exploitation Strategy at partner level

The IANOS project is coordinated by EDP, a leading Energy Utility, with vast experience in European projects. The consortium consists of 34 partners from 8 European countries, with 60% involvement of industrial or SMEs partners. 5 research centres and universities contribute with scientific expertise in analysis, methodologies, dissemination support, technology development, work covering several different aspects on the integrated IANOS framework.
10 SMEs demonstrate novel technical solutions (such as RES and storage) on both lighthouse islands showcasing their relevant expertise. 10 heavily experienced large industries and utilities support the efficient integration and performance monitoring of all (i.e., ICT, Energy, Mobility etc.) solutions on the LHs as well. Additionally, citizens are involved in the project so it is ensured that IANOS will have a strong user-driven approach. Dissemination and exploitation potential is strong, including leading EU partners in the field (such as RINA, EREF). IANOS's Horizontal Partners will focus on global solutions (including the development of IEPT and iVPP) for the chosen lighthouse and fellow islands. Fellow islands participate also through their municipalities and are accompanied by supporting partners for drafting their replication plans. A core responsibilities' split for the local LH ecosystems partners is made in the following table.

Table 2-5: Partners responsibilities

Island	Energy	ICT	Citizen engagement	General
Terceira	EDP, UNINOVA, EFACEC, EDA, EFAEM, TERA,	EDP, UNINOVA, EFACEC, EDA, EFAEM, TERA,	EDP, UNINOVA, EFACEC, EDA, EFAEM, TERA,	EDP, UNINOVA, EFACEC, EDA, EFAEM, TERA,
Ameland	Sunamp, Beon	Sunamp, Beon	Sunamp, Beon	Sunamp, Beon

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Based on the information provided in the first project period, the individual partner exploitation strategies have been defined in the table below.

Table 2-6: Exploitation at partner level

Partners	Role in the project	Exploitation strategy
EDP (Portugal)	EDP is the project coordinator, it is involved in the majority of the project's tasks and it is the lead partner of WP 2 and 6. In WP2 EDP is involved in the definition of technical and integration requirements, Use Cases (UCs) formulation and design, meanwhile in WP6 is involved in the testing, deployment, system integration, UCs operation and monitoring at project's Lighthouse Island #2. In addition, EDP is responsible for collecting all the relevant information linked to the proposed TRL advancements, evaluate the most innovative features to be developed and tested in the project, mainly focused on integrability and optimized interoperability, and together with tech providers, define the projects technology roadmap.	Commercial exploitations know-how: EDP take a step further in what concerns Smart City applications and solutions concerns RES, storage, mobility and citizen engagement domains. EDP acquired foreground knowledge directly linked to the results from the demonstration of solutions targeting building and city-level energy management and citizen engagement, e-mobility, storage, and RES grid-integration. Another possibility is the joint exploitation of results particularly targeting partners whose solutions are somehow framed within the technical domains. Examples of those solutions are grid-integrated assets, such as the hybrid transformer and the V2G charging solutions, and iVPP modules and tools. Scientific exploitations: publications regarding the integration, demonstration and monitoring of the project solutions, and presentation in internal events for innovation dissemination and external conferences and workshops.
UNINOVA (Portugal)	Characterization and use of energy flexibility, including smart distribution management systems and flexibility control algorithms to perform Demand Response and to the development of power electronics Energy Router.	Scientific exploitations: Use the knowledge gained from the project to enrich relations with its partners. Through the experience gained within the project launch new research both internally (PhDs, MsCs, etc.) and with other partners. Use the equipment/ technology developed, such as Smart Energy Router, to support/develop the research work in smart grids and energy efficiency fields, or to carry out training and demonstration activities for university students and researchers.
EFACEC (Portugal)	EFACEC develops a novel distribution transformer with the capability of adjusting and regulating the output voltage during operation, to cope with increased consumption variability and increased installed PV generation capacity for the Terceira island. Its main role is to develop the Hybrid Transformer (HT), an innovative transformer concept specifically designed for distribution level applications to cope with increased consumption variability and increased installed PV generation capacity.	Commercial Exploitation Know-how: Use knowledge obtained in the project and incorporate the technological outputs of the project in its products and solutions. This will improve the product portfolio and pave the way to a more global offer of EFACEC within the scope of smart grids and digital transformation business areas. Update products and solutions and leverage their technical readiness level, allowing a future commercial exploitation of the innovative project outcomes. Scientific exploitations: Collaborate in joint scientific initiatives promoted by the Academy partners.

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Partners	Role in the project	Exploitation strategy
EDA (Portugal)	The main role of EDA is to ensure the interface in the relationship between all partners involved in the application, the target customers, and link with the independent producers. To achieve this object EDA has promoted several engagement sessions, in Terceira, regarding the end users/testers of every technology, and has performed the site surveys for each technology to be deployed in Terceira, allowing IANOS Partners to have a better understanding of their technical needs. EDA is helping the several technology deployments on Terceira, and then will conduct several explanation sessions, on how to use each of the deployed technology.	**Commercial exploitations know-how:** Use of acquired knowledge in smart grids to promote the integration of renewable energy sources in island systems. Existing and acquired knowledge will allow to take a step further in reaching climate goals in the other islands managed by the group by the integration of RES. **Scientific exploitations:** EDA is co-author regarding the papers: • 11345 – Integrated solution to decarbonize and improve a resilience of power and energy system in geographical islands – CIRED 27th International Conference on Electricity Distribution • IANOS – Innovative Energy Storage Solutions for the decarbonization of geographical islands.
EFAEM (Portugal)	The main role of EFAEM is the development of v2g chargers with embedded grid support features and the smart integration and exploitation of the EV charging services within the iVPP ecosystem. The KER 11, for which EFAEM is responsible, is directly related with the v2g charger technology and the associated charging service. As planned in the KER strategy, the activities related with the certification and industrialization are being implemented.	**Commercial Exploitation Know-how:** Use the knowledge acquired with IANOS project and incorporate the technological outputs of the project in its products and solutions. Through the knowledge gained the enhancement of product portfolio in distinct areas will be possible. Consequently, EFACEC will offer to their partner a more global offering of within the smart grids and digital transformation business areas. **Scientific exploitations:** Collaborate in joint scientific initiatives promoted by the Academy partners within the scope of its activities in the project.
RGA (Portugal)	The main role of RGA in the project is to ensure the smooth implementation of the Azores demonstrator, coordinating all the necessary local actions. RGA has been involved in activity related to community engagement, regulatory and legal aspects, and planning how to decarbonize the Azores. RGA presented the Portuguese legal framework in the IANOS Workshop and give its contribution to the Decarbonisation Master Plan. RGA was actively involved in the preparation and participation of a site visit to Terceira in order to assess the conditions for the deployment of technologies in identified households, together with regional and national (Portuguese) partners. Furthermore,	Use acquired knowledge on public policy, regulation and legislation and the findings and outcomes of the LH Ameland, as well of the FHs to future activities and joint exploitation of results.

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Partners	Role in the project	Exploitation strategy
	RGA has been actively involved in community engagement in Terceira (WP6 and WP8). RGA has developed together with UNINOVA and NEC a questionnaire on energy transition distributed in Terceira Island.	
Cleanwatts (Portugal)	The main role of Cleanwatts in the project is as technological provider for the Portuguese pilot responsible for integration and commissioning of the complete system (WP6) and partner involved in the development of the VPP platform (WP4).	**Commercial exploitations know-how:** Use the experience gained from the project to improve and expand the interoperability with third party systems and services. This will allow to reduce implementation costs and expand the market scope of its solutions in Energy Communities. The inputs of the project can be used to customize its products which consequently could be offered to a new part of clients who may be attracted by energy communities or the investment in RES.
Teraloop (Finland)	Teraloop participates as technical partner in WP6 and specifically in tasks 6.1 to 6.4. Teraloop's flywheel is due to be installed at an industrial facility for power quality management, more specifically avoiding voltage sags.	Teraloop's solution will be interfaced both with the grid and the industrial facility, operating according to the control system provided by Teraloop, acting based on the measured grid data. This activity will allow Teraloop to collect data that will be used to prepare paper that demonstrate the impact of the technology.
Sunamp (Scotland)	Sunamp is the technology provider for Heat Batteries. This technology is used in the pilot plants to ensure optimal performance of the thermal systems. Sunamp is involved in the sizing and design, integration with technologies from other partners, installation and monitoring of the thermal stores. Sunamp has been able to implement an Ethernet connection to Thermino to be able to read data provided by Thermino and being able to monitor the behavior of the heat battery in the real island energy environment where 24 Therminos are installed.	**Commercial exploitations know-how:** Through the IANOS project it is possible to demonstrate the integration of the heat batteries technology in a real-life island energy environment, bring forward knowledge and experience of the renewable technology in a balanced smart energy system. This information and the process taken at IANOS will be used to try and develop the same approach on other islands around the world.
BEON (Portugal)	BeON has developed the remote power adjustment for plug inverters for PV systems, making it possible for grid operators to manually or automatically adjust in mass the power output of PV systems connected to the network at an individual panel level granularity and in real time. BeON developed the integration capabilities within the IANOS ecosystem for remote data viewing and power control output. BeON has installed PV systems in Terceira Island.	**Commercial exploitations know-how:** Exploitation of results with EDP, in terms of integrating BEON system within EDP grid operators and, for PV system for Terceira island, in terms of local grid integration and control under difficult local grid conditions, such as overload of local grids.
Ameland (Netherlands)	Both in terms of organisation and management, the municipality of Ameland facilitates all experiments in the context of Sustainable Ameland as well as initiatives of individuals and	The project results will be used for to facilitate possible case which fits in the (energy) landscape that are beneficial to the island. This can lead to the goal to be CO2 neutral in 2035.

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Partners	Role in the project	Exploitation strategy
	entrepreneurs on the island. Besides, Ameland initiates and facilitates the process of citizen participation in the field of sustainable development on the island.	
NEC (Netherlands)	New Energy Coalition leads WP8 and gives its contribution in tasks. T2.2, T5.4, T8.3 and T8.4. Based on best practices from citizen engagement and replicable business models, NEC develops crowd funding approaches that foster deep decarbonisation of energy systems.	Commercial exploitations know-how: Future development and use of the approach developed by New Energy Coalition for the use of waste streams as feedstock for energy. Scientific exploitations: Use acquired knowledge writing scientific report on legal and economic barriers that hinder deep decarbonisation of islands and one on best practices on crowdfunding, combining the citizen engagement and business model research within the project.
TNO (Netherlands)	TNO is the technology provider for technical and commercial flexibility aggregator companies who will capture the value of the available flexibility on the island and system wide solution integration models.	TNO is a not for profit organization and as such no commercial exploitation is in order. However, TNO will support other commercial businesses and industries to innovate. For IANOS is in line with TNO's research programming, the innovations of IANOS will be part of the process. As for products and services developed, TNO can work with 'tech tranfer' processes to set up licensing or spin-out schemes. The exploitation is primarily academic as the technology used is to improve the knowledge position which can further support in consulting governments, municipalities or industry park owners.
ALI (Netherlands)	Alliander has legal task as Grid Operator and follows all activities in the use cases that are carried out on Ameland.	Exploiting the knowledge gained about the managing of energy flows and to control the "new system" of bottom-up energy-management. From the project it is also possible to understand how to predict generation and consumption and how to manage storage and conversion between the different energy carriers (Elect, gas, heat) in order to optimize the social value of the entire energy system.
AEC (Netherlands)	AEC is mainly involved in WP5 (LEC, stakeholder and community engagement, owner of RES -solar park).	Through the knowledge and experiences gained, especially on stakeholder and community engagement, it will be possible to replicate, upscale and increase energy efficiency and self-sufficiency of citizens of Ameland.
SWT (Netherlands)	SuWoTec further develops and installs a 120kWh battery close to a new construction with 13 houses in the city of Nes. SuWoTec support the construction and optimization of the system which will consist of aquathermal heat pumps and buffers. SWT deals with battery testing and delivering the battery system to Ameland.	Commercial exploitations know-how: development of 3-5 new patents on decentralized energy storage and delivery, efficient energy use and reduction of the carbon footprint. In addition, it is expected a growth for assembly, production and installation. Scientific exploitations: Through the knowledge gained from the project, 10 publications are planned.
HUAS (Netherlands)	HUAS is active in T 5.5, T 7.5, T 8.1 and T 8.2. The community engagement approach as developed within WP8	Commercial exploitations know-how: The approach, the business modelling methods and the best practice guides developed within the

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Partners	Role in the project	Exploitation strategy
	was first used within WP5 and led to valuable insight in the approach (which can and will be developed further) and in the actions to be taken on Ameland.	project could be used in future projects on community engagement. The knowledge gained could be integrated in education programs. Scientific exploitations: Based on the results and knowledge gained in the project, HUAS will deliver project reports on business modelling and on community & citizens engagement and monitoring.
Neroa (Netherlands)	Neroa is responsible for the development of the VPP framework. Neora provides its support in the installation and development of the architecture and dissemination activities and in the development of optimal urban planning tools for fast decarbonization. Neroa has developed a platform to be able to monitor the energy assets and have also developed interfaces and configured existing open source hardware to be able to connect to the energy assets.	Commercial exploitations know-how: The experience gained during the project will allow Neroa to increase the number of projects to implement an open source DefPi (energy management system). The further development of the DefPi platform will allow the implementation of projects to local governments, energy corporations.
REP (Netherlands)	In cooperation with a NEROA and TNO, REPowered develop a smart algorithms and services on the iVPP to optimize self-consumption, grid stability, decarbonisation of the transport, large industrial loads and the heating network and possible share of RES within the existing network.	Commercial exploitations know-how: Within IANOS project, REPowered will refine the current algorithms for multi RES, various storage technologies, demand response to TRL 8. Using the developed iVPP by TNO combined with the algorithms and tool will create new services for REPowered to optimize self-consumption and reduce grid enforcement using the available energy flexibility.
SQH (Netherlands)	In IANOS project, SQH adapts its TidalKite technology to make it suitable for deployment near Ameland, enable integration in the island energy system to enable tidal energy production from this location. To achieve this goal, SQH carries out the following activities: grid integration, forecasting, flexibility assessment and integration in central dispatcher.	Commercial exploitations know-how: Through the activities developed in the project SQH will demonstrate the integration of the TidalKite technology in a real life island energy environment, bring forward knowledge and experience of the renewable technology in a balanced smart energy system. This knowledge could be used in the future for larger projects.
Bareau (Netherlands)	The main role of Bareau is to be the process technologist and the operator of the AHPD plant, so that the extra substrates like swill, hydrogen and carbon dioxide, will be treated and the green gas production will be scaled up consequently.	Commercial exploitations know-how: The result of the project will be used further to develop AHPD design model. Scientific exploitations: Barau will produce at least 2 peer reviewed articles.
GASTERRA (Netherlands)	GasTerra supports the development of the small-scale High-Pressure digester.	N/A (GasTerra will be involved without budget)
LAMP (Italy)	Lampedusa municipality will support the action by providing relevant information for IANOS activities linked to the peculiarities of the archipelago and providing the local perspective. In addition, it will involve local	Further research and replication in other geographical island context and improve access to other funding opportunities. Use the knowledge gained during the project regarding citizen engagement solutions in the

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Partners	Role in the project	Exploitation strategy
	stakeholders towards the adaptation of IANOS innovations on the island, thus guaranteeing their future uptake. Its main objectives are to study the technologies used by Lighthouse islands and build a Master Use Case that could handle 50% and 95% RES penetration scenarios. Lampedusa also engaged in the development of analysis and modelling based on the use of "IANOS" technologies such as Teraloop Flywheel, V2G systems, hybrid heat pump+PCM and Electrolyzer+Fuel Cell to produce H2 to fuel a sustainable Ferry.	face of greater connection with citizens who usually feel excluded from energy decisions.
CNR-IIA (Italy)	The main objective of CNR-IIA in IANOS project is to support Lampedusa municipality in scientific and peculiar activities in the replication of IANOS concepts. In addition, it provides insights derived from its knowledge generated in years of activities in collaboration with Italian islands. CNR-IIA works on the environmental benefits and impacts and the realization of the replication and scalability plan of Lampedusa.	Commercial exploitations know-how: Knowledge gained by supporting Lampedusa could be useful in further energy transition projects. This will allow the replication in other geographical island context and improve access to other funding opportunities. Scientific exploitations: One peer-reviewed publication
BORA (France)	The role of municipality of Bora Bora is to facilitate the project developed by Akuo on the Island. The municipality brings the political legitimacy to the project by granting knowledge of the local context and opportunities. The municipality of Bora Bora is also engaged in activities of optimization of waste collection and treatment, through the implementation of high temperature pyrolysis to destroy waste (to optimize the land) and development of methanization (wood, cardboard, fabrics). Studies have been launched in January 2023, delivery of the studies are expected at the end of June 2023.	Not applicable for a public body.
AKUO (France)	In IANOS project, Akuo supports the municipality of Bora Bora throughout the process of decarbonizing its power generation and transportation sectors. Akuo supports the municipality in its ambitious target of increasing the share of renewable energies up to 75% by 2030. In addition, Akuo is in the process of deploying 2,5 MW of PV agricultural greenhouses and shading	Commercial exploitations know-how: The results obtained from the project will be useful to optimize the processes by understanding the challenges faced by other islands.

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Partners	Role in the project	Exploitation strategy
	structures coupled with an energy storage system, further facilitating the island's food autonomy, for which technical studies are currently being carried out.	
NISYROS (Greece)	The Municipality of Nisyros is involved in the replication activities of the proposed solutions in Nisyros island in WP9 and more specifically in Task 9.2.	Not applicable
CERTH: first group ITI (Greece)	CERTH is the technical coordinator of the project. CERTH/ITI leads T1.2, T4.2, T4.3, T2.5, T6.1 and supports the replication activities for the FI of Nisyros. CERTH is one of the main developers of the iVPP platform, FEID-PLUS and the Crowdfunding platform. CERTH contributes to the development of the: • Forecasting Engine, built upon state-of-the-Art Machine Learning algorithms and satisfying load and generation forecasting requirements of residential prosumers and RES infrastructure; • OptiMEMS module within the Centralized Dispatcher, for providing cost-efficient optimal dispatch within distributed energy resources infrastructure (also including electrical and thermal storage technologies); • Intelligent Segmentation, Aggregation and Clustering Engine, for assisting Aggregators' decision-making regarding portfolios of residential prosumers.	CERTH will exploit the IANOS's results both directly and indirectly: • direct exploitation: protection of the knowledge created by CERTH during the project through patents or copyright and granting licenses for its use or collaboration with industry. • indirect exploitation: Use the knowledge gained during IANOS project CERTH may increase its role in the respective technology areas of research (blockchain, Flexibility enabling technologies, etc.) on a European scale. In addition, the technologies validated under IANOS will attract the interest of relevant enterprises and can initiate new collaborations with industrial partners towards technology transfer and commercialisation. The knowledge and skills gained can be exploited both academically and industrially. For instance, they can be provided as commercial solutions in the market, as means to be used in certification, standardization, consultancy services as well as in further R&D.
CERTH/CPERI (Greece)	CERTH/CPERI is involved in T2.3, T 3.1, T7.2, T9.1 and T9.2. CERTH/CPERI supports the technical coordination of the IANOS project and supports the replication activities for the FI of Nisyros. In the framework of the IANOS project, CERTH/CPERI has developed three distinct, but also synergetic platforms, namely i) VERIFY ii) INTEMA and finally iii) USE. Each of these platforms, with their technology validated under IANOS, has the potential of attracting the interest of relevant enterprises and can initiate	Understanding, knowledge and leadership in the technology areas of life cycle assessment, power flow, project evaluation and energy modelling have increased thanks to IANOS projects. CERTH/CPERI is open to the idea of joint exploitation of the results with other partners and is willing to contribute towards this goal. However, such a venture is something that should be decided on a consortium-level. Therefore, CERTH/CPERI is planning to launch a spin-off company that will take advantage of the collected knowledge regarding the VERIFY, USE and INTEMA platforms, with the goal to enable businesses, governments, and communities to reduce their carbon footprint and achieve their

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Partners	Role in the project	Exploitation strategy
	new collaborations with the relevant industrial partners.	sustainability goals through data-driven insights and innovative solutions.
ETRA (Spain)	ETRA is mainly involved in WP7 for the market analysis, the cost benefit and effectiveness assessment and the implementation of the business models. ETRA is responsible for the cybersecurity issues and it takes part in many tasks in the project. ETRA I+D brings into the project its expertise in research and development of new technologies and applications as well as a long success record in managing large scale complex EU projects.	IANOS results will be presented and demonstrated to ETRA's customers that are interested in adopting the solutions, customized to fit their needs if necessary. As ETRA's product (ESB) is part of the iVPP orchestration platform a joint exploitation plan and activities will be developed in collaboration with other project partners whose products are also part of the platform, in order to start running the iVPP platform in the islands. In collaboration with other project partners, ETRA will participate in marketing activities focused on raising public awareness of the developed tools and the project's outcomes by publications such as scientific articles, whitepapers and reports about the tools' functionalities and pilot site activities.
ENG (Italy)	ENG is leader in four Tasks and in one Work Package. ENG is also involved in the IANOS operational framework (WP4) and in the replication and scalability on EU Islands (WP9). In IANOS project, ENG team developed a P2P market platform that enables prosumers in a local network to directly trade energy with each other, by avoiding RES curtailment and future grid transports. The platform, based on blockchain, guarantees the transparency and security of the transaction, which remains permanently recorded in the platform, allowing all parties to audit the results. Fungible tokens based on ERC-20 standard are exploited as a payment for the purchase of energy between prosumers.	Evaluate the project results and the assessment in the different pilots, to extend the company offer aiming at support the emergent ecosystem models. Support to the new models will extend the company commercial offer under the perspective of evolved ecosystem models, those new models will drive the company ICT offer evolution incorporating the project results on the necessary extensions. The result of the project will be exploited in several European research projects exploring the usage of distributed ledger solutions in the energy field; moreover, these technologies will be made available to the related Engineering business unit. Part of the last step is to exploit the results of the IANOS project by including them in the business offer to its customers. Engineering provides services and projects to more than 300 clients in the field of Smart Energy & Utilities. In this context, the P2P market could be seen as a further modular extension of the tool suite enriching its offer with a marketplace for Local Energy Communities stakeholders.
RINA-C (Italy)	RINA is mainly involved in the Dissemination and Communication activities, as well as in the impact assessment and the market analysis. In addition.	Commercial exploitations know-how: promotion of low carbon energy planning services to EU islands Other: strengthening RINA-C knowledge about islands energy systems decarbonization, creation of new R&D and industrial consulting business opportunities
EREF (Belgium)	EREF's main role is to execute tasks related to the communication, dissemination and promotion of projects results, in particular at EU; and to act as hub transferring knowledge and information among national and the EU levels, including between the consortium's project partners and	Commercial exploitations know-how: EREF will share IANOS project among its national renewable energy associations. The expertise and knowledge gained in course of the IANOS project will benefit renewable industry actors in considering new approaches in terms of business models and operational proceedings, but also deliver insight on general financial

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Partners	Role in the project	Exploitation strategy
	relevant EU and national decision-makers and stakeholders. EREF is involved in the finalisation and publication of D 8.2 which presents an extensive portfolio of tools and methods to foster meaningful participation of local community stakeholders and citizens. In addition, EREF initiated extensive stakeholder dialogue in the conceptualisation and preparation of the national / regional policy advisory papers (D8.3 and 8.4) and held national stakeholder workshops (D8.5 and 8.6), with the objective to further engage with citizens and local stakeholders on the IANOS fellow islands.	viability and implementation of the integrated solutions developed for decarbonising geographical islands. Scientific exploitations: EREF closely works with a number of knowledge partners at national and EU level, including research institutes and universities. The IANOS project results will be exploited in the knowledge transfer among the EU and national level, and feed into the fact finding tasks that are related to EREF's dialogue with decision-makers and further stakeholders. The scientific exploitation further extends to related project work carried out by EREF and its partners. Other: EREF will exploit the IANOS project results in the general policy-making process started with the recently announced "European Green Deal", which will result in a set of policy initiatives issued by the European Commission, to accelerate and strengthen efforts for effectively decarbonising Europe's societies. The related policy process is expected to remain on top of the EU's institutions' and energy and climate protection stakeholders for at least during the 5 years. Integrated renewable solutions as developed under IANOS will make valuable contributions to the decision-making process.
HAEE (Greece)	HAEE is involved in the development of a dissemination strategy exploiting its identity as an interdisciplinary forum for the exchange of ideas, in the creation a specific communication identity for the project and in the establishment of a communication and marketing activities through HAEE's conferences, papers and newsletters. HAEE is involved in Market analysis and business model development. Within IANOS project, HAEE participated in the stakeholder capacity building activities organised in Samso Islands. In addition, a National Stakeholder Event is planned (Task 8.2) as a side event of HAEE's 8th Energy Transition Symposium, which will be dedicated to the Greek case study. The outcomes of both events will be used beyond IANOS project to promote the energy transition of the other Greek islands. This is also in line with HAEE's target to be among the promoters of the clean energy transition in Greece, especially in islands.	The participation in this project helps in the diffusion of HAEE group in aspects associated with energy management in islandic regions and will strengthen the cooperation and exchanges among HAEE members and partner Universities and companies. The knowledge gathered with the project could allow HAEE in the implementation of case specific solutions for the island. In addition, through the knowledge gained by developing business models for the lighthouse islands in the IANOS project, HAEE can explore the adoption of these models adapting them to the specific solutions and characteristics of the Greek islands. It is possible to continue the collaboration with the partners exploring other collaboration opportunities.

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Partners	Role in the project	Exploitation strategy
UBE (Belgium)	UBE takes over the development of the Energy Planning & Transition Decision Support Toolset and the prevalidation of the DS toolset. Furthermore, UBE participate also in the Islands requirements and the KPIs definition.	**Commercial exploitations know-how:** With the knowledge gathered in the project, UBE could expand the provided services to industry, develop relationships and collaboration with universities, end users and manufacturers. **Scientific exploitations:** UBE foresee Two peer-reviewed publications. UBE will follow the general project dissemination and exploitation plan and investigate additional opportunities for joint exploitation activities with other consortium partners.

2.3.4 Exploitation Strategy at Consortium Level

The IANOS project is an opportunity to demonstrate and replicate the symbiotic operation of various energy streams in EU islands, unlocking their great potential to act as Lighthouses of pan-European decarbonization. The project aims to demonstrate, under real-life operational conditions, a group of both technological and non-technological solutions adapted to harsh islandic conditions, covering a multitude of energy supply, storage and end-use vectors on different climatic and socio-economic conditions.

At the planning level, IANOS streamlines the decision-making process towards tailor-made solutions considering islands' specific traits, through the Island Energy Planning and Transition Suite (IEPT). IANOS adopts a LEC - oriented design, in which the policy/ regulations decision makers, small prosumers, large energy providers are empowered to create synergies, exchange knowledge and lead community-driven RE investments, also reaping the benefits of their active participation in transactive energy programs and services.

To achieve this result, the IANOS project brings together 34 partners from 9 countries, including municipalities, public authorities, research institutes and companies. The consortium members provide great geographic coverage end ensuring the visibility of project outcomes across Europe.

The IANOS project consortium brings together industrial actors, academic partners, research organizations, and municipality. For this reason, the exploitation strategy must consider all the different partners involved.
To achieve this, the acquired knowledge resulting from the project will be subjected to two types of exploitation: commercial exploitation and scientific exploitation.

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The main difference between them is that commercial exploitation is generally concerned with the direct or indirect utilization of the developed foreground for commercial purposes, while academic exploitation deals with results the use of the results in further research activities other than those covered by the project. There are several partners in IANOS project who have decided to have both these types of exploitation.

In this framework, one of the main elements of the IANOS project is the balance between consortium partners which is composed of 4 research institutes, 20 companies, 5 public bodies and 5 non-profit organisations/ foundations.

Table 2-7: IANOS consortium

Type	Partner
Research institute	UNI, TNO, CNR-IIA, CERTH
Companies	EFACEC, EDA, EFAEM, GASTERRA, AKUO, ETRA, ENG, EDP, RINA-C, BEON, CWD, Teraloop, SUN, SWT, Neroa, REP, ALI, Bareau, UBE, SQH
Public bodies	RGA, Ameland, LAMP, BORA, NISYROS
Non-profit organisations/foundations	NEC, AEC, EREF, HAEE, HUAS

Diversity among consortium members allows the project to have specific and valuable knowledge and expertise.

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3 Business model

In this chapter the key exploitable results prioritized are analysed more in depth. Specifically, the analysis is focused on the development of Canvass business model for each of them.

The choice of the KER to be prioritized was made based on the information reported in the characterization tables filled in by the partners. Specifically, the main factors that have been taken into account are the TRL level expected at the end of the project and the potential marketability of each KER. The list was shared with project partners for verification and confirmation. Below is the list of KER prioritized.

Table 3-1: Prioritized KER

#	Exploitable Results	Responsible Partner(s)	TRL before IANOS	TRL after IANOS
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa	6	8
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH	6	8
8	iVPP platform: Enterprise Service Bus	ETRA	6	8
10	PCM Thermal Storage Heat Batteries	SUNAMP	9	9

iVPP platform: Centralized Dispatcher [Ameland]

This platform integrates flexible energy assets on the island and implements an optimal dispatch plan that deals with grid congestion while integrating as much renewable energy sources as possible.

iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)

This tool will be able to provide a detailed overview of the environmental profile of the energy portfolio of islands, supporting their SECAP development in the future. INTEMA.grid can facilitate the optimization process and overall long-term cost benefit of a wide repository of solutions in energy grids, able to address the energy balance in the system on short timescales over all infrastructure.

iVPP platform: Enterprise Service Bus

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Allows the communication of the different components in the iVPP and other elements in the IANOS architecture.

PCM Thermal Storage Heat Batteries

Heat Batteries are modern-day, energy saving thermal stores made with a high-performance phase change material (PCM technology) to deliver fast flowing hot water, reliably, safely and efficiently. Sunamp heat batteries are beneficial for multiple reasons, they are four times smaller than the equivalent hot water cylinder, easier to install, kinder to the environment and there is no mandatory annual maintenance.

A business model is a strategic plan used by a company to define a value proposition for its customers and to obtain economic value from it. The Business Model Canvas consists of nine conceptual blocks, which highlights the most relevant aspects for the business solution and enable companies to visualize and analyze their strategy. By using the Business Model Canvas, the complexity of business modelling is reduced, because through this visual tool it is possible to effectively represent all the typical elements of a Business Model.

Below is the Canvas Business Model framework that will be used to create specific business models for each technology prioritized.

Table 3-2 : Business Model Canvas framework

BM Canvas building blocks	Description
Customer segments	Who is going to take advantage of the value proposition/to whom partners are delivering a product or a service
Customer Relationship	Ways in which the organization interacts with prospective and existing customers, including communication and marketing activities.
Distribution Channels	Ways in which the product/service is distributed.
Value proposition	Main advantages of the products/services proposed and that distinguish them from the competitors
Key Partners	Most relevant partners required to deploy the value proposition

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Key Activities	Most relevant activities required to deploy the value proposition
Key resources	Key resources needed for the value propositions, distribution channels, customer relationships and revenue streams.
Revenue Streams	Main potential revenue streams associated to the implementation of the business model
Cost Structure	Main cost items required for the implementation of the business model

The Business Model Canvases will be realized during the next months of the project and will be included in the final version of IANOS Exploitation Plan (D10.11).

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4-IPR Management

4.1 General Overview and IPR Background

Effective exploitation of the project results depends, among others, on the proper management of intellectual property. There are several intellectual property-related activities, namely the evaluation of the existing knowledge of project partners, their potential contribution to the prospective project's intellectual property rights, and the potential overlap of intellectual property rights in order to formulate and prepare the shaping of the IP strategy of the consortium. Main results patent mapping studies will be specified and delivered in order to raise the IPR protection scheme. The overall IPR strategy of the project is to ensure that partners are free to benefit from their complementarities and are able to fully exploit their market position.

This chapter, relevant to the IPR management, provides an overview of the main provisions related to intellectual property rights as well as use and dissemination of the results (also named foreground) generated by the IANOS project. It is however recommended to always refer to prescriptions included in the Consortium Agreement and Grant Agreement and to consult the Project Coordinator and the Exploitation Manager for any issues concerning IPR protection in order to elaborate exploitation agreements.

Background Information (B), in the context of Horizon 2020 programme, means "any data, know-how or information whatever its form or nature, tangible or intangible, including any rights such as intellectual property rights, which is:

- held by participants prior to their accession to the action.
- needed for carrying out the action or for exploiting the results of the action.
- identified by the participants."[9]

To summarise, Background includes pre-existing IP, know how, knowledge and any additional data that is needed for carrying out the project as well as that each partner is going to bring to the project itself.

Before the beginning of the project, it is necessary to ensure that every information needed for the smooth running of the project is accessible to all project partners, therefore matters related to access rights, have already been addressed in the IANOS Consortium Agreement.

[9] Definition from DESCA Template: https://www.desca-agreement.eu/what-is-desca/

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4.2 Results (Foreground) and BFMULO Analysis

Results, formerly called "Foreground" in FP7 projects, mean "any data, knowledge and information, whatever their form or nature, whether or not they can be protected, which are generated in the action as well as any attached rights, including intellectual property rights".[10] Concerning the protection of results and dissemination, the following aspects should be considered:

- Owners must ensure adequate protection for the Results capable of industrial or commercial application in conformity with Grant Agreement and Consortium Agreement.
- In the absence of protection and transfer of Results, owner(s) shall inform EC, which may take the responsibility of protection and granting of access rights. Beneficiary concerned may only refuse if its interests are impaired.
- Any disclosure (publication, announcements etc.) shall not affect the protection of Results.

The Consortium Agreement may specify details concerning protection and publication but not in conflict with EC Contract.
In the specific case of the IANOS project, the Background (B) and Foreground (F) associated to the partners involved in each related exploitable result will be analysed. The methods of exploitation will be resumed in the following four cases identified by a single letter, describing the intention of the partner to exploit the results by:

- M = Making the products, manufacturing, and selling or directly implementing through own facilities and skills
- U = Using the result, implemented with own knowledge to develop new ranges of products or newer processing. Furthermore, the direct or indirect use of foreground in further research activities other than those covered by the project, or for developing, creating, and marketing a product or process, or for creating and providing a service
- L = Licensing the result, therefore earning from a negotiation towards third parties outside the Consortium
- O = Other, any other exploitation means (e.g.: consultancy, services, etc.)

The analysis of the IANOS exploitation claims are reported in Table 4-2 on how each partner could exploit the foreseen results for instance by producing and selling them (M); by using them internally (U) (new research project, lectures in case of universities, etc.); by licensing them (L); or by providing services (O) (consultancy, etc.). Below, we reported Table 4-1 with the list of KER again, in order to make the relationship between the responsible partners of each result and the exploitation claims evident.

[10] Definition from DESCA Template: https://www.desca-agreement.eu/what-is-desca/

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Table 4-1: List of KER

#	Key Exploitable Results	Responsible Partner(s)
1	iVPP platform: Centralized Dispatcher [Terceira]	CERTH & CW
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa
3	iVPP platform: Forecasting Engine	CERTH
4	iVPP platform: - Intelligent Segmentation & Clustering Engine	CERTH
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH
6	iVPP platform: - P2P Transactive Energy Trading Framework	ENG
7	iVPP platform: - Virtual Energy Console	CW
8	iVPP platform: Enterprise Service Bus	ETRA
9	FEID PLUS	CERTH
10	PCM Thermal Storage Heat Batteries	SUNAMP
11	V2G Charging & Services on Terceira	EFAEM
12	DefPi Platform	NEROA
13	Smart Energy Router	UNINOVA
14	Flywheel	TERALOOP
15	Tidal Kite	SQH
16	Hybrid Transformer	EFACEC
17	PVs with microinverter	BEON
18	Biobased saline batteries	SWT
19	IANOS Energy Planning and Transition suite (IEPT)	UBE

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As anticipated, by using the BFMULO matrix, IANOS partners can gain valuable insights into the project's intellectual property landscape, facilitating a comprehensive understanding of each partner's contributions and intended use of the project results. This information will not only aid in monitoring and managing intellectual property rights throughout the project's duration but will also support efficient decision-making and future collaborations.

Below is the filled-in BFMULO matrix detailing the individual responses of each partner, capturing their respective IPR intentions in a concise and structured manner:

Table 4-2: BFMULO analysis – Filled in by IANOS partners

KER / Partners	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AEC	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU		FU	FU	FU	FU
AKUO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO
ALI		BFU	BFU	BFU			BFU			BF		BFU	BFU		BF	BFU		BF	
AMELAND		FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU	FU
BAREAU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEON	FU	FO	FO	FU	FO	FU	FU	FU	FO	FU	FU	FU	FM	FO	FU	FO	BM	FU	FU
BORA	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO
CERTH CPERI					BFUL														
CERTH ITI	BU	BU				BU	U	BU			B	B	B						
CLEANWATTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CNR - IIA	FU	BU	FO	FO	BU	BU	BO	BO	FO	BO	BO	FO	BO	BU	BU	BU	BM	BO	BU
EDA	BU	FU	BU	BU	BU	BU	BU	FU	FU	FU	BU	BU	FU	BU	FU	BU	FU	FU	BU
EDP	FO	FO	FO	FO		FO	FO				FO					FO			
EFACEC																BFMU			
EFAEM											BFMU								
ENG						FM													
EREF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETRA	BFU	BFU	BU	BU	BU	BU	BFU	FM	BFU		BFU	BU	BFU			BU	BU		BU
GASTERRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAEE																			
HANZE	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO	BO
LAMP																			
NEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEROA	BU	BU	BU	BU	BU	BU	BU	B		B	F	O	BU	F		FU	F		
NIS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
REP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RGA	FU	BO	BU	BU	BU	BU	BU	BU	BU	BL	FL	BU	FU	FL	FU	BL	BL	BU	FU
RINA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SQH															BF				U

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SUNAMP	FU	FU	BM	FU	FU	FU	BU	BU	FU	BU	FU	FU	FU	FU	FU	FU	BM	BM	BU
SWT	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU	BFU		BFU
TERA								B						FM					
TNO		BFO	BF	B			B					B							
UBE													BM						BFMU

4.3 Access Rights

Access Right, in Horizon 2020, simply stands for the right to use Key Exploitable Results or Background.

During the implementation stage of the project, partners need to give access rights to their background and results being created in order to allow to other partners to carry out their work on the project and/or exploit their results. The requests should be done in written form, which could take for instance the format of an email with acknowledgement of receipt, if participants so decide in their Consortium Agreement. Participants granting access rights may request to put in place an agreement, particularly when they wish to make the access rights limited to some conditions (e.g., stronger confidentiality commitments).

The following table gives an overview of the general conditions concerning the granting of access rights as established in the GA (articles 25.2 and 25.3):

Table 4-3: Overview of the general conditions concerning the granting access rights

Purpose	Access to background	Access to results
Implementation of project	Royalty – free, unless otherwise agreed by participants before their accession to the Grant Agreement.	Royalty - free
Exploitation of owned project results	Subject to agreement, access rights shall be granted under fair and reasonable conditions (which can be royalty – free)	

The above-mentioned rules are normally valid unless stated otherwise. One new feature of Horizon 2020 concerns the granting of access rights to a project's results, not only to the European Union, but also, in specific cases, to Member States. Access rights for the European Union's institutions and bodies will be granted on a royalty-free basis, limited however to non-commercial and non-competitive use since their purpose relates merely to the development, implementation and monitoring of EU policies and programmes.

4.3.1 Access Rights on the Background of the Project

In attachment 1 of the Consortium Agreement, the Parties have identified and agreed on the Background of the project and have also, where relevant, informed

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each other that access is subjected to legal restrictions or limits. Anything not identified in the Consortium Agreement shall not be objected to Access Right obligations regarding Background.

Table 4-4: Claims for Background in Attachment 1 of the CA

Background provision / Partners	Yes	No
EDP	X	
UNI		X
EFACEC	X	
EDA	X	
EFAEM	X	
RGA	X	
VPS	X	
TERA	X	
SunAmp	X	
BEON	X	
AME		X
NEC		X
TNO	X	
ALI	X	
AEC		X
SWT	X	
HANZE		X
NEROA	X	
REO	X	
SQH	X	
BAREAU	X	
GASTERRA		X
LAMP	X	
CNR-IIA	X	
BORA	X	
AKUO	X	
NIS		X
CERTH	X	
ETRA		X
ENG		X
RINA	X	
EREF	X	
HAEE		X
UBE		X

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4.3.2 Results ownership

According to the Horizon 2020 Rules for Participation and Models Grant Agreement, project results belong to the participant generating them. Given the collaborative nature of European projects, some results can be jointly developed by several participants; therefore, situations of joint ownership might arise.

4.3.3 Joint ownership

Results are jointly owned when:

- they have been jointly generated by two or more participants
- it is not possible to:
  - establish the respective contribution of each beneficiary, or
  - separate them for the purpose of applying for, obtaining, or maintaining their protection.

Usually, joint ownership occurs in very specific situations, mainly for technological results.

It is best practice to regulate, in the Consortium Agreement, the rules on joint ownership of results. However, since this agreement is entered into force before the launch of the project and the development of the results, participants shall, if needed, establish a separate joint ownership agreement during the project implementation, defining the allocation and terms of exercising their ownership.

Unless otherwise agreed in the Consortium Agreement or in the joint ownership agreement, according to the default Grant Agreement rules, each joint owner may grant non-exclusive licences to third parties to exploit the jointly owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

Since managing jointly owned results is a complicated issue, participants have the possibility to implement a different ownership regime from the one established in the Consortium Agreement, if the new agreement is done in a written form.

In fact, they may decide for instance to transfer ownership to one of the joint owners, in accordance with the rules on transfer of results under the grant agreement.

4.3.4 IANOS Project Results Ownership

Based on the performed BFMULO Analysis and the individual interviews that will be carried out during the IANOS project execution, the type of ownership of each result (single or joint ownership) will be discussed. In particular, the need of Joint Agreement among partners will be investigated to agree on potential agreement that will be formalized and finalized before the end of the project.

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4.3.5 Transfer of results

Transferring the ownership of their results to other partners is a possibility for those participating in Horizon 2020. However, it is fundamental that, whenever transferring the ownership of their results, participants follow the requirements established in their Grant Agreement:

- The transfer should be done through an agreement (preferably in written form), since beneficiaries must ensure that the obligations of the participant(s) under the grant agreement are passed on to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.
- Prior notice is given, at least 45 days before the intended transfer, to the other consortium partners that may still have (or may still request) access rights to the results, with sufficient information about the new owner. The right to prior notice can be waived in the case of transfers to a specifically identified third party, which is usually done through the consortium agreement.
- Participants are bound to formally request authorization from the European Commission in advance, in cases of foreseen transfers to third parties established in a non-EU country not associated with Horizon 2020, including information on:
  - the identification of the results at stake;
  - the new owner and the planned or potential exploitation of the results;
  - the likely impact of the transfer or licence on EU competitiveness and its consistency with ethical principles and security considerations. This notification must be done up to four years after the end of project.

4.4 Knowledge Management and Protection

Throughout the project, the Consortium continuously contributes to generating new knowledge that is instrumental for shaping the expected project outcomes, several of which may be qualified for Intellectual Property (IP) protection. On the other side, it is an obligation and is also the interest of the Consortium to disseminate the proposed new methods and tools, including qualified scientific publications, with open access which will have to be provided.

A strategy aimed at proper management of the generated knowledge shall ensure that communication and dissemination activities is duly carried out.

This strategy will be taken into account on the one hand the obligation to disseminate results as well as open access rules and obligations and from the other hand the need of safeguarding the rights of the Consortium partners to protect their IP, thus enhancing the chances of effective commercial exploitation of the project's results. Accordingly, a dedicated procedure for knowledge management and protection (see paragraph below) was already defined at proposal stage and adopted along the project duration.

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4.4.1 Procedure for Knowledge Management and Protection

While being instrumental for IP management within the project, the procedure for knowledge management and protection represents at the same time relevant input for the exploitation action plan. In particular, knowledge management refers to a series of practices that enable knowledge to create value in an organization. Intellectual property management is the management of intellectual assets, which meet the protection conditions of the intellectual property law.[11]

This procedure has been developed while taking into account the basic principles set in the Grant Agreement as well as the Consortium Agreement, with particular focus on the assessment of the background of the Consortium partners and monitoring of the partners' potential contribution to new IP generation. Indeed, whenever certain results are identified to be attractive for the future business opportunities of one or more of the partners, the necessary steps to protect the associated IP shall be taken. IP protection measures (such as, but not limited to, patents, copyrights, trademarks, registered designs, design rights, databases, trade-secrets, confidentiality, and other forms of protection) may follow the procedures already in use by the concerned partner(s).

However, according to the procedures defined by the consortium, the Exploitation Manager (ETRA), will be informed at the earliest possible instance, about the intention by the concerned partner(s) to protect that IP. Hence, the Exploitation Manager brings the IP protection intention at the attention of the Project Coordinator, who directly informs the Project Steering Committee. In order to secure research and business interests of all partners involved, any issue that might arise from the IP protection initiative will be dealt with by the General Assembly. In case of jointly owned IP, procedures for IP protection, use and licensing will comply with the rules set in the Grant Agreement and described in the Consortium Agreement.

In addition to the above, issues related to IP protection will be handled within the Project Steering Committee on a regular basis, as well as within the General Assembly upon necessity. Below, Figure 4-1 represents the scheme of the management structure that clarifies specific roles.

[11] A detailed contribution to the differentiation between knowledge management and intellecutual property management concept is available at the following document: AD-minister N°. 31 julio-diciembre 2017 pp. 137 - 160 · ISSN 1692-0279 · eISSN 2256-4322 - Monica Henao-Calad · Paula Rivera Montoya · Beatriz Uribe Ochoa - Knowledge Management Processes and Intellectual Property Management Processes: an Integrated Conceptual Framework

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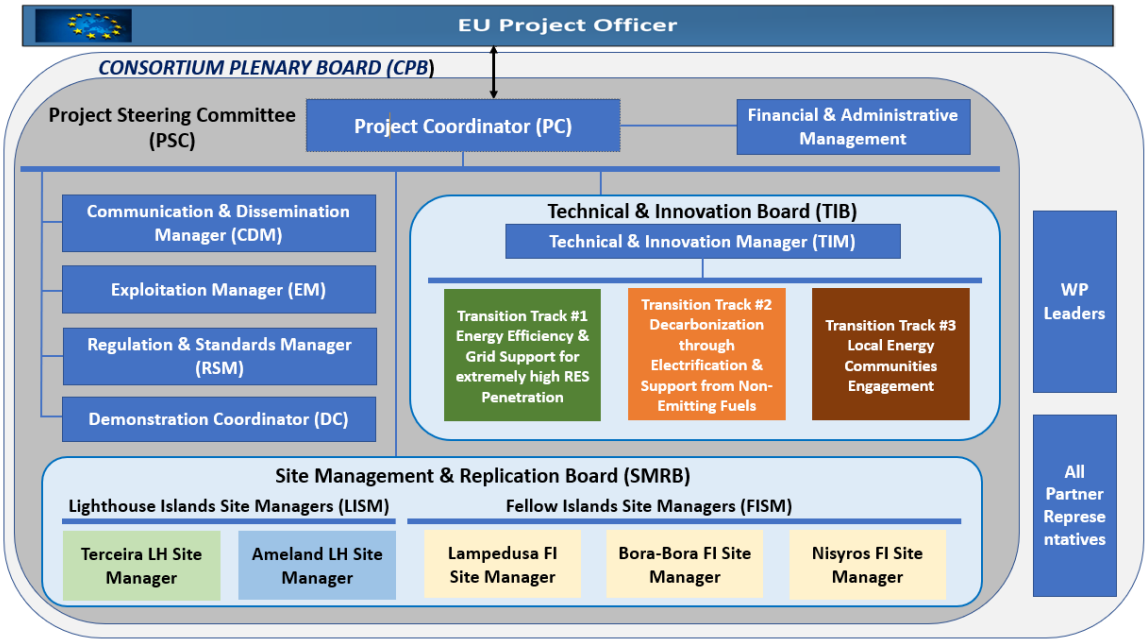

Figure 4-1: Management Organization Structure of IANOS Project

Each time certain results are identified that are worth IP protection; legal aspects are handled along with activities aimed at analysing and providing support for filing the IP protection application. If necessary, commercial agreements are also drafted and agreed upon among the relevant actors. Hence, for any protectable IP the following steps are carried out:

- The concerned partner notifies the Exploitation Manager about the technical contents it would aim to protect and the related ownership rights (including in case of joint ownership).
- Preliminary copyright, trademark, or patent searches are conducted by the concerned partner as well as the Exploitation Manager, in order to check 'freedom-to-operate' with the scope of avoiding eventual infringements.
- Filing of the related IP protection application is then followed directly by the relevant partner(s), in accordance with the perimeter agreed with the other partners, as well as the perimeter of innovation and in order to maximize the potential for protection of the result.

Any filed application for protection of results will duly include information on the EU funding.

4.4.2 Knowledge transfer to industrial partners

According to the Model Grant Agreement, and in line with the rules laid down in the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities, the beneficiaries belonging to the category of universities or other public research organisations will consider knowledge transfer towards relevant stakeholders as a strategic mission to maximize the impact from this project.

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Accordingly, the universities and other public research organizations belonging to the consortium will ensure that knowledge is appropriately transferred, via licensing to the private industrial and commercial organisations existing in the consortium or to potential spin-off companies, should these appear to be the best option for exploitation according to the final exploitation action plan.

4.4.3 Dissemination and Exploitation of Results

In the context of Horizon 2020, dissemination refers to the public disclosure of results by any appropriate means, except those resulting from protecting or exploiting results. Scientific publications, providing general information on web sites, participation in conferences or trade fairs are some examples of dissemination activities.

According to the general model grant agreement, dissemination activities have to be undertaken starting from the beginning of the project. Under the leadership of RINA-C and the supervision of the Coordinator, all partners have to proactively contribute to disseminate activities. To this end, roles and responsibilities of each partner will be clearly agreed upon at the beginning of the project through a dissemination plan and coordinated actions.

Prior to any dissemination activity, other partners must/have to be consulted in order for them to exercise their right to object in the case where such dissemination could cause significant harm to their background or results. In particular, at least 45 days prior notice of any dissemination activity shall be given to the other beneficiaries concerned that within 30 days may object about the dissemination activity.

A novelty of Horizon 2020 is the requirement for participants to ensure open access to project results that is free of charge for any user, to all peer-reviewed scientific publications relating to its Horizon 2020 project's results. This does not mean that participants have the obligation to publish their results, nor does this affect their plans for exploitation. In fact, first, participants must decide on the protection of their results and, once the decision is taken, they have to consider if and when dissemination should be done through scientific publication.

Participants receiving European Union funding must use their best efforts to take measures aiming at ensuring the exploitation of their results up to four years after the project. This means that participants must take steps to make sure the results they own are used:

- in further research activities other than those covered by the project concerned;
- in developing, creating, and marketing a products or processes;
- in creating and providing a service;
- in standardisation activities.

The exploitation does not necessarily need to be done directly by the participants. Indirect exploitation can be performed by licensing the results or assigning them

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to third parties, in accordance with the requirements established in the Grant Agreement.

4.5 IPR Protection Strategy

Outcomes generated within the project must be properly protected, in order to guarantee their effective commercial exploitation.
Protection of results has to be ensured in a reasonable and justified way for an appropriate period of time and in a suitable territory.
In particular, IP protection measures can be distinguished in:

- Industrial property that can be protected through Patents, Designs and Trademarks
- Non-technical intellectual creations, e.g., literature or artistic ones including software, that can be protected through Copyrights

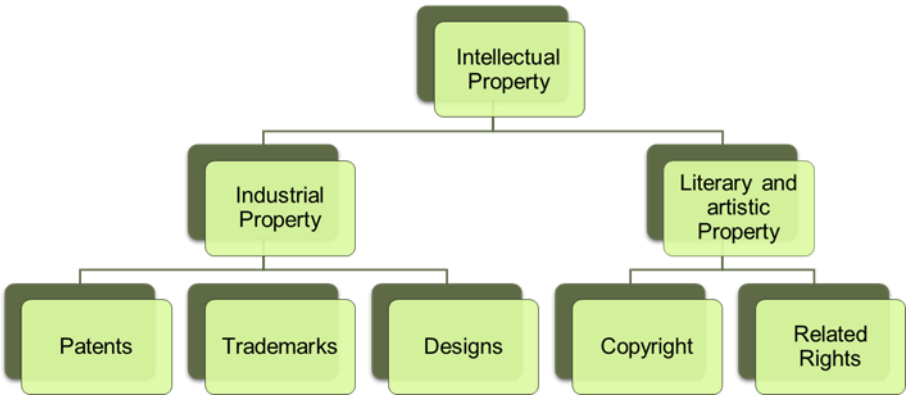

Figure 4-2: Different Intellectual Property Rights

The choice of the most suitable form of IP protection, as well as the duration and geographical coverage depends on the results at stake, but also on the business plans for their exploitation and on the legitimate interests of consortium partners. Patents, trademarks, designs, and copyrights are described further in the following section, while related rights are not covered in this manual, since they deal with rights that benefit to performers (e.g., actors, musicians), producers of phonograms (CDs) and broadcasting organisations (TV, radio).

4.5.1 Formal and informal IP protection – Intellectual Property Rights

Formal IP is designed to provide incentives for innovation through a reward system that makes it easier for innovators to gain profits if their innovation is successful by allowing them to exclude imitators for a finite period.
A number of common formal IPRs measures are listed in the Table 4-5 below.

Table 4-5: Formal IP protection measures

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Patents	A **patent** is an industrial property right that protects a technical invention for a limited period of time (generally 20 years), giving the holder an exclusive right to prevent others from selling, making, and using the patented invention. An invention to be patentable must fulfil three criteria: being new, innovative and be susceptible of industrial application[12].
Utility Models	A **Utility Model** is an exclusive right granted for an invention, which allows the right holder to prevent others from commercially using the protected invention, without his authorization and for a limited period of time (usually between 7 and 10 years, without the possibility of extension or renewal). It may be any useful machine, implement, tools, product, composition, process, improvement, or part of the same, that is of practical utility, novelty, and industrial applicability. In practice, protection for utility models is often sought for innovations of a rather incremental character that may not meet the patentability criteria. Although a utility model is similar to a patent, it is generally cheaper to obtain and maintain, it has shorter grant lag, and less stringent patentability requirements. This kind of solution can be evaluated among the project partners to improve the IP protection[13].
Industrial Design	**Industrial Design** is a type of protection dedicated to the intellectual creation used by designers; it is provided for a shape, configuration, surface pattern, colour, or line (or a combination of these), which, when applied to a functional product, produces, or increases aesthetics, and improves the visual appearance of the design, be it a two-dimensional or a three-dimensional product. The subject of the design protection is the outwardly visible appearance of the product or its part, packaging, or the ornamentation itself [14] [15].
Copyrights	**Copyrights** protect non-technical intellectual creations; in practice, it refers to all of the rights owned by creators over their literary or artistic work. In order to be protected by copyright, a work must first have sufficient originality and, second, have taken form. Protection arises automatically giving the holder the exclusive right to control reproduction or adaptation[16]. This type of protection could be envisaged in the context of the IANOS project, particularly if specific software or programming codes would be developed as support for the exploitation of other IANOS results.
Trademarks	**Trademarks** are distinctive signs identifying brands of products or services. Any sign that can be represented graphically may be registered as a trademark for a period of 10 years, with the option for indefinite renewal[17]. If not already registered, the IANOS acronym and logo should most probably be registered as a trademark in view of reinforcing other IPR types.

[12] https://www.wipo.int/patents/en/

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Protection of the Intellectual Property generated within the IANOS project can be ensured also through 'informal' methods, such as[18] :

- Secrecy of information;
- Restricted access to information;
- Database and network protection;
- Confidentiality agreement;
- Technical protection (imitation difficult);
- Components and system design protection.

The list above consists of conventional procedures, which will be adopted by each Partner in the IANOS project and will be strictly followed also post-project to ensure that no information may leak outside of the Consortium.
Below, some examples of project outcomes that may be subjected to IPR protection are reported, and possible IPR protection measures for each of them are identified (Table 4-6).

[13] https://www.wipo.int/patents/en/topics/utility_models.html
[14] https://www.wipo.int/designs/en/
[15] https://yourstory.com/2015/07/what-is-industrial-design-protectiontheir-designs/
[16] https://www.wipo.int/copyright/en/
[17] https://www.wipo.int/trademarks/en/
[18] Nber Working Paper Series - The choice between formal and informal intellectual property: a literature review - National Bureau Of Economic Research – April 2012
https://www.nber.org/system/files/working_papers/w17983/w17983.pdf

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Table 4-6: Examples of project outcomes that may be subjected to IPR protection

Subject Matter	Patent	Utility Model	Industrial Design	Copyright	Trademark	Confidential Information
Invention	X	X				X
Algorithm Software	X			X		X
Scientific article				X		
Design of a product			X	X	X	
Name of a product, service /project					X	
Know - How						X
Website			X	X	X	

4.5.2 IPR Protection procedure

In line with the Model Grant Agreement, the project has a policy of protection of the project's results whenever results are expected to be commercially or industrially exploitable and whenever protecting them is possible, reasonable, and justified.

In order to ensure an adequate share in the protection of joint efforts it is recommended to notify whenever an innovation or any foreground is generated, as well as to ensure that the foreground sharing is ascertained and agreed among the partners creating it. This should occur on a case-by-case basis and under the supervision of the Project Steering Committee, in the person of the project coordinator, supported by the Exploitation Manager.

Thus, according to the procedure for knowledge and management protection that has been anticipated, each partner has to inform, at the earliest possible instance, the Exploitation Manager (ETRA) about the technical contents it would aim to protect and the related ownership rights (including in case of joint ownership). In this case, it is considered a good practice to consult with other partners involved, before deciding whether and how to protect a specific result.

Any Partner intending to apply for any of the protection measures, listed in the previous section, acknowledges the Exploitation Manager of its intention. The

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Exploitation Manager then has to inform the project Steering Committee (SC). The acknowledgement of the intention to protect the generated foreground has to be accompanied by a synthetic description of the foreground subject to the intention for IPR protection by filling a specific template.
The template requires the following fields to be filled in:

- KER number and title
- Partners involved.
- Type of Protection (Patent, Trademark, Industrial Design, Copyright, Other);
- Subject;
- Potential Market;

The Subject field enables a unique identification of the innovation (possible patentable idea). Partners are encouraged to describe in the field description the main terms of the innovation, according to simple and clear terms precisely referring to the activities performed in the project.
The different possible protection mechanisms (more than one choice is possible) can be indicated in the field "Type of Protection".
The last column enables the partner to identify the possible potential market of the innovation. This can be useful both for the definition of the foreseen economic impact and for achieving a rough estimate of the potential geographical market penetration. Such information could be relevant for the definition of places where it can be crucial to protect the claimed innovation.
The description shall be sufficiently detailed to allow the Steering Committee to evaluate whether the application for protection of the IPR may endanger other Partners of the Consortium, though it shall be sufficiently general not to disclose too much information related to the subject. In any case, the Steering Committee shall deem that the application for IPR protection may have an impact on other Partners' activities or businesses, the control body shall be entitled to ask for more details on the matter of the application and eventually involve all the interested Parties in a discussion to analyse the situation.
The Coordinator shall track all acknowledgements of partners expressing the intention for IPR protection as well as the date of the acknowledgement. The intention for IPR application shall be archived. This will be useful to uniquely identify the partner's ownership and attribute a clearly defined date to the claimed invention. This, besides the short description of the invention, will provide the Steering Committee with archive information to be referred to in the case of IPR related disputes between partners.

Table 4-7 provides the table filled in by IANOS partners used to define the list of applications for patents, trademarks, registered designs, etc.

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Table 4-7: Table for applications for IP protection measures

#	Key Exploitable Results	Responsible Partner(s)	IPR measure	Subject	Potential Market
1	iVPP platform: Centralized Dispatcher [Terceira]	CERTH & CW	Confidential Information	Integration of multiple energy assets and evaluation of optimal dispatch schedule	Any kind of energy portfolio management application
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa	-	Integration of multiple energy assets and evaluation of optimal dispatch schedule	Any region that has to deal with grid congestion or imbalance.
3	iVPP platform: Forecasting Engine	CERTH	Confidential Information	To deliver the necessary forecasts for the consumption, generation and market prices to the Centralized Dispatcher in order to provide the setpoints for the optimal dispatch of the assets.	Whenever there is a need for forecasting load/generation & price profiles: Renewable Energy Resources, Microgrids, Smart Grids, Architecture, Engineering and Construction (Smart Buildings), and Building Energy Management Systems
4	iVPP platform: - Intelligent Segmentation & Clustering Engine	CERTH	Confidential Information	To provide a detailed overview of the energy portfolio creating clusters of residential users based on various objectives and thus delivering insightful information for the end user.	This tool is best suited for managers of energy portfolios of residential clients with smart meters installation
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH	Patent	To offer a holistic life cycle tool applicable in energy networks considering both existing energy grid infrastructure and comparisons with planned energy grid interventions	This tool is best suited for managers of energy portfolios of residential clients with smart meters installation
6	iVPP platform: - P2P Transactive Energy Trading Framework	ENG	Copyright	It implements a marketplace for prosumers that intend to exchange their energy extra production with those that need some, temporarily limited, extra consumption on respect of their usual baseline	This framework is targeted for regional local communities of prosumers that experiment renewable energy autoconsumption maximization issued.

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#	Key Exploitable Results	Responsible Partner(s)	IPR measure	Subject	Potential Market
7	iVPP platform: - Virtual Energy Console	CW	-	To enable the dynamic connection of different datasets with several types of visualization	Any kind of VPP portfolio management application, when there is a need to visualize and manage operations of disperse energy assets.
8	iVPP platform: Enterprise Service Bus	ETRA	Utility Model / Confidential Information	To allow the communication of the different components in the iVPP and other elements in the IANOS architecture	Multi-protocol and multi-format scenarios which require a common language to perform the communication.
9	FEID PLUS	CERTH	Industrial Design	Real time monitoring and controlling of the local loads, the FEID-PLUS supports the most common wired and wireless communication protocols	Building Energy Management / wired and wireless monitoring and control applications
10	PCM Thermal Storage Heat Batteries	SUNAMP	-	Innovative thermal storage solution that immerses a powerful heat exchanger into the PCM storage and therefore maximizing its thermal power	Construction companies
11	V2G Charging & Services on Terceira	EFAEM	Copyright, Confidential Information	The EV Charger is constituted by several high efficiency power electronic conversion stages, using the latest technology in terms of semiconductors and conversion topologies for the inclusion of the bidirectional power capability	North and Central Europe/Portugal/Spain
12	DefPi Platform	NEROA	Pending		
13	Smart Energy Router	UNINOVA	-		
14	Flywheel	TERALOOP	Confidential Information	Teraloop 100 kW flywheel will be ready to supply or absorb 100 kW of the power difference, the power tolerance range is increased by 100 kW added to the 200 kW.	

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#	Key Exploitable Results	Responsible Partner(s)	IPR measure	Subject	Potential Market
15	Tidal Kite	SQH	-	The IANOS project scope related to the TidalKite focuses on the integration of the TidalKite produced electricity in the Ameland island electricity grid	Island energy cooperatives and islands energy systems
17	Hybrid Transformer	EFACEC	Copyright, Confidential Information	Low losses and more sustainable design, with the capacity to continuously adjust the voltage during operation, in each phase, with unlimited number of operations and with other innovative features.	DSOs with distributed renewable generation and high level of voltage quality profile.
18	PVs with microinverter	BEON	Patent	Filling in all the gaps that exist for the introduction of microinverters into affordable DIY kits, formed in combination between the panel and the conversion unit - the microinverter.	Energy retailers and energy solutions providers, distributors of solar products as well as Large solar installers and also end customers .
19	Biobased saline batteries	SWT	Utility Model, Copyright, Trademark, Industrial Design, Confidential Information	This unique concept battery is developed for electricity storage in a simple, safe and affordable way. Not using valuable resources like lithium and Kobalt.	Island energy cooperatives and islands energy systems
20	IANOS Energy Planning and Transition suite (IEPT)	UBE	Copyright	This tool satisfies the need of the decision-makers across the energy value chain by offering a tool that can provide quantifiable insights supporting their potential investments decisions in clean and smart energy interventions	

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4.5.3 Patent application

There are different routes to patent protection and the best route will depend on the invention and the markets where the IANOS results would be exploited.

National patents

If the intention is to apply for a patent in just a few European countries, it may be better to choose the national route and file the specific application at the IP offices in the countries for which protection is sought.

Patent law in the European Patent Organisation (EPO) member states has been extensively harmonised with the European Patent Convention (EPC) in terms of patentability requirements. However, the national route generally leads to national rights that confer protection of differing extent.

The European Patent Convention (EPC) is a multilateral treaty instituting the European Patent Organisation (EPO) and providing an autonomous legal system according to which European patents are granted.

The fees for applying for a patent at the EPO are, however, higher than those that are charged by the national patent offices. The fees at the EPO do not cover the actual grant of patents by individual countries, so one has to allow for additional official fees following the grant of the patent when it is validated in those countries in which the patent is wished to be in force.

Based on the fees related to the European grant procedure, costs for representation by a single agent and cost of conducting the proceedings in a single language, a European patent costs is as much as about three or four national patents.

In other words, if a partner wishes to gain protection in more than two or three of the countries that are members of the European Patent Convention, it will probably be cheaper to go for the European Patent route. If a partner just wants two countries, then separate national applications will probably be cheaper. If a partner would like patent protection in three countries, then a very careful analysis would need to be performed.

European or International Filing

The Patent Cooperation Treaty (PCT) is an international patent law Treaty that provides unified procedures for filing patent applications to protect inventions in each of its 148 Contracting States. A patent application filed under the PCT is called an international application, or PCT application.

A PCT application, which establishes a filing date in all contracting states, must be followed up with the step of entering into national or regional phases to proceed towards the grant of one or more patents. The PCT procedure essentially leads to a standard national or regional patent application, which may be granted or rejected according to applicable law, in each jurisdiction in which a patent is desired.

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If a partner decides to apply for a European patent, the choice would be to follow the direct European route or the international PCT procedure.
Due to the European scope of the IANOS project, European patent applications are the most likely to happen.
A European patent application consists in:

- A request for grant (obligatory), preferably on EPO form 1001;
- A description of the invention (obligatory);
- Claims;
- Drawings (if any);
- An abstract.

According to the Horizon 2020 Rules for Participation and Models Grant Agreement, the project results belong to the participant generating them.

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4.6 IANOS Prioritized Key Exploitable Results and IP Scenario Analysis

Along the project, in parallel to the collection of exploitation intentions and the collection of useful information through the Characterization Tables, reported and discussed within Chapter 2, the best option for protecting the Prioritized KERs IPR is addressed in order to plan subsequent actions in agreement with the intention of responsible partners.

Below, the proposed list of Prioritized Key Exploitable Results is provided.

Table 4-8: List of proposed prioritized KER

#	Exploitable Results	Responsible Partner(s)
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH
8	iVPP platform: Enterprise Service Bus	ETRA
10	PCM Thermal Storage Heat Batteries	SUNAMP

Moreover, in light of SuWoTec's intention to seek a patent submission for KER 18 - Biobased saline batteries, a patent analysis has been conducted, even though this particular KER has not been prioritized at this stage of the project.

4.6.1 IP Scenario Analysis

Patent analysis is a unique management tool for addressing the strategic management of the firm's technology and product or service development process. Translating patent data into competitive intelligence allows the firm to gauge its current technical competitiveness, to forecast technological trends, to plan for potential competition based on new technologies[19].

In this section the detailed IP competitive scenario analysis that has been developed during the project is presented. The most relevant patents identified will be discussed with the responsible partners and shared with the entire

[19] Fleisher, Craig S. and Babette E. Bensoussan. Strategic and Competitive Analysis: Methods and Techniques for Analyzing Business Competition

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Consortium during exploitation activities. The analysis has been done out exploiting PatSnap (website: https://www.patsnap.com/) database.

Patsnap is a global patent and innovation database that provides users with a comprehensive and user-friendly platform for conducting patent searches.

In the following paragraphs, the patent analysis for the identified results is provided, with the following:

- Scenario analysis related to the identification of patents temporal trend submission, main patents publication countries as well as main applicants active in the field. The query selected a patent portfolio where results are grouped in International Patent Documentation (INPADOC) families. An INPADOC patent family is a set of patents filed with different patenting authorities that refer to the same invention.
- Competitive and technical intelligence analysis allowing the identification of interesting technological solutions, tools and methods that could represent competitive solutions as well as hints to the further technological development of each exploitable result and suggest ideas for further patents development. In this case, the most relevant patents have been analysed in detail with the support of PatSnap features.

For each of them a table summarizing main contents is reported, providing the following information:

- Title
- Status (dead, alive or indeterminate, updated in August 2023)
- Publication number
- Assignee
- Publication date
- Current IPC(s)
- Abstract
- Drawings

Once the most relevant patents were identified, main conclusions and remarks for each of the KERs are reported in Chapter 5.

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4.6.2 KER 2 - iVPP platform - Centralized Dispatcher [Ameland]

#	Exploitable Results	Responsible Partner(s)
2	iVPP platform: Centralized Dispatcher [Ameland]	TNO & Neroa

Description

Ameland's iVPP platform integrates flexible energy assets at the island and implements an optimal dispatch plan that deals with grid congestion while integrating as many renewable energy sources as possible. Ameland's iVPP utilizes ReFlex technology to create the optimal dispatch plan.
The system reduces grid congestion and allows the island to incorporate as much renewable energy sources as possible, e.g., by shifting load and use intermediate storage for surplus of energy.

Patent Scenario Analysis – KER 2

A patent scenario analysis was performed for the solution identified by KER #2. The search query used to map the patent landscape is reported in the following table, while main results are depicted by following figures and comments. The patent analysis selected patents from 2005 up to today.

Query	
Title or Abstract	TA_ALL:(dispat* $pre0 syst* OR dispat* $pre0 sched*) AND TA_ALL: (energy)
Time interval	January 2005 – July 2023 (Data for the last 18 months incomplete due to standard patents publication procedures)
Results	**626** individual records, **408 INPADOC** families

The query selected a total of 626 patents in the period under analysis (corresponding to 408 INPADOC families).
As it can be noticed from the following figure in the period under consideration (2005-2023) there was a positive temporal trend. It is worth to point out that data for the last 18 months are incomplete due to standard patents publication

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procedures). In this sense, it is a good practice to not consider the last two years (2023 and 2022) within the patent trend analysis.

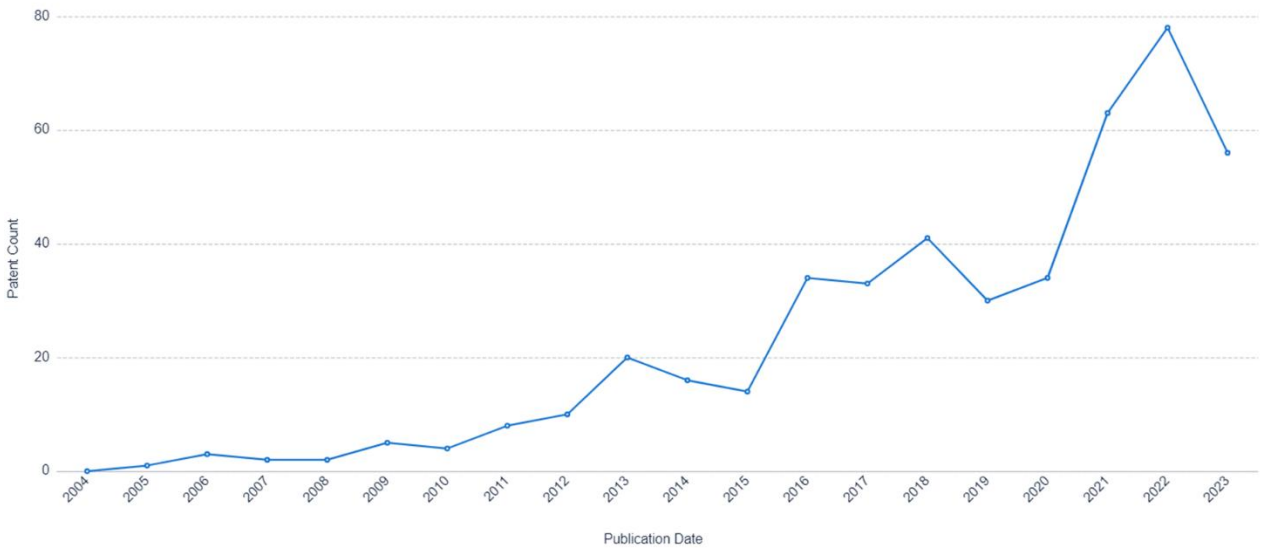

Figure 3: Publication trend - KER 2

In particular, there has been great interest towards patent applications from countries as China and United States and, as reported in the map of Top Application Countries and regions (figure below).

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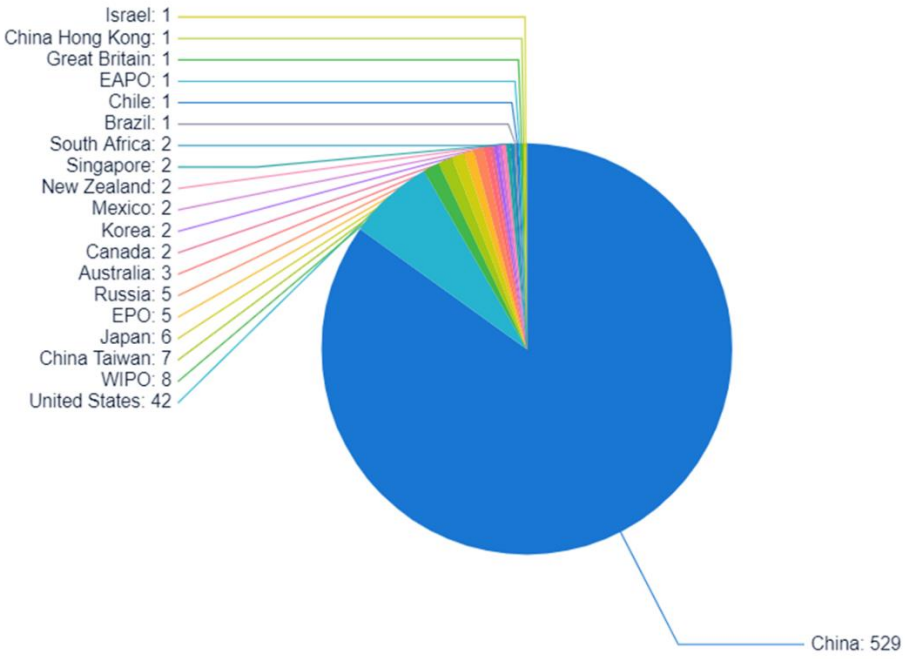

Figure 4: Top Application Countries and Regions – KER 2

Figure 5: Top IPC codes - KER 2 reports the main International Patent Classification (IPC) Codes of the patent dataset, identifying the main technologies related to the field of interest of KER #2. The description of each IPC code can also be checked at this website: https://www.wipo.int/classifications/ipc/en/. In this specific case, the most prevalent IPC codes are "electricity, gas or water supply" and "arrangements for parallelly feeding a single network by two or more generators, converters or transformers".

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Figure 5: Top IPC codes - KER 2

Figure 6: Top Assignee – KER2 reports the main assignee emerging from the analysis. They are primarily linked to the State Grid Corporation of China, commonly known as the State Grid and to Xi'an Jiaotong University.

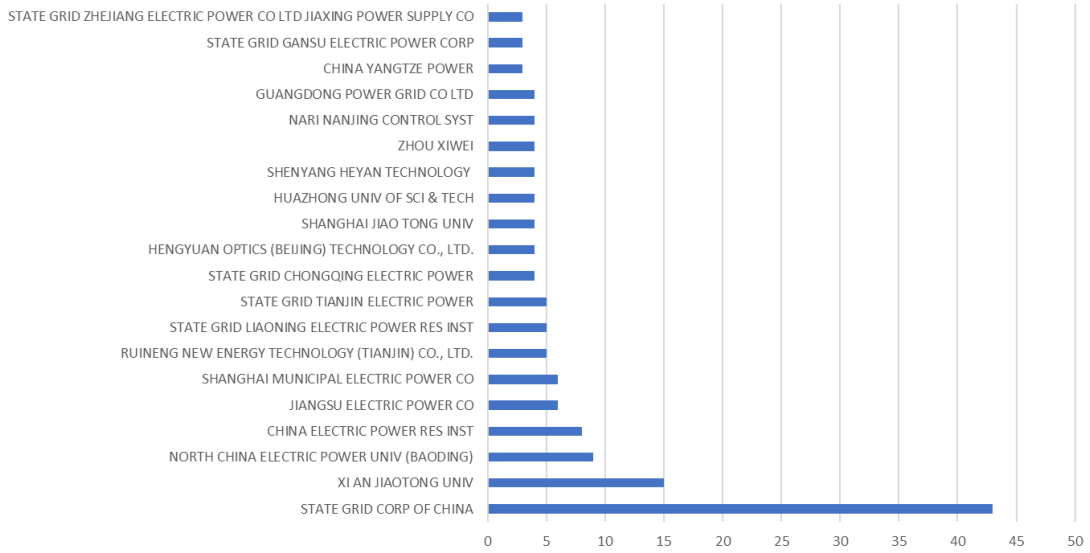

Figure 6: Top Assignee - KER 2

Competitive and technical intelligence analysis:

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The analysis of the patent dataset brought to the identification of the most relevant patents related to the field of optimal energy dispatch plan (KER # 2) resulting in the list hereby reported in Table 4-9: KER 2 - Relevant Patents.

Table 4-9: KER 2 - Relevant Patents

Publication number	Title	Assignee
IN202341033727A	Cooperative energy management algorithms for islanded hybrid microgrid using programmable logic controller	SHEILA, H KUMAR, KIRAN, PS
IN202241077496A	Development of Solar Energy Management System	BURRI ANKAIAH
US11043812B2	Controlling a behind the meter energy storage and dispatch system to improve power efficiency	INVENTUS HOLDINGS, LLC
CN115833265B	Comprehensive Intelligent Monitoring and Dispatch System of Electric Power Network	BEIJING THERMAL POWER GROUP CO., LTD. HEBEI UNIVERSITY OF TECHNOLOGY CHINA RAILWAY CONSTRUCTION GROUP ELECTROMECHANICAL INSTALLATION CO., LTD.

The details of the patents described above are shown below.

ASSIGNEE: SHEILA, H, KUMAR, KIRAN, PS	✓ **STATUS: PUBLISHED**
Title: Cooperative energy management algorithms for islanded hybrid microgrid using programmable logic controller	
Title INPADOC: Cooperative energy management algorithms for islanded hybrid microgrid using programmable logic controller	

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Publication number (Kind Code):

IN202341033727A

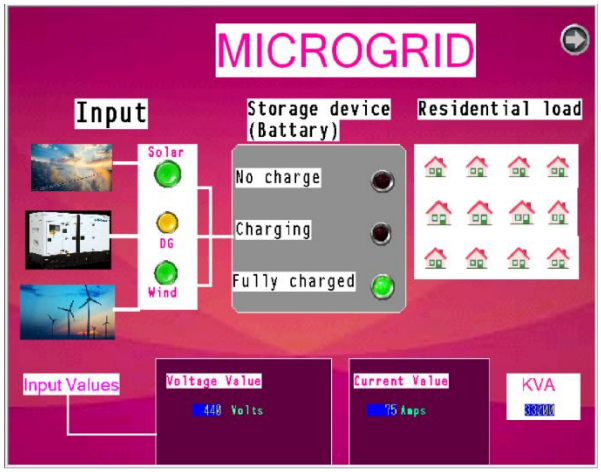
Publication Date: 16 Jun 2023

Current IPC:

A61K48/00; C12N15/113;

H02J3/00; H02J3/32; H02J3/38

DRAWINGS



Abstract

Islanded hybrid microgrids are becoming increasingly popular due to their ability to provide energy independence, increase reliability, and reduce greenhouse gas emissions. However, managing the distribution of energy among multiple sources and loads in such microgrids can be challenging, especially when integrating renewable energy sources. This paper presents cooperative energy management algorithms for an islanded hybrid microgrid using Programmable Logic Controller (PLC) and SOFTWARE GP Pro EX. The developed algorithms optimize the energy flow in the microgrid, ensuring that the energy sources are used efficiently, and that the energy demand of the loads is met in the most efficient manner possible. The system is designed to mitigate any risks of overloading or underloading of the system, ensuring that the system operates within safety limits. The integration of renewable energy sources such as solar panels, wind turbines, and batteries into the system reduces reliance on fossil fuels, minimizes greenhouse gas emissions, and promotes sustainable energy management practices. Real-time monitoring and control of the microgrid using the developed algorithms provides operators with valuable information for dynamic decision making, ensuring safe and effective management of the microgrid. The energy management system using PLC and SOFTWARE GP Pro EX is scalable, accommodating additional energy sources and loads as the demand grows, making it a sustainable and cost-effective solution for energy management in an islanded hybrid microgrid. Overall, the cooperative energy management algorithms using PLC and SOFTWARE GP Pro EX provide a robust, reliable, and easy-to-maintain energy management system, ensuring that the microgrid operates efficiently and effectively.

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ASSIGNEE: BURRI ANKAIAH ✓ **STATUS: PUBLISHED**

Title:

Development of Solar Energy Management System

Title INPADOC:

Development of Solar Energy Management System

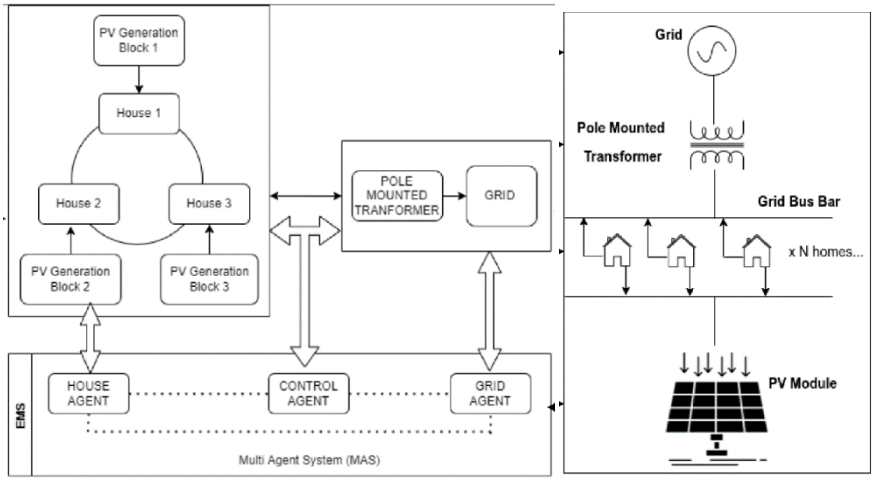
Publication number (Kind Code):

IN202241077496A

Publication Date: 06 Jan 2023

Current IPC: G06Q50/06; H02J3/14; H02J3/38; H02J3/00; G06Q30/02

DRAWINGS



Abstract

The advent of on-site and decentralized power generation poses a major challenge to conventional power grids in the form of virtual storage requirement. This has led to a trend of developing systems that rely less on the grid and behave more as a standalone generation source. The proposed energy management solution influences the on-site generation and facilitates demand response by shifting the flexible loads based on forecasted data. To ensure that self-utilization of energy is efficient within the district or community, an agent-based control model is modelled. It is designed for smart townships having 500 or more independent luxury villas which span across at least 100 acres or more. Once the individual villa's power demands are met, then with the help of a robust interconnected micro-grid across the entire township the rest of the power demands are met. As the load demand and renewable are uncertain throughout the day, an energy management system is essential to ensure grid stability and achieve reductions in operation costs and carbon dioxide emissions. A smart Energy Management System is proposed in to build a cleaner, greener, and sustainable society.

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ASSIGNEE: INVENTUS HOLDINGS, LLC ✓ **STATUS: GRANTED**

Title:

Controlling a behind the meter energy storage and dispatch system to improve power efficiency.

Title INPADOC:

Controlling a behind the meter energy storage and dispatch system to improve power efficiency.

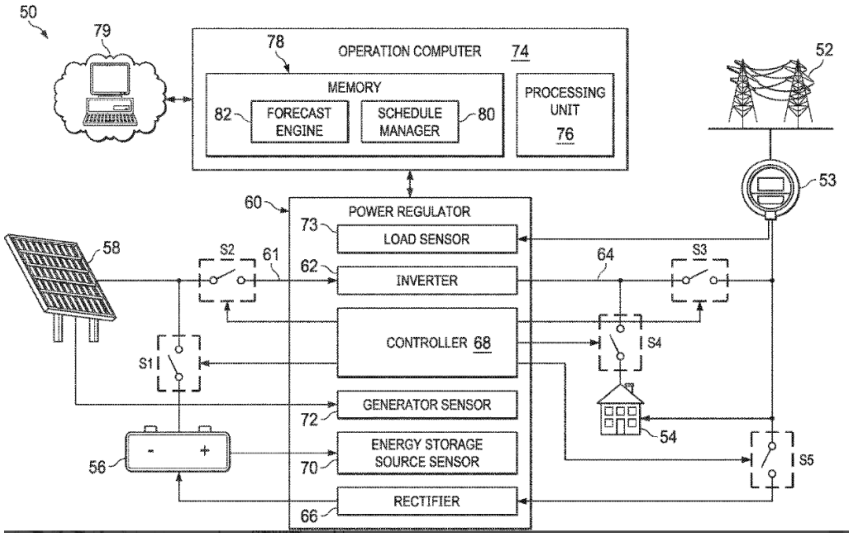
Publication number (Kind Code):

US11043812B2

Publication Date: 22 Jun 2021

Current IPC: H02J3/28; G05B13/04; H02J3/32; H02J3/00

DRAWINGS



Abstract

The invention includes a forecast engine that generates forecast data that characterizes predicted operating conditions of an energy storage system for a given time period in the future, wherein the predicted operating conditions are based on a load history for a power consuming premises coupled to the energy storage system and on a value history for power provided to and consumed from a power grid. The load history of the power consuming premises characterizes unmetered power transferred to the power consuming premises, metered powered transferred from the power grid to the power consuming premises and metered powered exchanged from the energy storage system to the power grid. In the example, a schedule manager generates an operation schedule for operating the energy storage system. The operation schedule includes charge and discharge patterns for an energy storage source that are tuned to curtail power costs and/or elevate power revenue value.

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ASSIGNEE: BEIJING THERMAL POWER GROUP CO., LTD. ✓ **STATUS: GRANTED**

Title:

Comprehensive Intelligent Monitoring and Dispatch System of Electric Power Network

Title INPADOC:

Comprehensive Intelligent Monitoring and Dispatch System of Electric Power Network

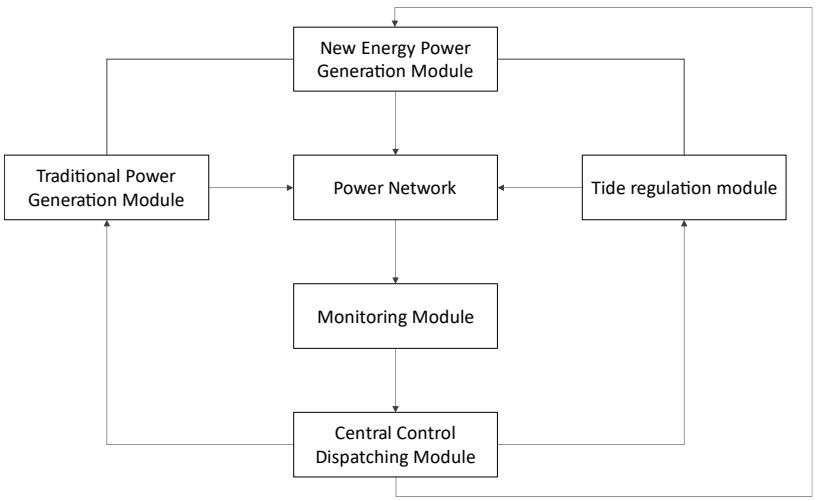
Publication number (Kind Code):

CN115833265B

Publication Date: 21 Mar 2023

Current IPC: H02J3/46; H02J3/00

DRAWINGS



Abstract

The present invention relates to the technical field of power supply coordination, in particular to a comprehensive intelligent monitoring and dispatching system of a power network, which includes a new energy power generation module, a traditional power generation module, a monitoring module, a tide regulation module and a central control dispatching module. Analyze the power consumption data of the power network to judge the power demand load of the power network to determine the preliminary power supply plan, and determine the opening timing and power generation of the traditional power generation module according to the actual storage power of the tidal regulation module in the system and the power consumption trend of the power network In order to provide electric energy to the power network, it avoids the lack of electric energy or the waste of electric energy caused by the error between the electric energy demanded by the electric power network and the power generated by the power generation end, and effectively ensures that the power station can meet the power demand of the electric power network. Utilizing the clean energy advantages of the new energy power station effectively ensures the energy saving and environmental protection features of the present invention

4.6.3 KER 5 - IEPT toolkits (specifically VERIFY and INTEMA.grid)

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#	Exploitable Results	Responsible Partner(s)
5	iVPP platform: IEPT toolkits (specifically VERIFY and INTEMA.grid)	CERTH

Description

VERIFY-D offers a holistic life cycle tool applicable in energy networks considering both existing energy grid infrastructure and comparisons with planned energy grid interventions. Multiple energy grid sectors, such as power plants production units, energy storage, and public infrastructures (e.g. lighting) can be incorporated to the life cycle analysis, specifically for the case of district level interventions.
INTEMA.grid offers an Energy Planning & Transition Decision Support Tool able to simulate multi-vector energy systems, integrated, accounting also the grid topologies and interconnections among variable systems.
Both tools are designed to be interoperable with multiple commercial platforms, if deemed as necessary, since are based on open-source algorithms, house developed by CERTH, through appropriately selected APIs offering the ability for instant communication and data exchange. Particularly, the analysis results of the VERIFY-D platform offer an accurate energy intervention planning mechanism through the quantify of environmental and economic impacts and further evaluation through the operation assessment specialized on IANOS demo sites.

Patent Scenario Analysis – KER 5

Query	
Title or Abstract	TA_ALL:(((lca ORlife $PRE0 cycle)AND(energ* $PRE0 syst* OR district*)))
Time interval	January 2005 – July 2023 (Data for the last 18 months incomplete due to standard patents publication procedures)
Results	**107** individual records, 98 **INPADOC** families

The query selected a total of **107** patents in the period under analysis (corresponding to **98** INPADOC families).

As it can be noticed from the following figure in the period under consideration (2005-2023) there was a positive temporal trend, except for 2019. It is worth to

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point out that data for the last 18 months are incomplete due to standard patents publication procedures). In this sense, it is a good practice to not consider the last two years (2023 and 2022) within the patent trend analysis.

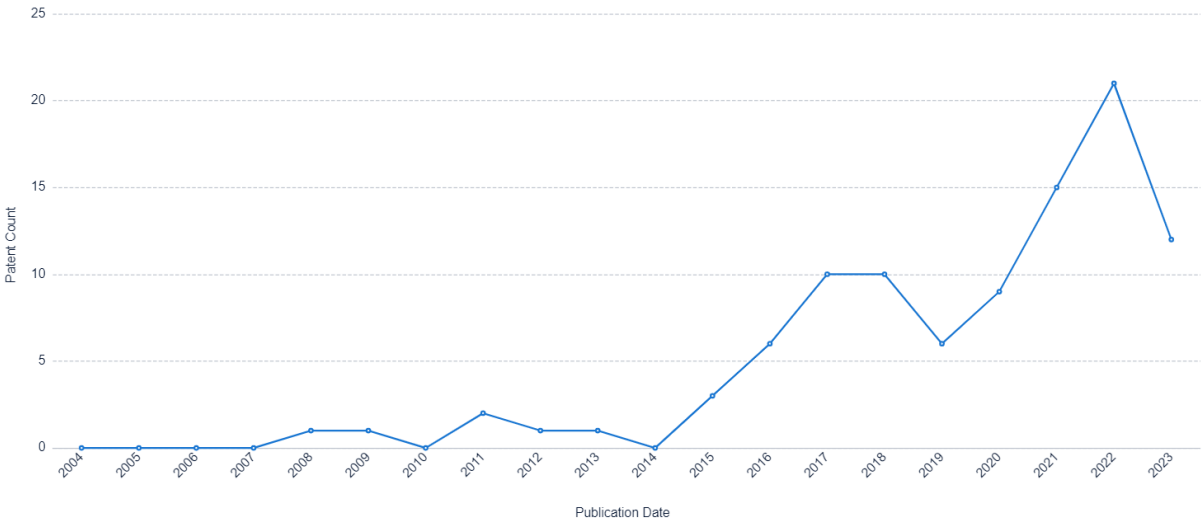

Figure 7: Publication trend - KER 5

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As presented below, the nation that have expressed the most interest in the topic is China with more than 100 submitted patents.

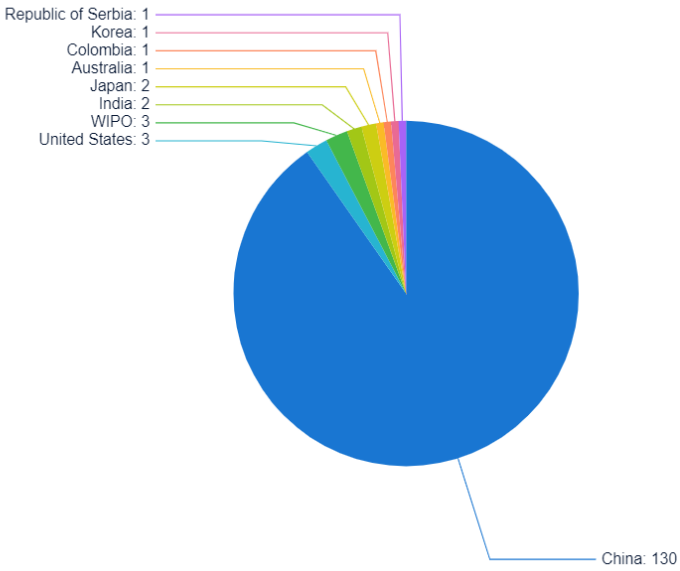

Figure 8: Top Application Countries and Regions – KER 5

Figure 9: Top IPC codes - KER 5 reports the main International Patent Classification (IPC) Codes of the patent dataset, identifying the main technologies related to the field of interest of KER #5. Each IPC code description can also be checked at this website: https://www.wipo.int/classifications/ipc/en/. Again, one of the most prevalent topic is “Electricity, gas or water supply” but also “Self-organising networks e.g., ad hoc networks or sensors networks".

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Figure 9: Top IPC codes - KER 5

Finally, Figure 10: Top Assignee - KER 5 reports the main assignee emerging from the analysis. They are primarily linked to the State Grid Corporation of China, commonly known as the State Grid and to Nanjing University.

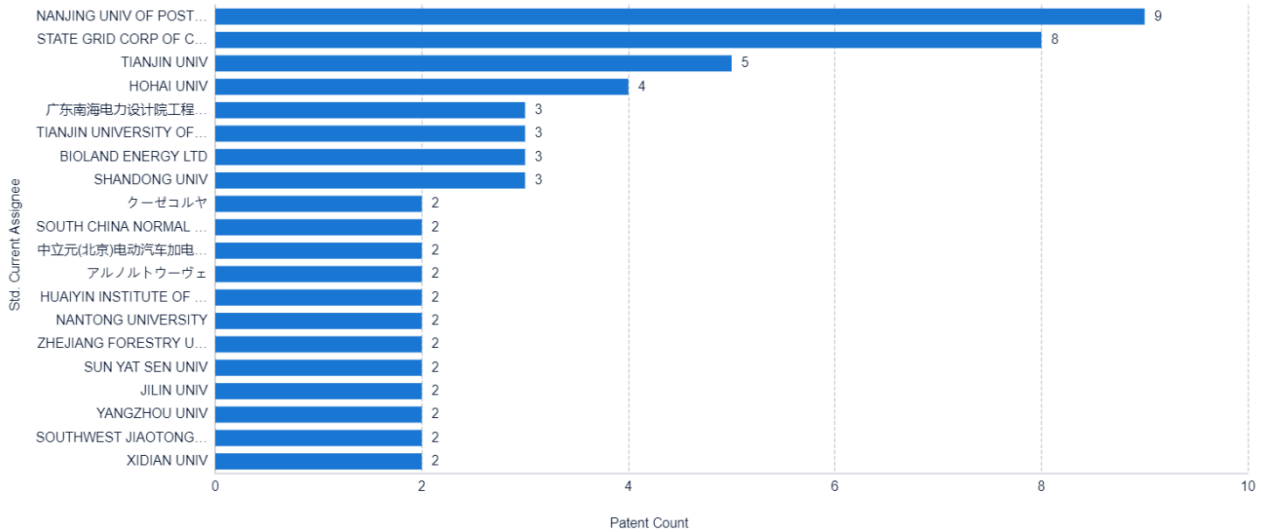


Figure 10: Top Assignee - KER 5

Competitive and technical intelligence analysis:

The analysis of the patent dataset brought to the identification of the most relevant patents related to the field of Life Cycle Analysis on energy systems (KER # 5) resulting in the list hereby reported in Table 4-10: KER 5 – Relevant Patents.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

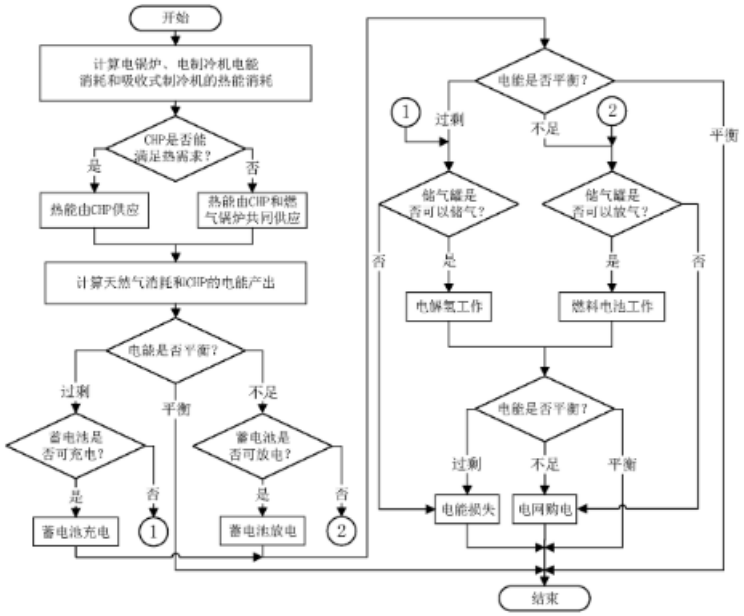
Table 4-10: KER 5 – Relevant Patents

Publication number	Title	Assignee
CN108832656A	Multi-objective programming method for micro-energy grid based on power-to-gas and renewable energy utilization	Tianjin University
CN114493020A	An integrated energy system planning method based on full life cycle cost and carbon emission	Zhejiang Yingji Power Technology Co., Ltd.
US9653759B2	Method and apparatus for optimized battery life cycle management	THE BOEING COMPANY
US9558250B2	System tools for evaluating operational and financial performance from dispatchers using after the fact analysis	ALSTOM TECHNOLOGY LTD.
CN112765714A	BIM-based environmental impact and cost accounting method of Chinese building life cycle	Tianjin University

The details of the patents described above are shown below.

ASSIGNEE: Tianjin University	✓ **STATUS EXAMINING**
Title: Multi-objective programming method for micro-energy grid based on power-to-gas and renewable energy utilization	DRAWINGS
Title INPADOC: Multi-objective programming method for micro-energy grid based on power-to-gas and renewable energy utilization	
Publication number (Kind Code):	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

CN108832656A **Publication Date:** 16 Nov 2018 **Current IPC:** H02J3/38 H02J3/28 H02J3/32	

Abstract

The present invention relates to the field of micro-energy network and distributed energy planning. In order to propose a multi-objective planning method for micro-energy network considering power-to-gas technology and renewable energy utilization, it includes fan, photovoltaic, combined cooling, heating and power supply system, P2GSS and storage battery, etc. The planning of the micro-energy network has guiding significance. In the present invention, based on the multi-objective planning method of the micro-energy network based on power-to-gas and renewable energy utilization, the steps are as follows: (1) Modeling of the micro-energy network; (2) Calculation of the micro-energy network based on the full life cycle method. The whole life cycle cost of the energy network, with the lowest whole life cycle cost and the smallest annual carbon dioxide emissions as the optimization goal, considering the influence of the operation mode such as the proportion of electric cooling and electric heating, establishes a multi-objective optimization for the capacity of key equipment in the micro energy network Configuration method; (3) Through the comparison of different scenarios, a multi-objective planning method for micro energy network is proposed. The invention is mainly applied to micro energy network and distributed energy planning occasions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Zhejiang Yingji Power Technology Co., Ltd. ✓ **STATUS EXAMINING**

Title:

An integrated energy system planning method based on full life cycle cost and carbon emission

Title INPADOC:

An integrated energy system planning method based on full life cycle cost and carbon emission

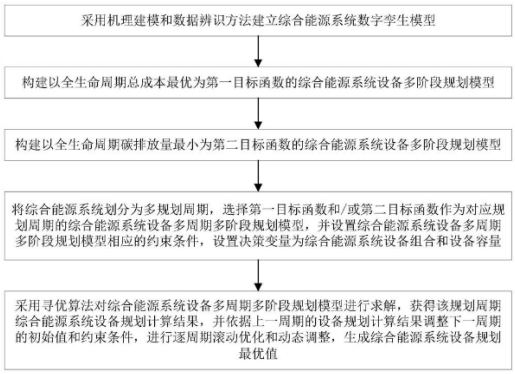
Publication number (Kind Code):

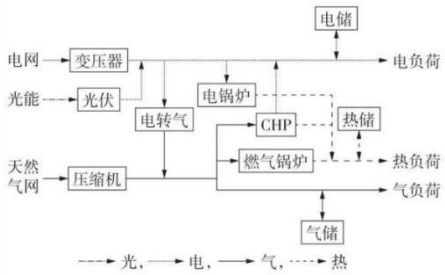
CN114493020A

Publication Date: 13 May 2022

Current IPC: G06Q10/04; G06Q30/02; G06F30/20; G06Q50/06; G06N3/00; G06F111/04; G06F119/06; G06F119/08

DRAWINGS





Abstract

The invention discloses a comprehensive energy system planning method based on full life cycle cost and carbon emissions, including: establishing a digital twin model of an integrated energy system; constructing an integrated energy system equipment with the optimal total cost of the entire life cycle as the first objective function. Multi-stage planning model; build a multi-stage planning model for integrated energy system equipment with the minimum carbon emissions in the whole life cycle as the second objective function; divide the integrated energy system into multiple planning cycles, and select the first objective function and/or the second objective The function is used as the multi-period and multi-stage planning model of the integrated energy system equipment corresponding to the planning cycle, and the corresponding constraints and decision variables are set; the optimization algorithm is used to solve the planning model, and the planning calculation result of the integrated energy system equipment in the planning cycle is obtained, and based on The calculation results of the previous cycle adjust the initial value and constraint conditions of the next cycle, and perform cycle-by-cycle rolling optimization and dynamic adjustment to generate the optimal value of the comprehensive energy system equipment planning.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: THE BOEING COMPANY ✓ **STATUS GRANTED**

Title:

Method and apparatus for optimized battery life cycle management

Title INPADOC:

Method and apparatus for optimized battery life cycle management

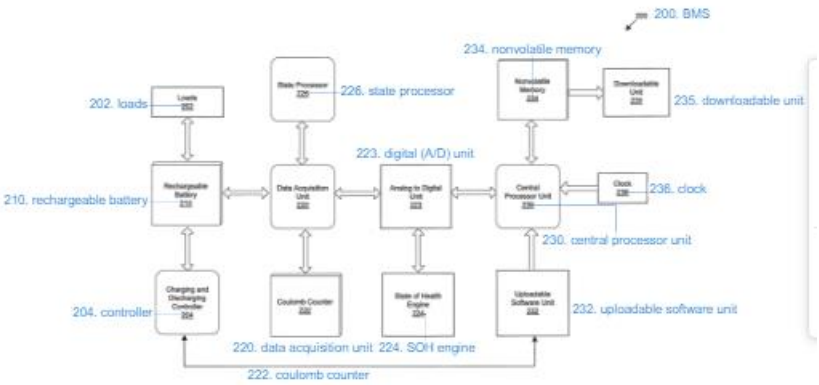
Publication number (Kind Code):

US9653759B2

Publication Date: 16 May 2017

Current IPC: H02J7/00; H01M10/42; G01R31/36; G01R31/00

DRAWINGS



Abstract

Method and apparatus for optimized battery life cycle management are described. A battery management system (BMS), comprising a battery, identifies battery-specific factors with associated environmental conditions, and battery history profiles at a current time instant. The BMS measures current, voltage, and/or power of the battery instantaneously. The resulting battery measurements, the battery-specific factors with associated environmental conditions, and the battery history profiles, formed as battery dynamic situations at the current time instant, may be time stamped for estimating an instantaneous battery state of the battery. The time stamped battery dynamic situations may be aggregated for long-term trend analysis for the battery state. The instantaneous battery state estimate is updated by comparing with the long-term trend analysis to manage battery charging or discharging. The battery operating conditions are determined based on the updated battery state estimate. The BMS may manage system power consumptions based on the determined battery conditions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: ALSTOM TECHNOLOGY LTD. ✓ **STATUS GRANTED**

Title:

System tools for evaluating operational and financial performance from dispatchers using after the fact analysis

Title INPADOC:

System tools for evaluating operational and financial performance from dispatchers using after the fact analysis

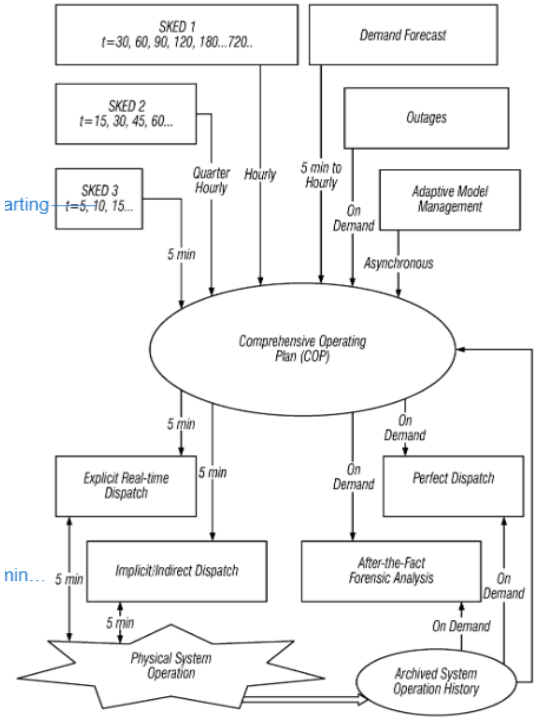
Publication number (Kind Code):

US9558250B2

Publication Date: 31 Jan 2017

Current IPC: G06Q10/06; G06F17/30; G06Q10/04

DRAWINGS



Abstract

A decision-support tool is provided to evaluate operational and financial performance for dispatchers in power grid control centers associated with utility systems. A scheduler engine is coupled to a comprehensive operating plan that applies after the fact analysis for performance metrics, root-cause impacts and process re-engineering. A relational database is coupled to a data archiver that captures actual system and resource conditions and then supplies the system and resource conditions to the relational database. The scheduler engine receives the actual system and resource conditions from the relational database and processes it to calculate system performance. A user interface is configured to display at least one of, transmission evaluation application displays, reference and scenario cases and associations between them, results presented with a graphical or tabular displays, comparison results between scenario cases and a reference case, a family of curves where each curve is a performance metric, comparison of scenario input data, study results and statistical analysis and historical data.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Tianjin University

✓ STATUS EXAMINING

Title:

BIM-based environmental impact and cost accounting method of Chinese building life cycle

Title INPADOC:

BIM-based environmental impact and cost accounting method of Chinese building life cycle

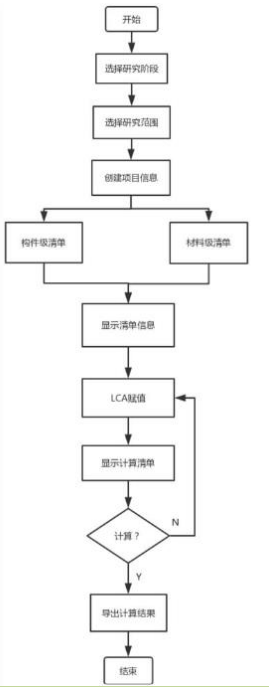
Publication number (Kind Code):

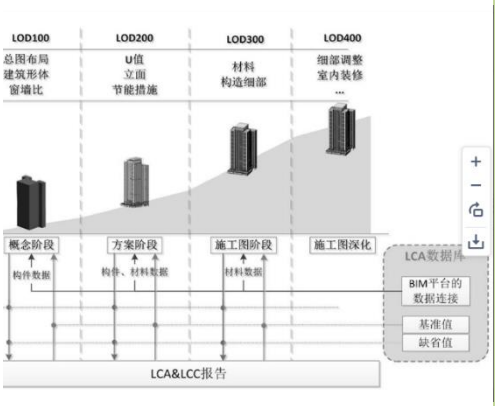
CN112765714A

Publication Date: 07 May 2021

Current IPC: G06F30/13; G06F30/20; G06Q10/06; G06Q30/02; G06Q50/08

DRAWINGS





Abstract

The invention belongs to the technical field of building informatization, and specifically discloses a BIM-based Chinese building life cycle environmental impact and cost accounting method, including: establishing a database system that includes a complete life cycle category of the building; naming components and materials in different parts; Components and materials are numbered, and material libraries and component libraries with coding systems are integrated; BIM- LCA /LCC evaluation tools are integrated to study key parameters in each stage of architectural design, default values that need to be supplemented in the early design stage, and different types of buildings life cycle assessment benchmark value. The invention builds a database framework of materials and components required for the life cycle of a building, provides a list of building components and materials based on China, automatically extracts building model information based on the Revit plug-in, and cooperates with the architectural design process for designers to use. The graphical export of the calculation results can provide timely feedback to the architectural design scheme.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

4.6.4 KER 8 - iVPP platform: Enterprise Service Bus

#	Exploitable Results	Responsible Partner(s)
8	iVPP platform: Enterprise Service Bus	ETRA

Description

The iVPP Enterprise Service Bus allows the communication of the different components in the iVPP and other elements in the IANOS architecture.

Patent Scenario Analysis – KER 8

A patent scenario analysis was performed for the solution identified by KER #8. The search query used to map the patent landscape is reported in the following table, while main results are depicted by following figures and comments. The patent analysis selected patents from 2005 up to today.

Query	
Title or Abstract	TA_ALL: ((Enterprise $pre0 service $pre0 bus))
Time interval	January 2005 – July 2023 (Data for the last 18 months incomplete due to standard patents publication procedures)
Results	**637** individual records, **354 INPADOC** families

The query selected a total of 637 patents in the period under analysis (corresponding to 354 INPADOC families).

As it can be noticed from the following figure in the period under consideration (2005-2023) the trend is up until 2014, at which time the trend begins to be discontinuous alternating between years in which the number of patents rises compared to the previous one (2016, 2018, 2021) and others in which there is a decline in patent submissions in the context of ESB (especially 2017 and the 2019 2020 biennium). In this sense, it is a good practice to not consider the last two years (2023 and 2022) within the patent trend analysis.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

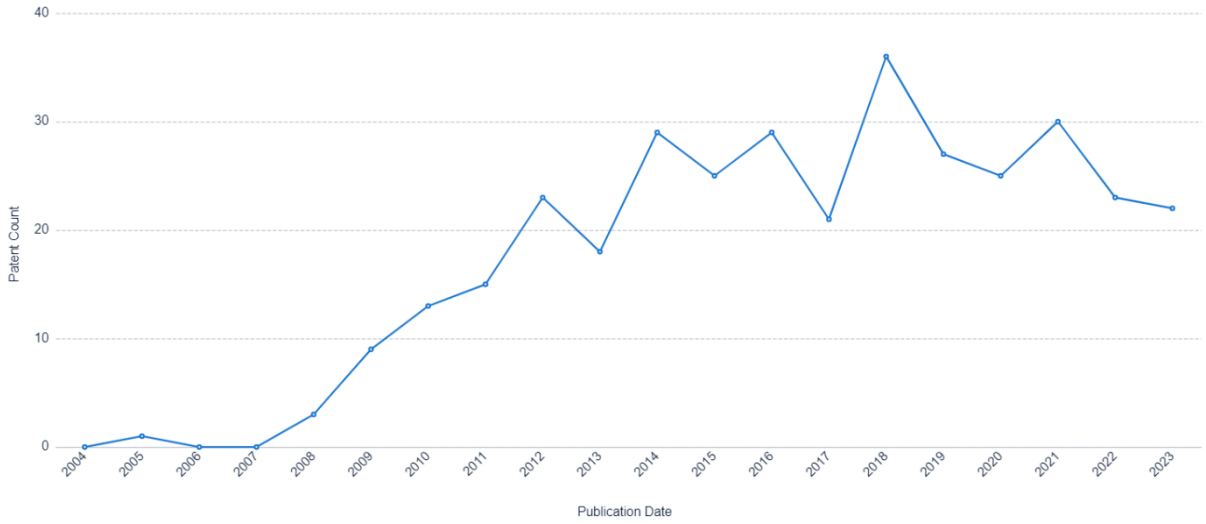


Figure 11: Publication trend - KER 8

The countries that expressed more interest in this topic are China and United States, as presented below. This is probably due to the interest on Enterprise Service Bus of three big firms such as IBM, Red Hat and State Grid Corporation of China.

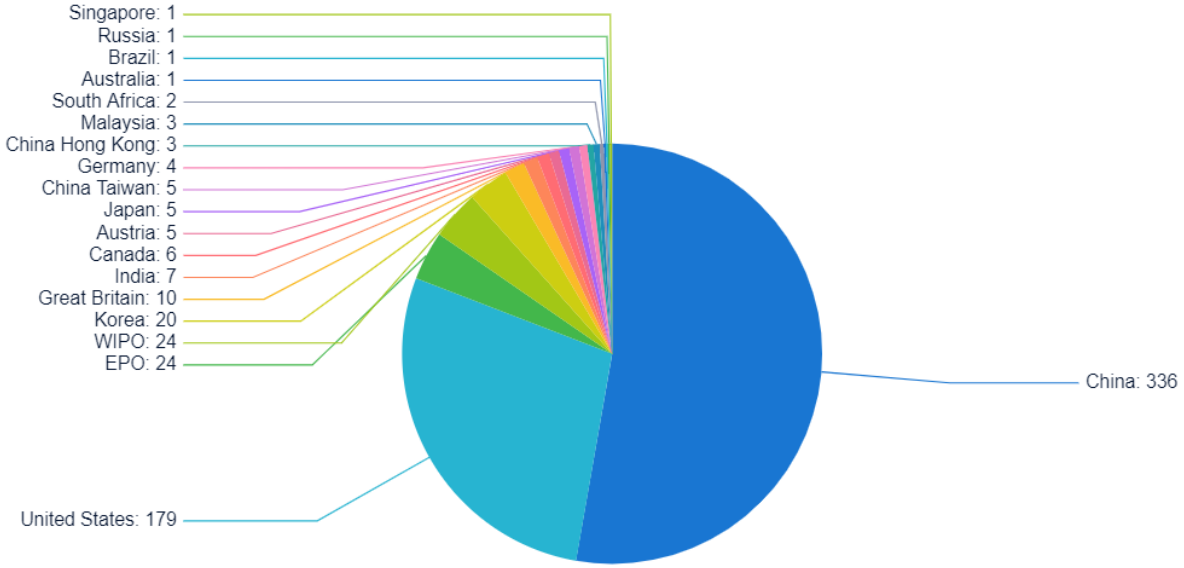


Figure 12: Top Application Countries and Regions – KER 8

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

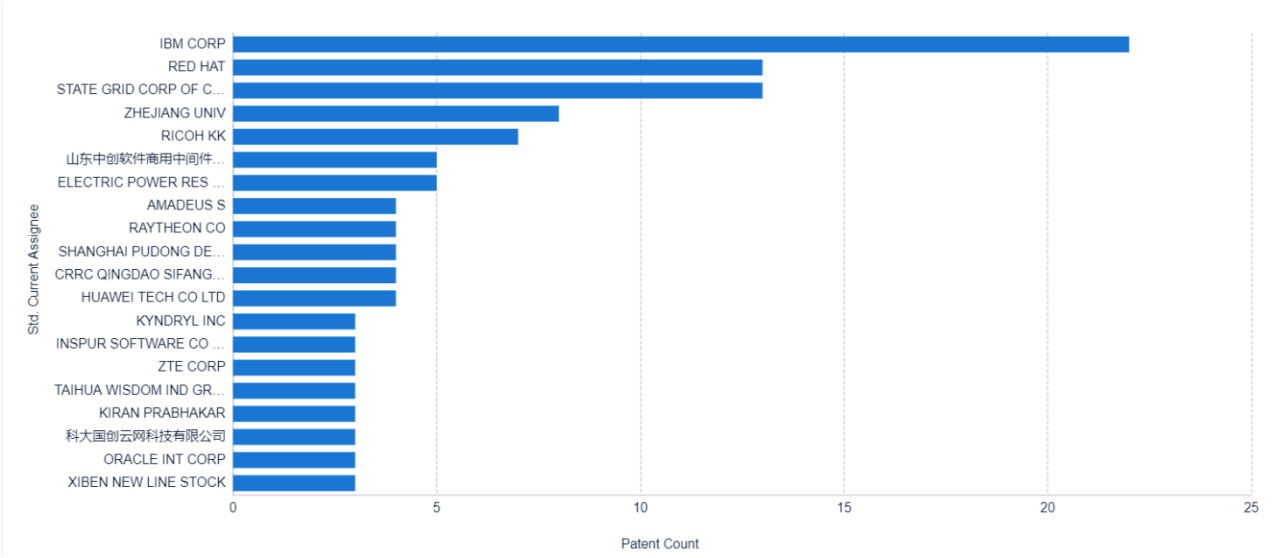


Figure 13: Top Assignee - KER 8

Figure 14: Top IPC codes - KER 8 reports the main International Patent Classification (IPC) Codes of the patent dataset, identifying the main technologies related to the field of interest of KER #2. Each IPC code description can also be checked at this website: https://www.wipo.int/classifications/ipc/en/ . In this specific case, the most prevalent IPC codes is, naturally, related to "transmission control procedures".

Figure 14: Top IPC codes - KER 8

Competitive and technical intelligence analysis:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

The analysis of the patent dataset brought to the identification of the most relevant patents related to the field of Enterprise Service Bus (KER # 8) resulting in the list hereby reported in Table 4-11: KER 8 - Relevant Patents.

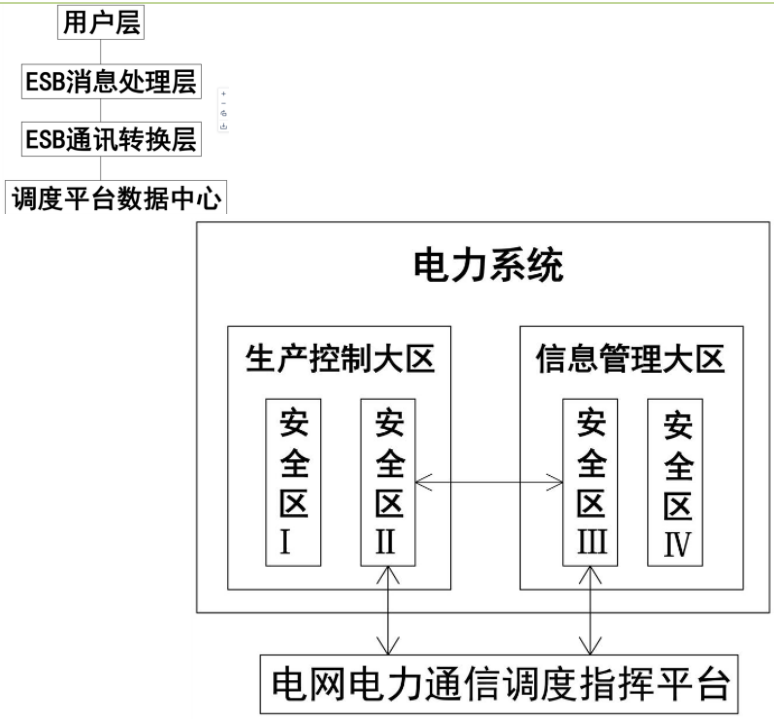
Table 4-11: KER 8 - Relevant Patents

Publication number	Title	Assignee
CN112286915A	Data interaction method between electric power communication dispatching command platform and third-party platform	STATE GRID CORP OF CHINA
CN105320113A	Information interaction method between grid space information service platform and distribution automation system	STATE GRID CORP OF CHINA
CN110134646B	Knowledge platform service data storage and integration method and system	Anhui Pengrui Technology Co., Ltd
US7912956B1	Service level agreement-based control of a distributed computing system	RAYTHEON CO
CN105207358A	Power quality online monitoring platform	STATE GRID CORP OF CHINA

The details of the patents described above are shown below.

ASSIGNEE: STATE GRID CORP OF CHINA ✓ **STATUS EXAMINING**	
Title: Data interaction method between electric power communication dispatching command platform and third-party platform	DRAWINGS
Title INPADOC: Data interaction method between electric power communication dispatching command platform and third-party platform	
Publication number (Kind Code): CN112286915A	
Publication Date: 29 Jan 2021	
Current IPC:	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

G06F16/21; 5G06F16/25; G06Q10/06; G06Q50/06; H04L12/40; H04L29/06; H04L29/08	

Abstract

The invention discloses a data interaction method between a power communication dispatching command platform and a third-party platform, and divides the power system into two large areas, which are respectively a production control area and an information management area; wherein the production control area is divided into control The safety area I of the district and the safety area II of the non-control area, the information management area is divided into the safety area III of the production management area and the safety area IV of the information management area; the power communication dispatching command platform and the safety area are realized through the ESB enterprise service bus II. General data interactive access service of security zone III; cross-zone data interaction between security zone II and security zone III is realized through cross-security zone service agent program. The invention satisfies the need for cross-regional access to data such as daily maintenance, provides technical support for the development of daily dispatching business, strengthens data interaction with third-party platforms, makes full use of data in the power system, and realizes dispatching operation, production technology and marketing Data sharing among departments is conducive to the long-term development of the power system.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: STATE GRID CORP OF CHINA ✓ **STATUS** **GRANTED**

Title:

Information interaction method between grid space information service platform and distribution automation system

Title INPADOC:

Information interaction method between grid space information service platform and distribution automation system

Publication number (Kind Code):

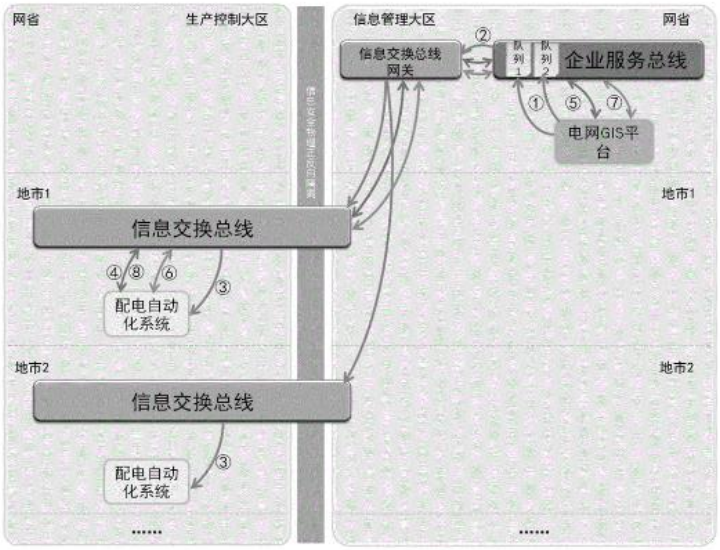
CN105320113A

Publication Date: 10 Apr 2018

Current IPC:

G05B19/418

DRAWINGS



Abstract

The invention relates to an information interaction method, which can effectively simplify the information interaction process, shorten the information interaction time, and support various upper-layer applications. Technical solution: the information interaction method between the grid space information service platform and the distribution automation system, which is characterized in that it includes the following steps: 1) the grid GIS platform sends the grid structure change message to the JMS message queue of the enterprise service bus; 2) the information exchange bus After the gateway receives the message, it forwards it to the information exchange bus of the corresponding city; 3) The message is sent to the distribution automation system of the corresponding city; 4) The distribution automation system of the corresponding city receives the request to establish a connection; 5) The service request establishes a service , after the service completes the corresponding business processing, return the connection token; 6) The distribution automation system obtains the grid model data; 7) Returns the grid model graph data to the distribution automation system; 8) The distribution automation system calls the closing connection service .

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Anhui Pengrui Technology Co., Ltd. ✓ **STATUS GRANTED**

Title:

Knowledge platform service data storage and integration method and system

Title INPADOC:

Knowledge platform service data storage and integration method and system

Publication number (Kind Code):

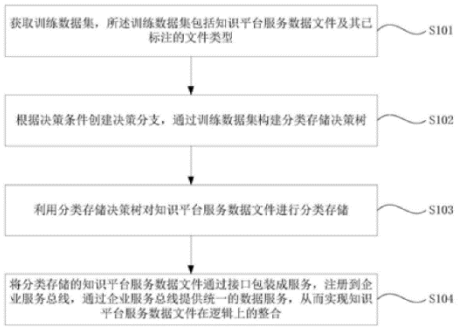
CN110134646B

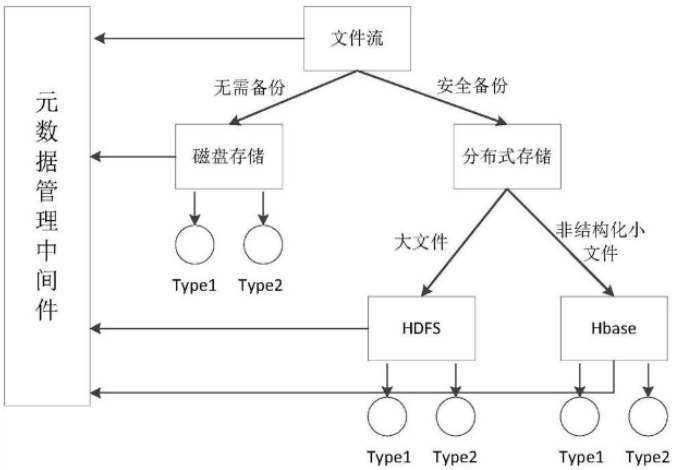
Publication Date: 07 Sep 2021

Current IPC:

G06F16/13; G06F16/182

DRAWINGS





Abstract

The present disclosure provides a knowledge platform service data storage and integration method and system. Among them, the knowledge platform service data storage and integration method includes: obtaining a training data set, the training data set includes knowledge platform service data files and their marked file types; creating decision branches according to decision conditions, and constructing classified storage through training data sets Decision tree; use the classified storage decision tree to classify and store the knowledge platform service data files; package the classified stored knowledge platform service data files into services through the interface, register to the enterprise service bus, and provide unified data services through the enterprise service bus, thereby Realize the logical integration of knowledge platform service data files.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: RAYTHEON COMPANY

✓ STATUS **GRANTED**

Title:

Service level agreement based control of a distributed computing system

Title INPADOC:

Service level agreement based control of a distributed computing system

Publication number (Kind Code):

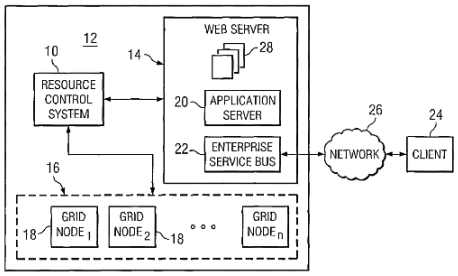
US7912956B1

Publication Date: 22 Mar 2011

Current IPC:

G06F15/173

DRAWINGS



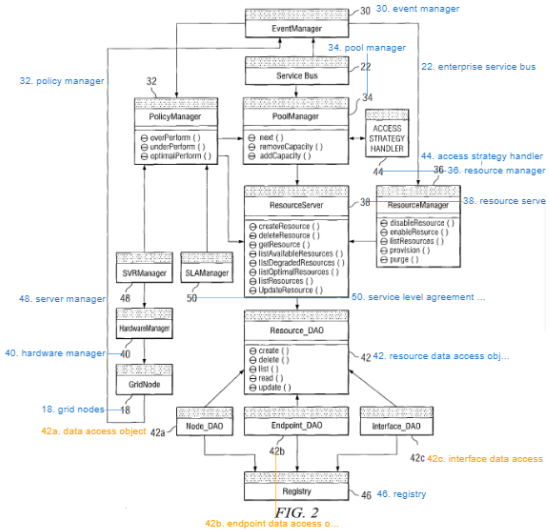
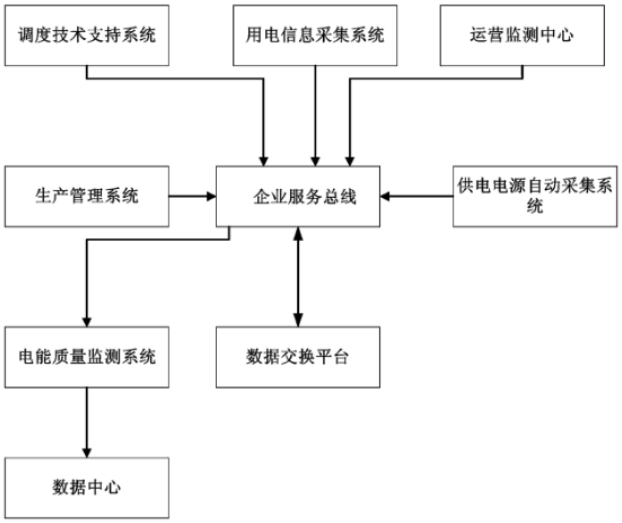


FIG. 2

Abstract

According to one embodiment, a distributed computing system includes a resource control system coupled to an enterprise service bus that orchestrates a plurality of services into a business application. The resource control system is operable to receive a performance parameter from the enterprise service bus in which the performance parameter includes a metric of the business application. Using the performance parameter, the resource control system determines a loading of each of a plurality grid node on which the plurality of services are executed, and provisions or un-provisions one of the pluralities of grid nodes according to the determined loading.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: STATE GRID CORP OF CHINA	✓ STATUS GRANTED
Title: Power quality online monitoring platform **Title INPADOC:** Power quality online monitoring platform **Publication number (Kind Code):** CN105207358A **Publication Date:** 19 Jan 2018 **Current IPC:** H02J13/00	DRAWINGS 

Abstract

The invention discloses an online power quality monitoring platform, which includes a power quality monitoring system, an enterprise service bus, a data exchange platform, a data center, a dispatching technical support system, a power consumption information collection system, an operation monitoring center, a production management system and a power supply Power automatic collection system; the dispatching technical support system, power consumption information collection system, operation monitoring center, production management system and power supply automatic collection system all transmit the collected data to the data exchange platform through the enterprise service bus, and the power quality monitoring system The data in the data exchange platform is read through the enterprise service bus, and the power quality monitoring system analyzes and processes the read data, and saves the results of the analysis and processing to the data center. The purpose of integrated automatic data collection is achieved.

4.6.5 KER 10 - PCM Thermal storage heat batteries

#	Exploitable Results	Responsible Partner(s)
10	PCM Thermal Storage Heat Batteries	SUNAMP

Despite SUNAMP already has a patent-protected solution related to this KER , it is worth to offer a comprehensive competitive analysis within the thermal energy storage/heat batteries sector. By evaluating alternative technologies and solutions, we aim to provide valuable insights into the broader market landscape.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

While SUNAMP's patented approach may hold a distinct advantage in certain aspects, it is vital to identify potential areas where alternative solutions may offer unique strengths or improvements.

Description

SunAmp's proprietary technology is an innovative thermal storage solution that immerses a powerful heat exchanger into the PCM storage and therefore maximizing its thermal power will be included in the iVPP, along with SoC monitoring controllers for optimal storage utilization.

Patent Scenario Analysis – KER 10

Query	
Title or Abstract	TA_ALL:((heat $PRE0 batter*)OR(heat $PRE0 storage)) AND PRIORITY_DATE:[20050101 TO *] AND IPC:(F28D20/02) AND TA_ALL:(phase change material OR pcm))
Time interval	January 2005 – July 2023 (Data for the last 18 months incomplete due to standard patents publication procedures)
Results	**1469** individual records, **1022 INPADOC** families

The query selected a total of **1469** patents in the period under analysis (corresponding to **1022** INPADOC families).

As it can be noticed from the following figure in the period under consideration (2005-2023) there was a positive temporal trend. It is worth to point out that data for the last 18 months are incomplete due to standard patents publication procedures). In this sense, it is a good practice to not consider the last two years (2023 and 2022) within the patent trend analysis.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

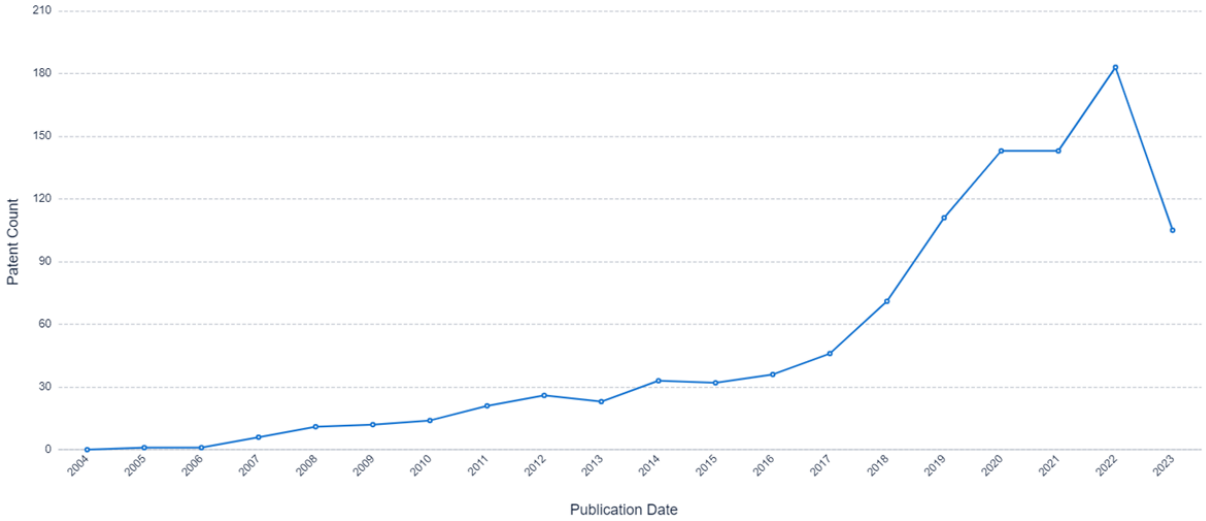


Figure 15: Publication trend - KER 10

In particular, there has been great interest towards patent applications from countries as China, Japan and Germany and, as reported in the map of Top Application Countries and regions (Figure 16: Top Application Countries and Regions – KER 10).

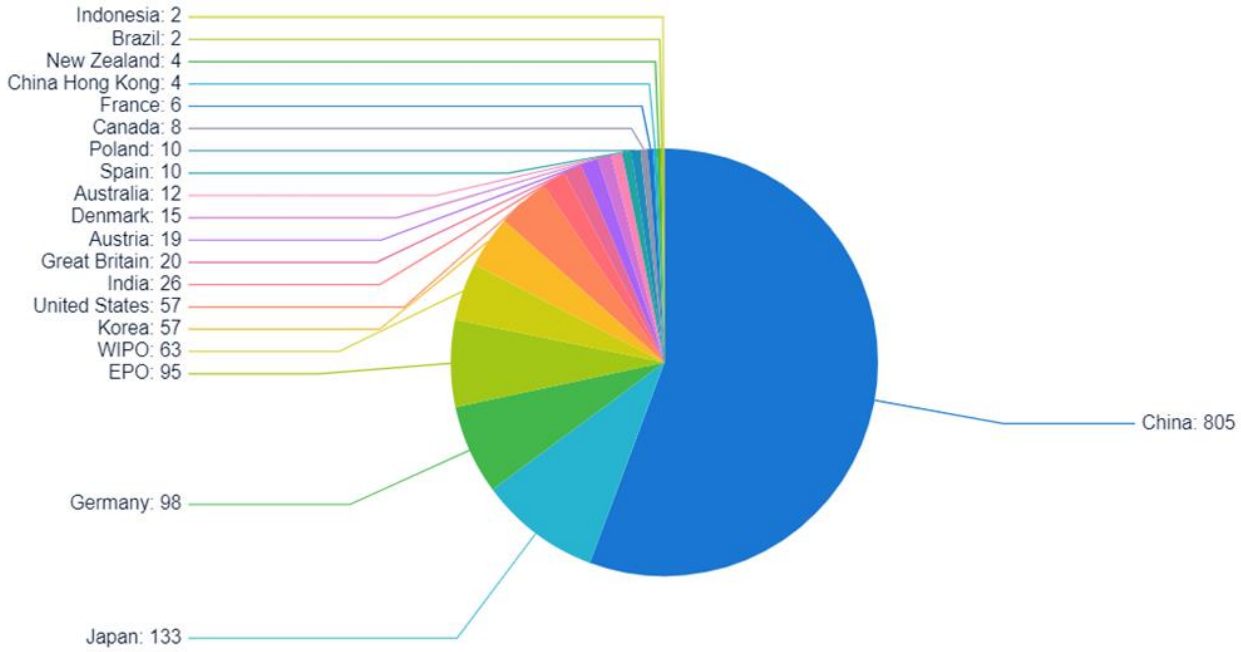


Figure 16: Top Application Countries and Regions – KER 10

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

Figure 17: Top IPC codes - KER 10 reports the main International Patent Classification (IPC) Codes of the patent dataset, identifying the main technologies related to the field of interest of KER #10. Each IPC code description can also be found at this website: https://www.wipo.int/classifications/ipc/en/ . In this case, the query was set to show results that included the use of latent heat as a heat storage mechanism, which is why it is the most featured topic.

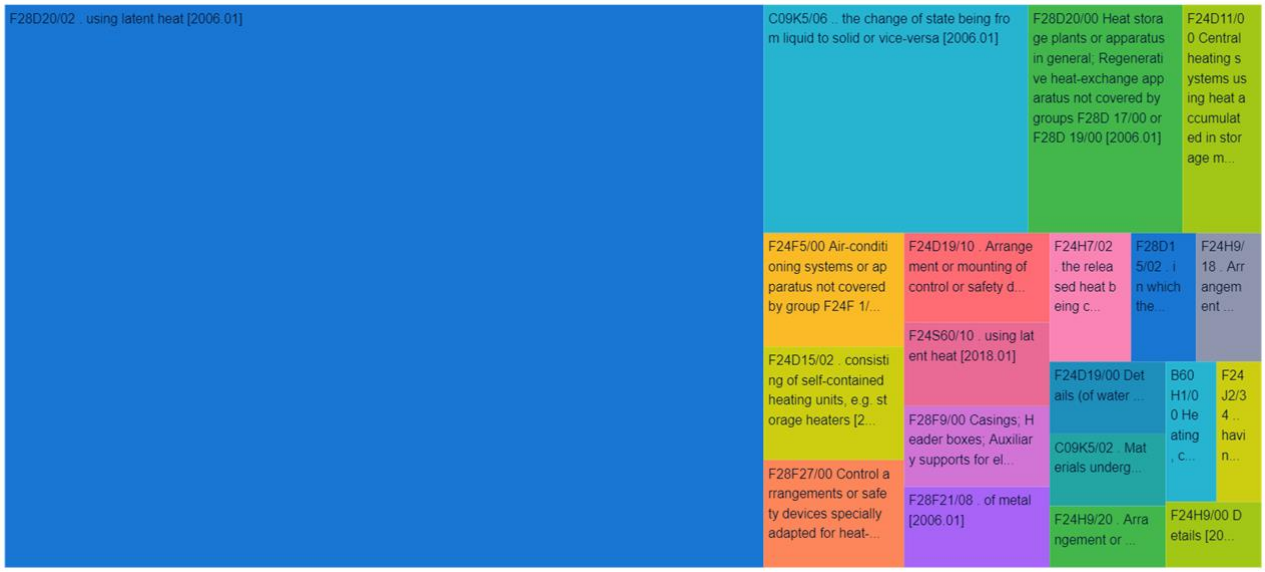


Figure 17: Top IPC codes - KER 10

Figure 18: Top Assignee - KER 10 reports the main assignee emerging from the analysis. They are primarily linked to the Zhejiang University, Pioneer Energy (Jiangsu), Grid Corporation of China and to Hebei University in China.

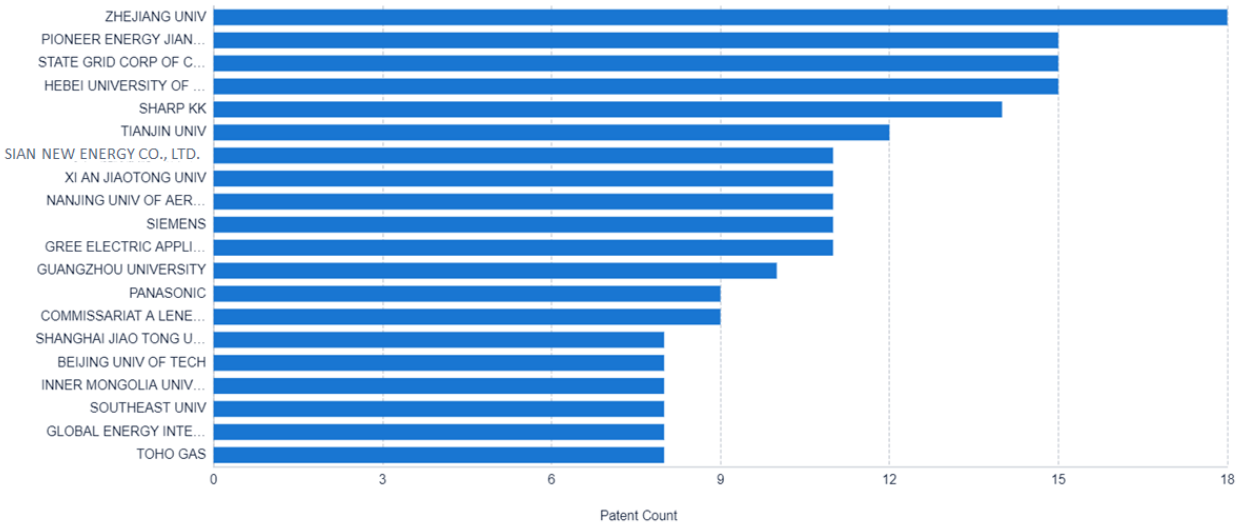


Figure 18: Top Assignee - KER 10

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

Competitive and technical intelligence analysis:

The analysis of the patent dataset brought to the identification of the most relevant patents related to the field of heat batteries and thermal storage systems through phase change materials (KER #10) resulting in the list hereby reported in Table 4-12: KER 10 - Relevant Patents.

Table 4-12: KER 10 - Relevant Patents

Publication number	Title	Assignee
US11041680B2	High-density latent heat storage device	Board Of Regents, The University Of Texas System
CN114561193A	A kind of phase change energy storage composite material and its preparation method and application	Xiangshui Huaxia Special Material Technology Development Co., Ltd.
IN202241014837A	PCM based thermal energy storage system using parabolic dish type solar collector	Dr. K. K. Ramasamy
IN202221022583A	Thermal energy storage for heating and cooling of the building using phase change materials	Dr. Jaykumar hasmukhbhai patel
US20180287231A1	Thermally Regulated Modular Energy Storage Device and Methods	Yotta solar, inc.
FR3038376A1	Phase Change Material Energy Storage Device and Method for Storage	Commission for atomic energy and alternative energies

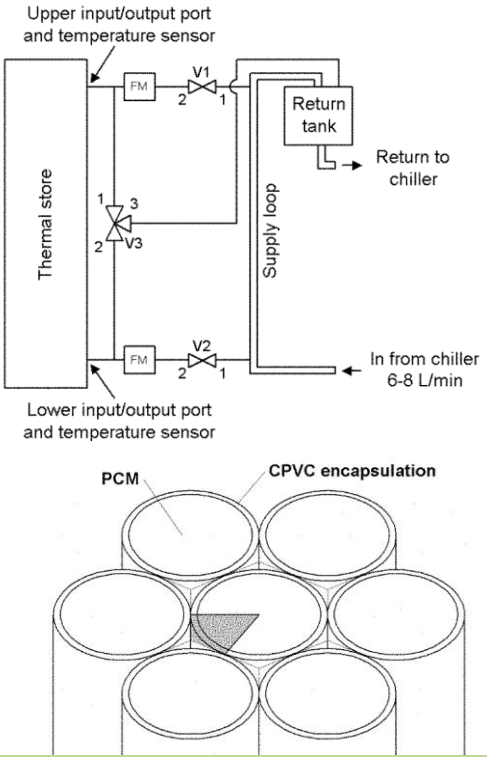
The details of the patents described above are shown below.

ASSIGNEE: Board of Regents, The University Of Texas System	✓ **STATUS:** GRANTED
Title: High-density latent heat storage device	DRAWINGS
Title INPADOC: High-density latent heat storage device	
Publication number (Kind Code): US11041680B2	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

Publication Date: 22 Jun 2021

Current IPC: F28D20/02; F28F1/04; F28D20/00



Abstract

Latent heat storage devices are disclosed, such as latent heat storage devices comprising a phase change material encapsulated in sufficiently conductive tubes, wherein the tubes are arrayed in a hexagonal-packed pattern. The devices herein can be used, for example, in residential and/or commercial HVAC systems.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Xiangshui Huaxia Special Material Technology Development Co., Ltd.

✓ **STATUS:** EXAMINING

Title:

A kind of phase change energy storage composite material and its preparation method and application

Title INPADOC:

A kind of phase change energy storage composite material and its preparation method and application

Publication number (Kind Code):

CN114561193A

Publication Date: 31 May 2022

Current IPC: C09K5/06

DRAWINGS

Abstract

The invention discloses a phase change energy storage composite material and its preparation method and application. The phase change energy storage composite material is composed of a high pore volume mesoporous substrate and a solid-liquid phase change material through a melt impregnation process. The preparation method includes the following Steps: S1, synthesis of high-porosity ultra-light mesoporous substrate; S2, composite of substrate and phase change material; S3, adsorption and screening, obtaining the phase change energy storage composite material of the present invention. The phase change energy storage composite material obtained by the invention has high thermal conductivity, large comprehensive phase change latent heat, controllable phase change temperature, low liquid leakage rate and high retention rate of 90%. It can be widely used in building phase change temperature control, automatic temperature-adjusting textiles, floor heating heat storage, battery passive thermal management, solar energy, air conditioning and other fields.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Dr. K. K. Ramasamy ✓ **STATUS:** PUBLISHED

Title:

PCM based thermal energy storage system using parabolic dish type solar collector

Title INPADOC:

PCM based thermal energy storage system using parabolic dish type solar collector

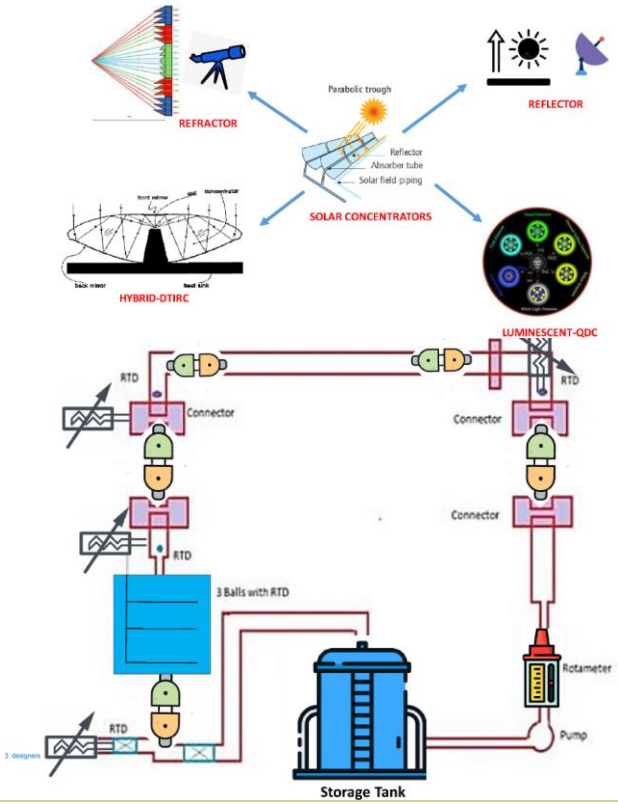
Publication number (Kind Code):

IN202241014837A

Publication Date: 25 Mar 2022

Current IPC: C09K5/06; F28D20/00; G06Q50/06; F28D20/02; F24S10/90

DRAWINGS



Abstract

In solar powered thermal and dissipate heat recuperation frameworks, the amount of energy supply does not usually match with the process demand. To conquer this some type of Thermal Energy Storage (TES) framework is fundamental for the best use of the energy sources. TES is the transitory stockpiling unit, which stores the hotness energy for some time in the future. Among the accessible advances for the warm stockpiling frameworks, thermal energy storing frameworks, utilizing stage change material (PCM) as capacity medium, are appealing because of their benefits for example, high hotness stockpiling limit and isothermal way of behaving during charging and releasing cycles. The degree of solar-based nuclear power in the globe isn't steady; rather, it relies on weather patterns & territory to determine the irregularity between energy supply and request. The idle heat storage system utilizing Phase Change Material (PCM) is a compelling approach to putting away solar powered nuclear power, which meaningfully has an impact on its state at a wide reach of temperature. In the current work, the illustrative dish type solar powered authority is utilized which gathers and reflects heat energy to a copper vessel. Water is coursed to a copper vessel and a consolidated nuclear power stockpiling tank by utilizing a DC siphon. A Solar board with a battery is utilized for the activity of the siphon. The presentation of the consolidated nuclear power stockpiling framework during charging and releasing cycles is widely investigated in this invention.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Dr. K. K. Ramasamy Dr. Jaykumar hasmukhbhai patel

✓ **STATUS:** PUBLISHED

Title:

Thermal energy storage for heating and cooling of the building using phase change materials

Title INPADOC:

Thermal energy storage for heating and cooling of the building using phase change materials

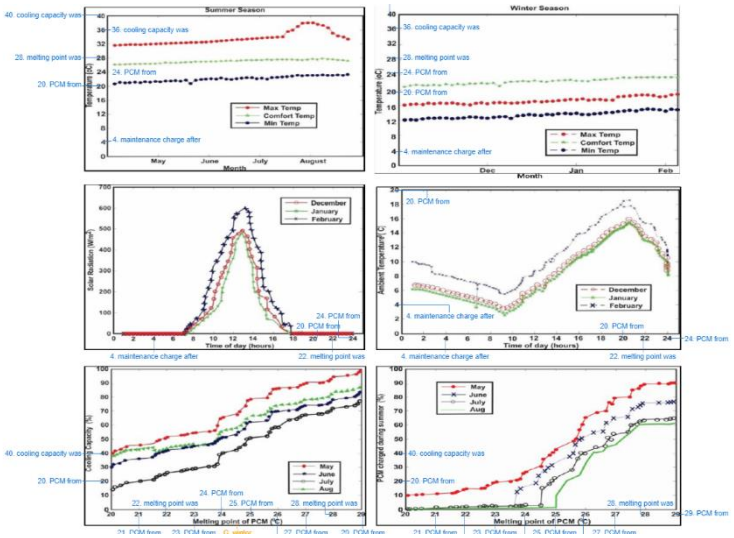
Publication number (Kind Code):

IN202221022583A

Publication Date: 29 Apr 2022

Current IPC: F28D20/02; F24F5/00; C09K5/06; F28D20/00; F24S60/00

DRAWINGS



Abstract

International Energy Agency Solar Heating & Cooling programme states the fact that space/water heating and cooling demand account for over 75% of the energy consumed in single and multi-family homes. Solar energy technology can meet up to 100% of this demand depending on the size of the system, storage capacity, heat load and region's climate. In this research was to provide heating and cooling of space into the buildings by using passive system. By avoiding conventional methods for thermal storage, phase change materials (PCMs) provide heat storage and nearly constant temperature at much higher energy storage densities. This technology can meet the requirement of indoor temperature regulation depending on the region's climatic zone. This study belongs to the passive system, wherein night ambient temperatures and solar energy participate in thermoregulation of the buildings. The PCMs was installed along with building substance used in floor to enhance their thermal storage capacity. Compare to other principles for thermal energy storage, latent heat storage is competent because even small changes in temperature leads to storage of high energy density, is promising technology with low heat losses and comes at attractive prices. This research was carried out to evaluate the performance of air based PCM storage system for cooling and heating of the building. In the present performance based research, the phase change materials can be used for heating and cooling of building space in summer and winter seasons. This study and performance was designed and carried out for Naliya city, Gujarat state. Also, this system can save the convection energy sources. As per the results, maximum efficiency of the system was in summer when melting point of PCM is about 28.8°C (~29°C). Similarly, in winter it was around up 22.5°C. As per the PCM properties, storage material has a single melting point. Finally, it was found that the storage unit had maximum efficiency when melting point was 26.8°C and melting point system can run in both the seasons. At same temperature in summer season, the storage system performance was dropped and heating capacity enhanced. The payback period of this system was 4.5 years but may be maintenance charge after 4.5 years can be applied therefore after five years the net present value can be achieved.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: YOTTA SOLAR INC ✓ **STATUS: GRANTED**

Title:

Thermally Regulated Modular Energy Storage Device and Methods

Title INPADOC:

Thermally Regulated Modular Energy Storage Device and Methods

Publication number (Kind Code):

US20180287231A1

Publication Date: 24 Sep 2019

Current IPC:

H01M10/65; 9F28D20/02; F28D15/02; H01M10/6552; H01M10/6551

DRAWINGS

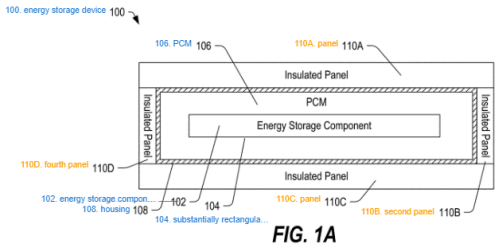


FIG. 1A

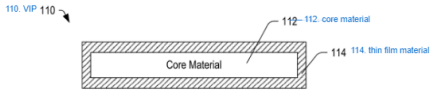


FIG. 1B

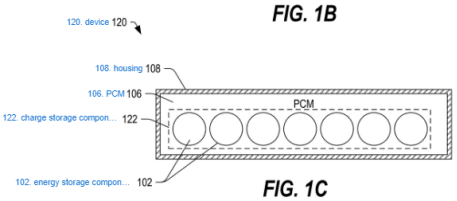
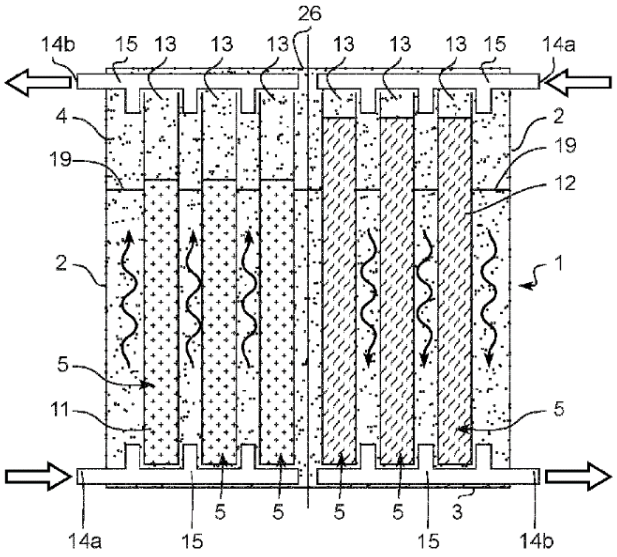


FIG. 1C

Abstract

In some embodiments, a device may include one or more thermal insulation panels defining an enclosure and a phase change material (PCM) within the enclosure. The device may further include at least one unidirectional heat pipe including a proximal portion extending into the enclosure, a distal portion extending outside of the enclosure, and an intermediate portion between the proximal portion and the distal portion. In one aspect, the device may also include a heat sink including a plurality of heat fins configured to dissipate heat, the heat sink coupled to the distal end of the at least one unidirectional heat pipe.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: Commission for atomic energy and alternative energies	✓ **STATUS:** GRANTED
Title: Phase Change Material Energy Storage Device and Method for Storage	DRAWINGS 
Title INPADOC: Phase Change Material Energy Storage Device and Method for Storage	
Publication number (Kind Code): FR3038376A1	
Publication Date: 22 Nov 2019	
Current IPC: F28D20/02	

Abstract

The invention relates to a thermal energy storage device using phase change material comprising: a storage enclosure (1) comprising modules (5) for retaining at least one PCM (10), and circulation means of heat transfer fluid (4) in the enclosure (1) configured for the inlet, the outlet and the circulation of the heat transfer fluid (4) in the enclosure (1) and around the modules (5) characterized in that each module (5) comprises at least one opening (13) in its upper part (6). The field of the invention relates to Thermal Storage Systems (SST) by Phase Change Materials (PCM); and more particularly, the integration of a system making it possible to optimize the availability of stored thermal energy.

4.6.6 KER 18 - Biobased saline batteries C1

#	Exploitable Results	Responsible Partner(s)
18	Biobased saline batteries C1	SuWoTec

Description

The IANOS project scope related to the Bio Based Battery C1 focuses on the island integration. This unique concept battery is developed for electricity storage in a simple, safe and affordable way. Not using valuable resources like lithium and

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

Kobalt. This recyclable battery has many advantages over lithium solutions for stationary applications.

Patent Scenario Analysis – KER 18

Query	
Title or Abstract	TA_ALL:(BioBatter* OR Bio $pre0 Batter* OR Bio $pre1 Battery)
Time interval	January 2005 – July 2023 (Data for the last 18 months incomplete due to standard patents publication procedures)
Results	**158** individual records, 80 **INPADOC** families

The query selected a total of **158** patents in the period under analysis (corresponding to **80** INPADOC families).

As it can be noticed from the following figure the period under consideration (2005-2023) shows a discontinuous temporal trend with a peak of submitted patent in 2018. Since that time the trend seems to be downward. As always, it is worth to point out that data for the last 18 months are incomplete due to standard patents publication procedures). In this sense, it is a good practice to not consider the last two years (2023 and 2022) within the patent trend analysis.

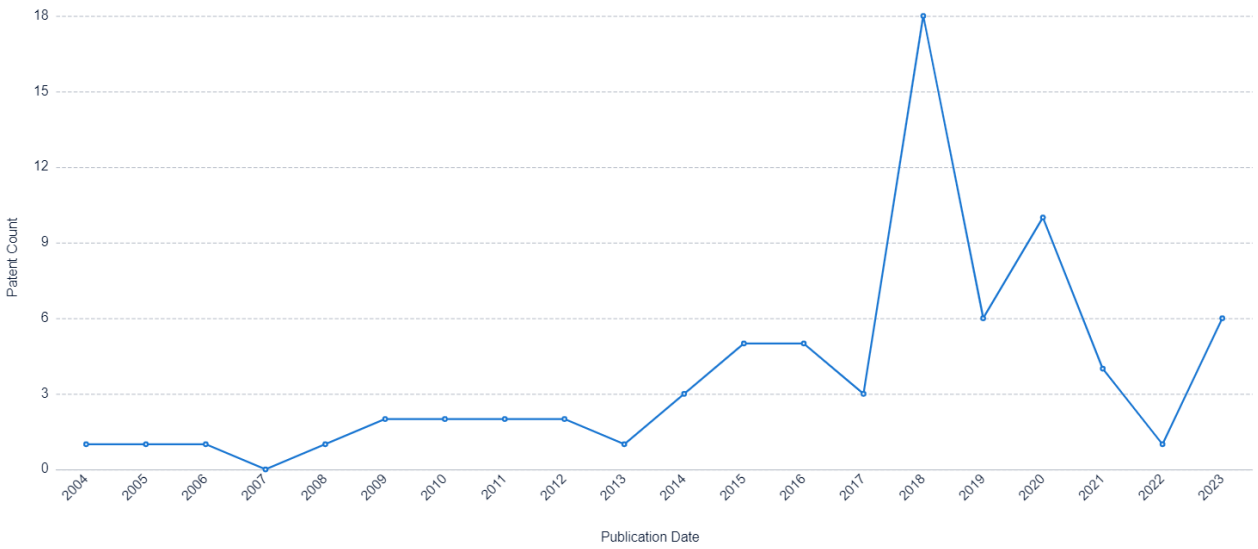


Figure 19: Publication trend - KER 18

The greatest interest in Bio Based Batteries has been shown by Japan and China, followed by the United States, as reported below.

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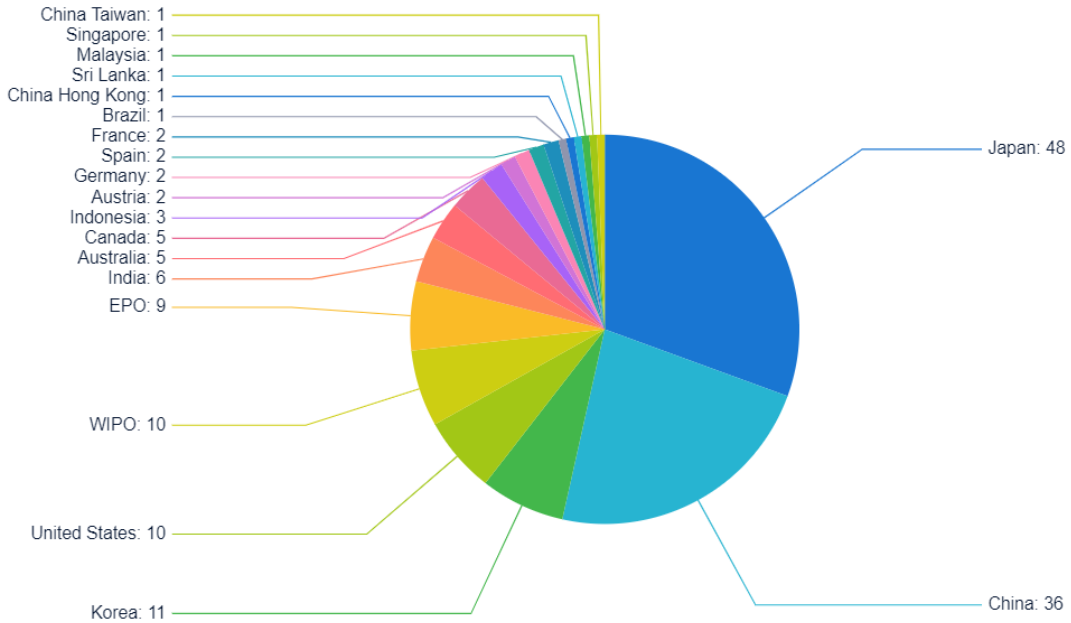


Figure 20: Top Application Countries and Regions – KER 18

Figure 21: Top IPC codes - KER 18 reports the main International Patent Classification (IPC) Codes of the patent dataset, identifying the main technologies related to the field of interest of KER #10. Each IPC code description can also be found at this website: https://www.wipo.int/classifications/ipc/en/. Within the selected query the top IPC are "biochemical fuel cells" and "biochemical electrodes"

Figure 21: Top IPC codes - KER 18

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

The following figure reports the main assignee emerging from the analysis. The company that has most patented technologies inherent in bio-based batteries is Aisin Corporation, a Japanese corporation that develops and produces components and systems for the automotive industry.

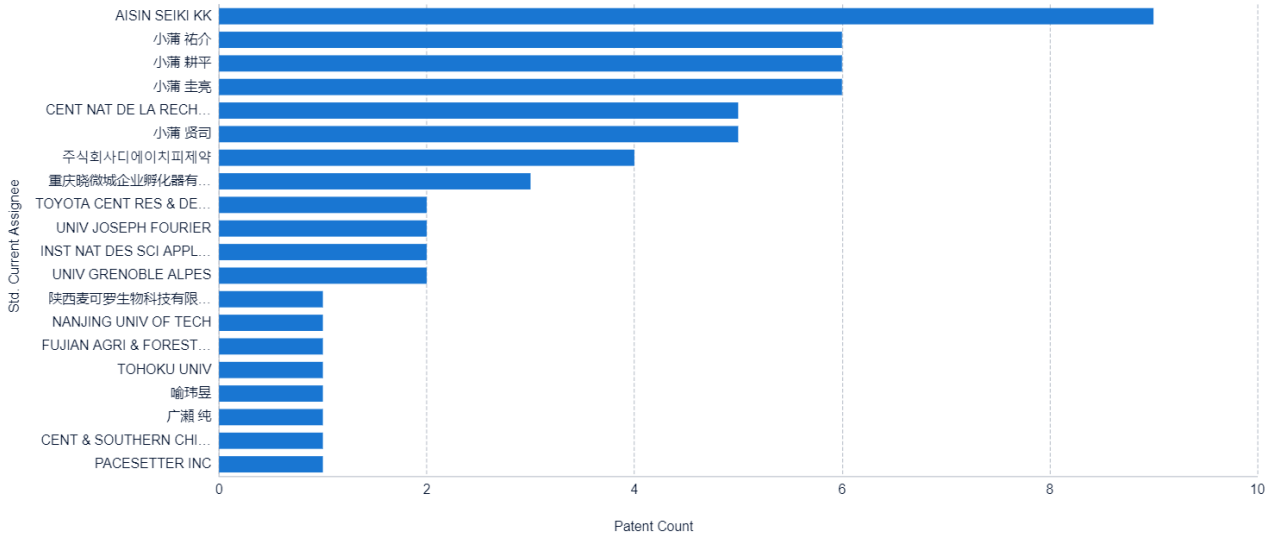


Figure 22: Top Assignee - KER 18

Competitive and technical intelligence analysis:
The analysis of the patent dataset brought to the identification of the most relevant patents related to the field of Life Cycle Analysis on energy systems (KER # 5) resulting in the list hereby reported in Table 4-13: KER 18 - Relevant Patents.

Table 4-13: KER 18 - Relevant Patents

Publication number	Title	Assignee
IN202341023417A	Integrated bio battery and hydrogen generation system for sustainable energy production	DR. T. RAVINDAR
CN116375177A	A bio-battery electric heating device based on photovoltaic energy storage	CENT & SOUTHERN CHINA MUNICIPAL ENG DESIGN & RES INST
JP6728589B2	Enzyme electrode preparation method and enzyme electrode storage method	AISIN SEIKI KK
	Bio-battery with enhanced yield	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

The details of the patents described above are shown below.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: DR. T. RAVINDAR ✓ **STATUS PUBLISHED**

Title:

Integrated bio battery and hydrogen generation system for sustainable energy production

Title INPADOC:

Integrated bio battery and hydrogen generation system for sustainable energy production

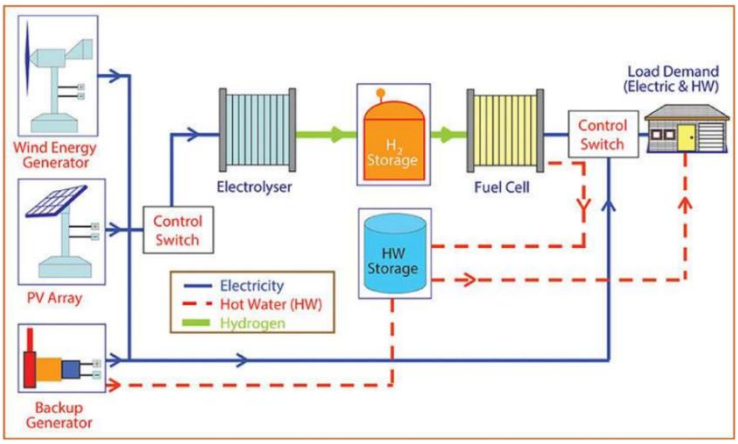
Publication number (Kind Code):

IN202341023417A

Publication Date: 26 May 2023

Current IPC: H01M8/16; H01M8/20

DRAWINGS



Abstract

The proposed invention is an integrated bio battery and hydrogen generation system that uses microbial fuel cells (MFCs) and electrolysis cells (ECs) to treat wastewater and produce hydrogen gas and electricity. The MFC generates electricity from wastewater, while the EC generates hydrogen gas from water. The system is sustainable, energy-efficient, and cost-effective, with potential applications in industries such as wastewater treatment, renewable energy production, and sustainable agriculture. The system can be scaled up or down depending on the application and has the potential to revolutionize the way we produce energy and treat wastewater, making our society more sustainable and environmentally friendly. The proposed invention offers a reliable source of electricity and hydrogen gas without relying on external sources of energy and does not contribute to climate change.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: CENT & SOUTHERN CHINA MUNICIPAL ENG DESIGN & RES INST

✓ STATUS EXAMINING

Title:

A bio-battery electric heating device based on photovoltaic energy storage

Title INPADOC:

A bio-battery electric heating device based on photovoltaic energy storage

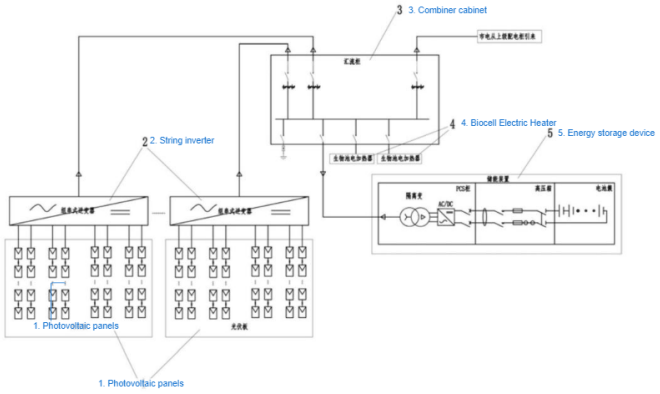
Publication number (Kind Code):

CN116375177A

Publication Date: 04 Lug 2023

Current IPC: C02F3/00; C02F3/30

DRAWINGS



Abstract

The invention belongs to the technical field of bio-battery electric heating and provides a bio-battery electric heating device based on photovoltaic energy storage, including a photovoltaic panel, a string inverter, a confluence cabinet, a bio-battery electric heater, and an energy storage device. The photovoltaic panel is electrically connected to the string inverter, the combiner cabinet is electrically connected to the string inverter, the electric heater of the biological battery, and the energy storage device, and the biological battery The electric heater is used to heat the sewage in the anaerobic section, anoxic section and aerobic section of the biological pool. The device does not need an external artificial heat source and converts solar energy into electrical energy through photovoltaic panels to directly supply power to the bio-battery electric heater, and can also store the converted electrical energy in the energy storage device, and then output it to the bio-battery electric heater. Electric heaters are installed in the anaerobic section, anoxic section, and oxygen consu mption section of the biological pool. In this way, the activity of fungi in the bio-pool can be increased while consuming as little electricity as possible, so as to achieve the purpose of reducing "power consumption" and "drug consumption".

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE: AISIN SEIKI KK ✓ **STATUS GRANTED**

Title:

Enzyme electrode preparation method and enzyme electrode storage method

Title INPADOC:

Enzyme electrode preparation method and enzyme electrode storage method

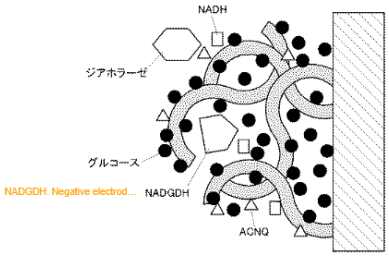
Publication number (Kind Code):

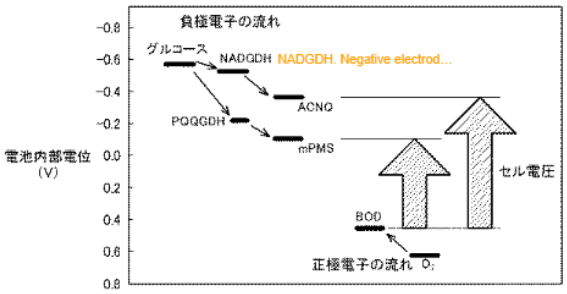
CN116375177A

Publication Date: 04 Lug 2023

Current IPC: C02F3/00; C02F3/30

DRAWINGS





Abstract

PROBLEM TO BE SOLVED: To provide a method for mitigating deterioration in an enzyme with time and stably improving the battery output of a bio battery, in the bio battery using the catalytic activity of the enzyme.
SOLUTION: There are provided: an enzyme electrode in which a nicotinamide adenine dinucleotide-dependent enzyme or a nicotinamide adenine dinucleotide phosphate-dependent enzyme is immobilized on a conductive substrate, as an electrode catalyst, the enzyme being immobilized on a conductive base material together with glucose with a concentration of exceeding 0.75 M, glycerol with a concentration of 1-20% or glucose with a concentration of exceeding 0.75 M and glycerol with a concentration of 1-20%; a bio electrode cell including an enzyme electrode; a manufacturing method of an enzyme electrode; a preservation method of an enzyme electrode; and a bio battery cell including the enzyme electrode.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

ASSIGNEE : CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE ✓ **STATUS GRANTED**

Title:

Bio-battery with enhanced yield

Title INPADOC:

Bio-battery with enhanced yield

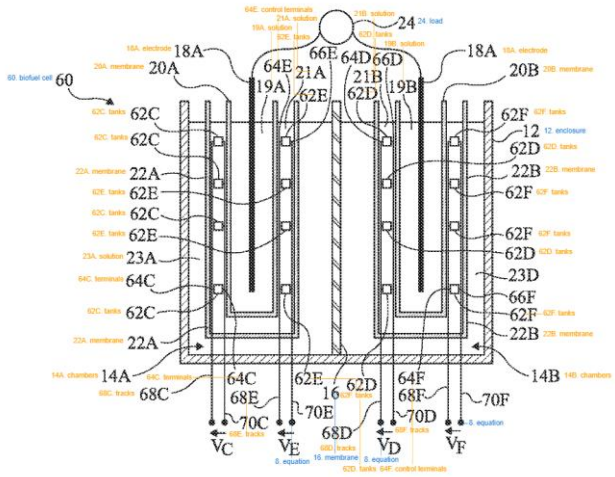
Publication number (Kind Code):

US8962196B2

Publication Date: 24 Feb 2015

Current IPC: H01M8/16; H01M8/20

DRAWINGS



Abstract

A novel cell including first and second chambers containing a solvent and separated by a wall permeable to the solvent and impermeable to hydronium and/or hydroxyl ions; a first electrode in the first chamber; a second electrode in the second chamber; a first redox couple in the first chamber comprising a first oxidizer and a first reducer taking part in first oxidation-reduction reactions resulting in an electron exchange with the first electrode; a second redox couple in the second chamber comprising a second oxidizer and a second reducer taking part in second oxidation-reduction reactions resulting in an electron exchange with the second electrode, the wall being impermeable to the first and second redox couples; and first enzymes or first microorganisms placed in the first or second chamber and promoting a third oxidation-reduction reaction resulting transforming a first substance to a second substance comprising acid or alkaline species.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

5 Conclusions and next activities

The present deliverable D10.10 has been developed in the framework of WP10 activities related to the "Dissemination, Exploitation, Promotion & Knowledge Transfer" of IANOS Key Exploitable Results and it is the second main outcome of T10.4 "Exploitation Strategy & IPR Management".

It represents the third release of the Plan for Use and Dissemination of Foreground (PUDF) for the IANOS project consortium, thus aimed at defining a proper exploitation strategy, based on the following actions:

- Update the list of Key Exploitable Results, 19 results have been identified with the relative Responsible partners.
- Analyse the characterization tables fill in by the partners.
- Define which KERs must be prioritized.
- Develop a first draft of the exploitation strategies both at partner and consortium level.
- Define the methodology for the Canvas Business Model that will be developed in the next version of this document.
- BFMULO matrix
- Partner's IPR measures
- Patent analysis on relevant and prioritized KER

D10.10 will then be updated along the project duration (D10.11); the final version is foreseen at the end of M48. In the next months the following activities will be carried on (and main results included in the final PUDF release):

- The characterization tables will be updated including more details in the next version of the document. The KER tables missing in this document will be completed and provided by the responsible partners during the next months and reported in the next version of the deliverable.
- The exploitation strategy at partner and consortium level will be updated with other information (if available).
- Canvas business models will be developed for Key Exploitable Results prioritized.
- The BFMULO analysis will be updated taking into account further project developments.
- The patent analysis will be updated based on future developments in the technologies of interest for IANOS project.
- IPR and exploitation intentions of IANOS partners will be further investigated.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810