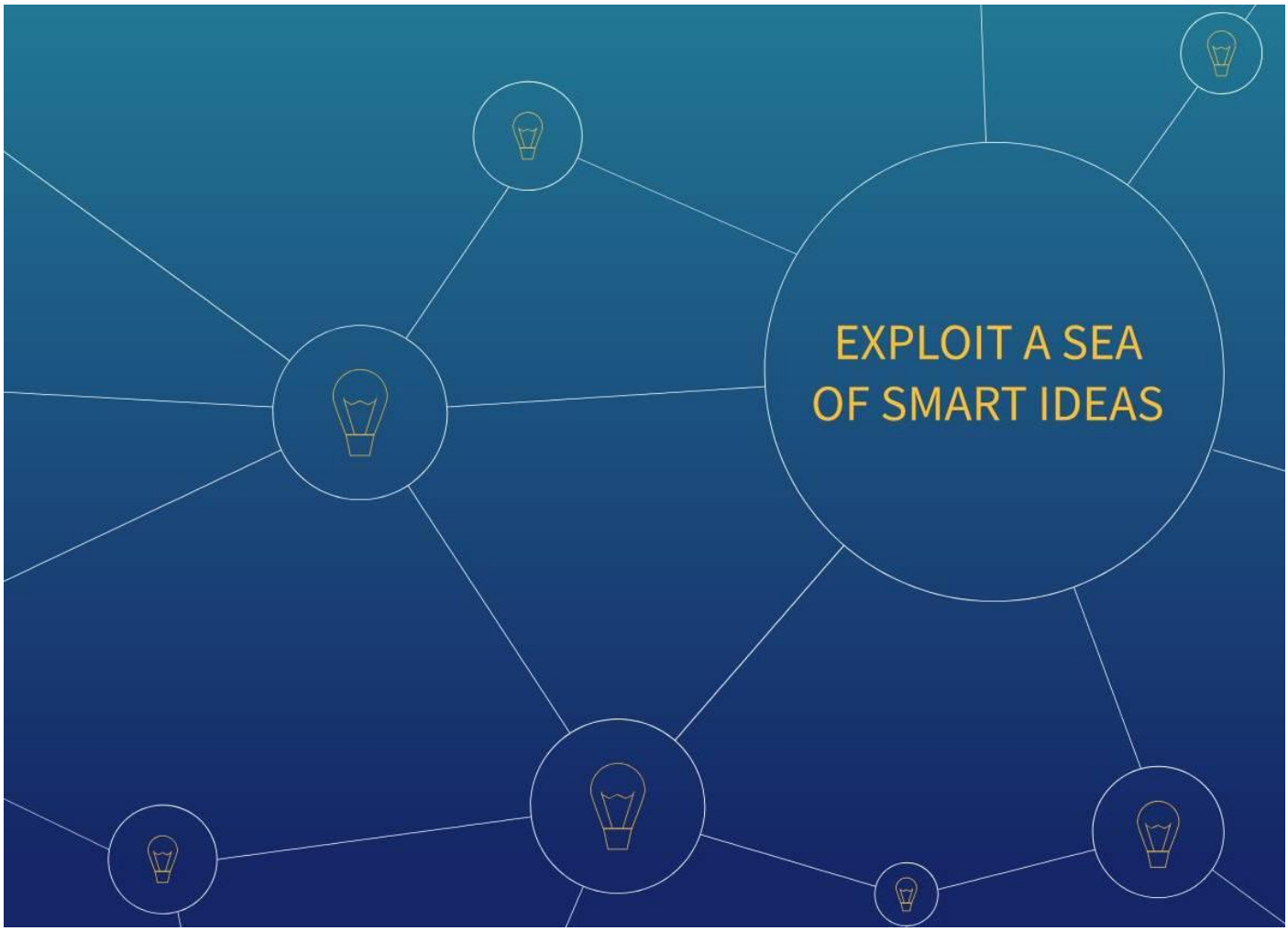

PROOF OF CONCEPT CALL

MRTPA Energy and Environment
Summary

OIS-AIR project

Open Innovation System of the Adriatic-Ionian Region

May 21th, Zagreb

OISAIR is implemented through the financial support of the ADRION programme

Abbreviations

ADRION	Interreg Programme of Adriatic-Ionian region
AI	Artificial intelligence
AIR	Adriatic-Ionian region/macro-region
B2B	Business-to-business
B2G	Business-to-government
DER	Distributed energy resources
EDP	Entrepreneurial discovery processes
EUSAIR	Macro-Regional Strategy of Adriatic-Ionian Region
G2G	Government-to-government
GHG	Greenhouse gases
GVCs	Global Value Chains
IoT	Internet of Things
KETs	Key enabling technologies
MRS3 AIR	Macro-Regional Smart Specialisation Strategy of Adriatic-Ionian Region
MRSTPA	Macro-Regional Sub-Thematic Priority Area
MRTPA	Macro-Regional Thematic Priority Area
OIS-AIR	Open Innovation System of the Adriatic-Ionian Region
R&D	Research and development
R&D&I	Research, development and innovation
S3	Smart Specialisation Strategy
SDGs	Sustainable Development Goals
TPA	Thematic priority area

Table of Contents

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of the ADRION programme

1. About OISAIR Project

The OIS-AIR Project pursues the final goal of establishing the Open Innovation System of the Adriatic-Ionian Region (OIS-AIR), a single competitive and attractive marketplace for technology and innovation at macro-regional level. OIS-AIR intends to strengthen the development of industrial and entrepreneurial activities within a virtuous circle involving relevant stakeholders, from research institutions to SMEs and public administration in the Adriatic-Ionian Region. Coordinated by Area Science Park (Italy), the OIS-AIR project is co-funded by the Interreg ADRION Programme and is developed in collaboration with six partners based in the Adrion Region: University of Basilicata; HR – National Chamber of Economy; RS – Belgrade Technology Park; SI – Ljubljana Technology Park; AL – Ministry of Finance and Economy; GR – Centre for Research & Technology Hellas.

In particular, the project wants to:

- Improve skills and competencies of innovation centers in stimulating the creation of innovation networks beyond borders;
- Stimulate SMEs[1] access to research infrastructures and facilities and increase business investments in R&I, with a specific focus on those sectors characterizing the competitive advantage of the partner regions;
- Valorize research results and establish durable links and synergies between enterprises, R2B centers and research infrastructures;
- Exploit the research results and new technologies taking into account the output of the pilot macro-regional Smart specialization strategy.

So far, based on a pilot macro-regional analysis of the Smart specialization strategies of the Adriatic-Ionian regions, the following three thematic- priority areas have been identified as project main intervention fields:

- Agro-Bioeconomy;
- Transport & Mobility;
- Energy & Environment.

Developed within the project, the INNOVAIR platform (https://www.oisair.net/) will support all project activities and manage the collection of applications to the Proof of Concept Call.

2. MRTPA Agro-Bioeconomy

In last decades between two UNFCCC milestones, Kyoto and Paris[2], energy and environment sectors globally merged into one ecosystem that is more complex and more interrelated than ever before and will be more in the future. The area of energy and environment is diverse and differs regarding its innovation, knowledge and market features. However, for this purpose and regarding to later described trends and like in analysis of the national Smart

[1] Small and medium-sized enterprises (SMEs) are defined by the European Commission as having less than 250 persons employed. They should also have an annual turnover of up to EUR 50 million, or a balance sheet total of no more than EUR 43 million (Commission Recommendation of 6 May 2003).
[2] UNFCCC, https://unfccc.int/process, retrieved: 21.1.2019

Specialisation Strategies in Central Europe[3], this thematic area can generally be distinguished across three sub-areas:

1. fossil fuels industry (oil, coal, gas);
2. renewable industry (photovoltaic, wind, biomass, hydropower);
3. environmental industries and services.

Each of these areas operates in different modes of innovation, have somewhat different knowledge bases and market structures. Last two merged into "environmental technologies" or "environmental-friendly technologies" and such make notable economic significance of environmental protection and climate action. Since sole fossil fuel industry has less attractive future especially within innovation and research potentials and trends, following presentation on thematic area will focus on other two as environmental technology and resource efficiency segment.

2.1. Megatrends

Energy and environment sectors share same influences from global megatrends such are population growth (mainly in developing countries), population ageing (in advanced countries), urbanisation and sustainability pressure. Those megatrends drive Energy and Environment sectors toward global energy transition and sector specific megatrends:[4]

1. the end of the fossil era has begun;
2. the energy future is renewable;
3. the energy future is decentralised;
4. the energy future is digital.

In addition, changes in so called "environmentally friendly industries" globally signal the arrival of new business models and product categories which allow companies to capture value and to compete on quality and product differentiation. These trends include: the growth of renewable energy; distributed generation; microgrids; innovative energy storage technologies, smart and efficient grids, energy efficient materials, waste separation and recycling, and wastewater management.

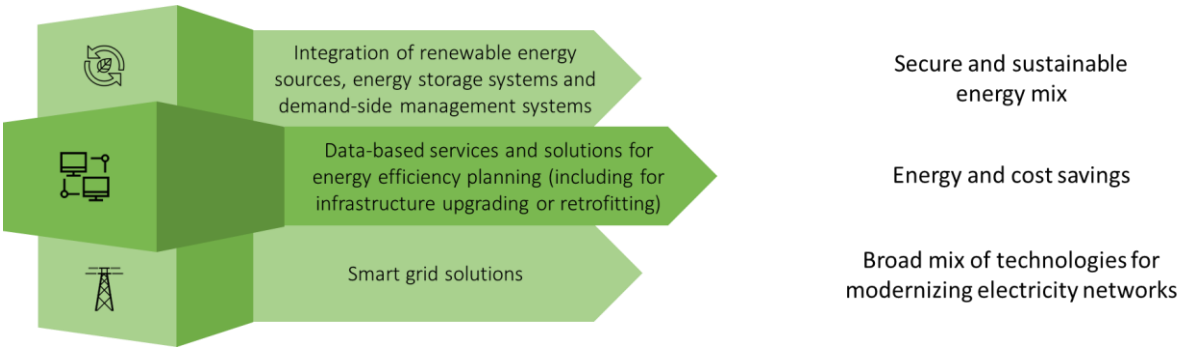
[3] Radosevic, S., Walendowski, J. (2016), op. cit.

[4] Rosenkranz, G. (2015), *Megatrends in the global energy transition*, https://energiewendebeschleunigen.de/Downloads/151201_Megatrends_der_Energiewende_EN.pdf, retrieved: 16.1.2019

2.2. Sub-thematic priority area

Integration of distributed energy resources (DER)

Figure 1 Integration of distributed energy resources (DER) subtopics and their impact



Source: Authors

The traditional model of energy distribution is one in which power is transmitted from centralized stations to end users over great distances. The conventional grid model emerged in the late 19th century and by using transformers for step up voltage after electric power being generated for the purpose of transmit the electricity over large distances, and then step down the voltage again before distributing it to the final users. Electricity is generated in large, centralized plants that are often located at large geographical distances from end users.

However, after decades where centralized grids have prevailed, the increasing emphasis on renewable energy is driving an unavoidable shift toward distributed generation. The rise of renewable generation marks a transition from the traditional AC grid toward a more decentralized energy system. Instead of a transmission and distribution network radiating from a centralized power station, today's energy networks incorporate both traditional energy sources and an array of decentralized energy resources (DER) that reflects the increasing deployment of wind, geothermal, CSP and especially solar PV generation. (The latter represents the most dispersed renewable technology of all.) As the share of RES in the total energy mix rises, the prevalence of distributed generation will only grow.

Based on proposed macro regional trajectory and described trends within EUSAIR energy networks pillar (besides large regional interconnecting infrastructural projects), foresight area should be focused on few of "more SME based" solutions and skills for integrating renewable resources by parallel managing in demand and energy efficiency through big data and digitalization of the sector. Foresight areas (subtopics) might include as follows:

1. Integration of renewable energy sources, energy storage systems and demand-side management systems
2. Data based services and solutions for energy efficiency planning (including for infrastructure upgrading or retrofitting)
3. Smart grid solutions.

Integration of renewable energy sources, energy storage systems and demand-side management systems - products, solutions and knowledge for integration of distributed energy sources into networks are needed for achieving a secure and sustainable energy mix in both populated areas and remote communities (islands) or even on commercial buildings or just on family house level. The products in this segment include distributed generation and the associated control systems and technologies to facilitate such networks. The products are often characterized by 'smart' technologies to smooth consumption over time and to respond dynamically to energy availability and prices—even from minute to minute.

Data based services and solutions for energy efficiency planning (including for infrastructure upgrading or retrofitting) – energy savings services or solutions based on data collecting through remote smart metering and cloud computing (including maintenance and asset repair packages) are expected to grow globally over the next 5 to 10 years. Market for such services is broad and it will cover segments from individual customers and homeowners to commercial, industrial, and municipal organizations.

Smart grid solutions – smart grids comprise a broad mix of technologies for modernising electricity networks. Improved monitoring, control and automation technologies can help to enable new business models while unlocking system-wide benefits including reduced outages, improved response times, deferral of investment in the grids themselves and the integration of distributed energy resources. At the end-user level, smart grids can enable demand flexibility and consumer participation in energy systems, including through demand response, electric vehicle charging and self-produced distributed generation and storage (IAE on Smart grids). Those technologies on smart grids applies on Blue economy areas as well like islands, ports, coastal infrastructure and multi-purpose offshore platforms.

Following the idea of using mission-based policies[5] framework, proposed MRSTPA is embedded within strategy-based components such as mission, goals and solutions that define more focused approach to the success of the strategy.

3. MRSTPA mission

Energizing natural diversity with affordable and integrated renewables.

4. Goals

Build regional capacities and expertise for successful and smart integration of renewable and distributed energy sources to assure sustainable future and regional biodiversity.

Goals are about:

Capacities and expertise – know-how and talent management are needed and represents second key enabler in addition to technology itself.

Integration of renewables – integration is the practice of developing efficient ways to deliver variable renewable energy to the existing grid. Secure and proofed methods should

[5] Mazzucato, M. (2018), op. cit.

be developed and deployed to maximize the cost-effectiveness of incorporating the variety of renewable energy (RE) sources into the power system while maintaining or increasing system stability and reliability.

Distributed energy – distributed energy sources situated close to customers or consumers tackling both challenges of higher efficiency and sustainability. Development and deployment of various technologies both "on grid" or on remote locations can meet the criteria of sustainability and efficiency. It resonates heavily with the shift from energy consumer (in traditional energy landscape), to energy prosumer (indicating a bi-directional energy flow).

Smart and data-based – smart grids comprise a broad mix of technologies for modernising electricity networks. Improved monitoring, control and automation technologies can help enable new business models while unlocking system-wide benefits including reduced outages, help energy users make better energy choices based on data collection and information, improve response times, deferral of investment in the grids themselves and the integration of distributed energy resources.

5. Impact and Relevance

Having availability of clean and affordable energy produced near consumption allows for a more efficient and transparent energy system as one of the key enablers for sustainable development and growth of local societies and communities. Innovation and development of such distributed and renewable energy sources accompanied with new business models would make shift from national incentives, enabling them to operate on market principle. Integration of such distributed energy sources, developing new services and aggregation models based on data would accelerate the greening of the energy systems.

6. Solutions

Affordable renewable technologies for energy independence, better efficiency and improved energy storage technologies and systems require research in new strategies for controlling renewable energy generators, and for the improvement of the existing algorithms for the optimal use of the obtained power; new concepts for generators; development of cross-border connections, power measurement units, predictive analytics, phase-shifting transformer technologies: high and low voltage converters, new Maximum Power Point Tracking algorithms, interfaces for network connection involving new quality and grid management; development of software applications and tools for the observability and the flexibility of the whole power system; as well as new materials and components to improve both energy storage costs and performance.[6]

[6] European Commission, Directorate-General for Research and Innovation (2018); op. cit.

7. R&D topics

Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission's proposal for Horizon Europe – the EU framework programme for research and innovation 2021-2027.[7]

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. methods, practices and solutions to promote energy saving and reduction of energy consumption;
2. developing optimal regulatory framework and incentives for long term systems change toward 100% renewables;
3. smart grids deployment, including aspects such as infrastructure, demand response services and blockchains;
4. research and exploitation of energy harvesting;
5. research on batteries;
6. environmental impact assessment;
7. eco-efficient materials;
8. research focusing on renewable materials and their split up/recycling in early development process;
9. building models for a sustainable circular economy based on renewable resources and renewable energy;
10. inquiry into and development of solutions for environmental, social and economic impact assessment;
11. exploring the intersection of ecology and technology, and in particular using technology for sustainable practices;
12. research on smart grid management and on the opportunities for cross-domain solutions (Smart Mobility, Smart City and Smart Grids).

Several other important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. development of new and improvement of existing primary and secondary equipment for electrical energy systems (primary equipment: turbines, generators, motors, transformers, switchgears, transmission lines and cables, secondary energy equipment: management, measurement, protection, supervision, guidance);
2. new technologies and improvements related to power plants, substations, components and systems connected to renewable energy sources;
3. advanced energy storage systems;
4. diagnostic and better management of energy equipment;

[7] European Commission, https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/foresight/activities/current/bohemia_en, retrieved: 1.2.2019

5. energy management systems for planning, investment, real time management and monitoring of energy efficiency and CO_2 reduction;
6. process and embedded computer automation and control processes;
7. systems for energy management and support for the functioning of energy markets at levels of microgrids, smart grids and smart cities;
8. advanced conventional energy solutions;
9. application of smart grids and complex energy systems;
10. energy-efficient interconnected and universal lighting;
11. sustainable conversion of biomass into energy;
12. biogas technology for production of electricity and heat;
13. energy saving technologies combined with effective usage of renewable energy capacities;
14. technologies reducing harmful industry emissions of CO_2 through applying innovative new technologies and solutions;
15. development of technologies and equipment for protection of sea;
16. technologies for energy saving combined with efficient use of renewable energy capacities.

8. Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of Key enabling technologies (KETs) are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various 'grand challenges' the world faces (such as ageing, climate change, natural resource depletion, health inequality) .
The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Energy and Environment foresighted area proposal are given in the following list.

OPTION A – KETs (from Re-finding Industry)[8]

I) PRODUCTION TECHNOLOGIES
   A) Advanced Manufacturing Technologies
      1) Process industry (processing of novel materials, structures, etc.)
      2) Monitoring and control
      3) High performance computing / cloud-based simulation services
      4) Intelligent/ sensor-based equipment
      5) Green propulsion technologies
   B) Advanced materials and Nanotechnologies
      1) High performance, smart sustainable materials
      2) Materials for energy storage and generation
      3) Lightweight technologies
II) DIGITAL TECHNOLOGIES

[8] European Commission, Directorate-General for Research and Innovation (2018), op. cit.

A) Micro/Nano electronics and Photonics
   1) IoT
   2) Smart/Intelligent sensors
B) Artificial intelligence
   1) Data generation and handling
   2) Big data analytics
   3) Machine learning and deep learning
   4) Software technologies
   5) Decision making technologies

III) CYBER TECHNOLOGIES
A) Security
   1) Data protection and privacy
   2) IoT cyber security solutions
B) Connectivity
   1) Cyber Physical Systems
   2) Blockchain.

OPTION B - KETs (OECD)[9]

1. DIGITAL
   1) Internet of Things (IoT)
   2) Big data analytics
   3) Artificial intelligence (AI)
   4) Blockchain
   5) Cloud computing
   6) Photonics and light technologies
2. ENERGY + ENVIROMENT
   1) Fuel cells
   2) Hydrogen energy
   3) Photovoltaics
   4) Wind turbine technologies
   5) Marine and tidal power technologies
   6) Power microgeneration
   7) Smart grids
   8) Electric vehicles
   9) Carbon capture and storage
   10) Advanced energy storage technologies
3. ADVANCED MATERIALS
   1) Nanomaterials
   2) Additive manufacturing
   3) Carbon nanotubes and graphene.

[9] OECD (2016), op. cit.