Webinar - Space for Infrastructure:

Energy

ESA Space Solutions

18/10/2023

The largest space innovation network in the world

- The go-to place for great business involving space to improve everyday life.
- Supporting European start-ups and SMEs to develop businesses using space technology and data.
- Offering funding, business and technical support to help to generate successful business and create jobs.

ESA Space Solutions

Using **any space asset(s)** and integrating them with terrestrial assets for the **benefit of life on Earth**

Space Weather

Earth Observation

Satellite Navigation

Satellite Communication

Human Spaceflight Technologies

Financial

Aviation

Education

Energy

Media

Agriculture

Environment

Transport

Healthcare

Maritime

How ESA Space Solutions Work with you

Idea Creation

Explore idea generation.

Filling out the narrative, exploring ideas.

Concept Design

Defining core functionality.

Understanding the market size and potential revenue

Prototyping

Create Prototype and assess feasibility.

Updating of the business plan.

Product/Service Development

Testing.

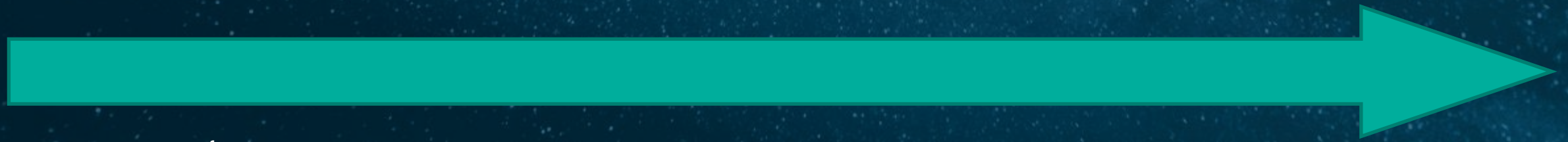
Validation with pilot customers.

Verifying the viability of the financials.

Commercialisation/ Product Rollout

Feasibility Studies: Up to 50% co-funding*

Demonstration Projects: Up to 50% co-funding*



*Up to 80% for SMEs (depending on specific initiative and approval of national delegation

Thematic call for Proposals – 'Space for Infrastructure'

Key Objectives:

- **Support the infrastructure sector** by stimulating the emergence of innovative space applications and services with high market potential.
- **Improve efficiency** in the selected domains within the infrastructure sector through allowing lower costs, better capacity management and increased output while reducing environmental footprint.
- Increase the **resilience** of the infrastructure with more accurate resilience models and reducing the impact of disruptive events.

Energy Infrastructure:

Opening Date: 30th October 2023

Closing Date: 31st December 2023

Accepting both Feasibility Studies and Demonstration Projects.

Energy Infrastructure – The Power of Space

Satellite Communications (SatCom) enables the provision of ubiquitous connectivity to enhance the communication links, connectivity of IoT devices, support for remote locations. In addition, satellite communications can provide real-time, long-range communications with infrastructure monitoring systems (i.e. UAVs/robots/remote assets).

Global Navigation Satellite Systems (GNSS) can be used to enable geo-referencing of in-situ data, as well as navigation and tracking of vehicles, people and goods; PNT. GNSS-based technologies can be used for time-stamping reference system information, ensuring the traceability of the data.

Satellite Earth Observation (satEO) can be used for the monitoring of the status of the working sites, the planning, construction and maintenance of the infrastructure, collecting information on geographical and environmental parameters for the sustainability analysis, integration of environmental data; identification of patterns and trends that may be linked to infrastructure safety risks, and provide insights into how to best address them.

Task Force for Innovation in Energy Through Space (Energy Task Force)

Key objectives:

- Leverage the use of space for advancing sustainable innovative services addressing the priorities of the green energy ecosystem and supporting the growth of a sustainable green economy.
- Increase the impact in the energy sector of the space-based applications developed through ESA programmes, thanks to the support of the energy sector stakeholders.
- Kicked-off in October 2022.
- This call is one of our first outputs from the Energy Task Force

Priority areas:

- Renewable Energy (Net Positive)
- Small-scale Renewable Generation
- Green Hydrogen & Alternative Energy Carriers
- Ensuring Energy Supply Security
- Electric Mobility Planning
- Circularity & Decommissioning
- Decarbonisation
- Energy Asset Operation & Maintenance

Accelerating Innovation for the Energy Infrastructure

EPRI – ESA Cooperation

Mark McGranaghan
EPRI Fellow
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+353-87-795-7236

EPRI's Mission

Advancing **safe, reliable, affordable and environmentally responsible** electricity for society through global collaboration, thought leadership, and science & technology innovation.

- **Independent**
- **Non-Profit**
- **Collaborative**

Nuclear

Environment

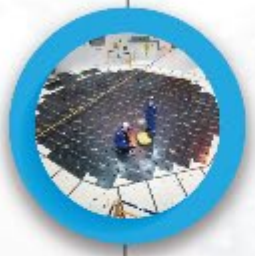
Generation

Power Delivery and Utilization

Research Addressing all Aspects of the Energy Transition

TECHNOLOGY INNOVATION

Driving thought leadership, advanced R&D, and technology scouting and incubation to sustain a full pipeline of solutions

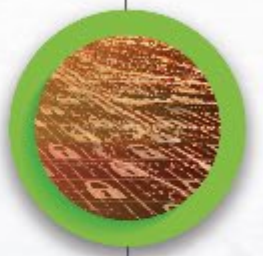


Nuclear Power

Energy Supply and Low-Carbon Resources

Electrification and Sustainable Energy Strategy

Transmission and Distribution Infrastructure



Integrated Grid and Energy Services

STRATEGIC RESEARCH

Low-Carbon Resources

End-Use/ Economy-Wide Carbon Reduction

Electric System Reliability/Resilience

Electric System Flexibility

Market Transformation/ Policy/Regulatory Education

Collaboration to Accelerate Innovation

Universities

UCD ENERGY INSTITUTE

ERA ENERGY RESEARCH ACCELERATOR

WASEDA University

TU Delft

جامعة خليفة
Khalifa University

Government

European Commission | Horizon 2020 European Union funding for Research & Innovation

esa

USAID FROM THE AMERICAN PEOPLE

UKRI Innovate UK

USTDA U.S. TRADE AND DEVELOPMENT AGENCY

AFFORDABLE CLEAN ENERGY RACE for 2030 CRC

Industry

IERE Electric Power Technology Platform

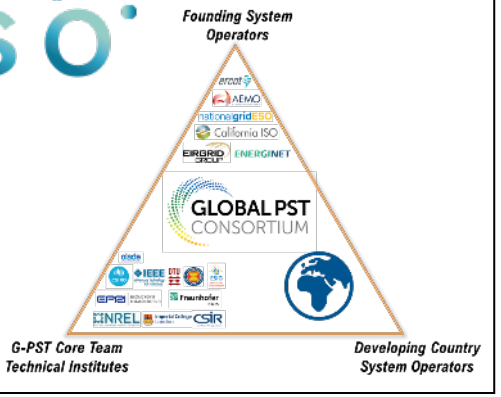
entsoe

energy web FOUNDATION

GSEF Global Smart Energy Federation

E.DSO

WORLD ENERGY COUNCIL



The Energy Infrastructure is Critical for Decarbonization Goals

Stronger grids will require both rapid expansion and improved use of assets

Climate Change

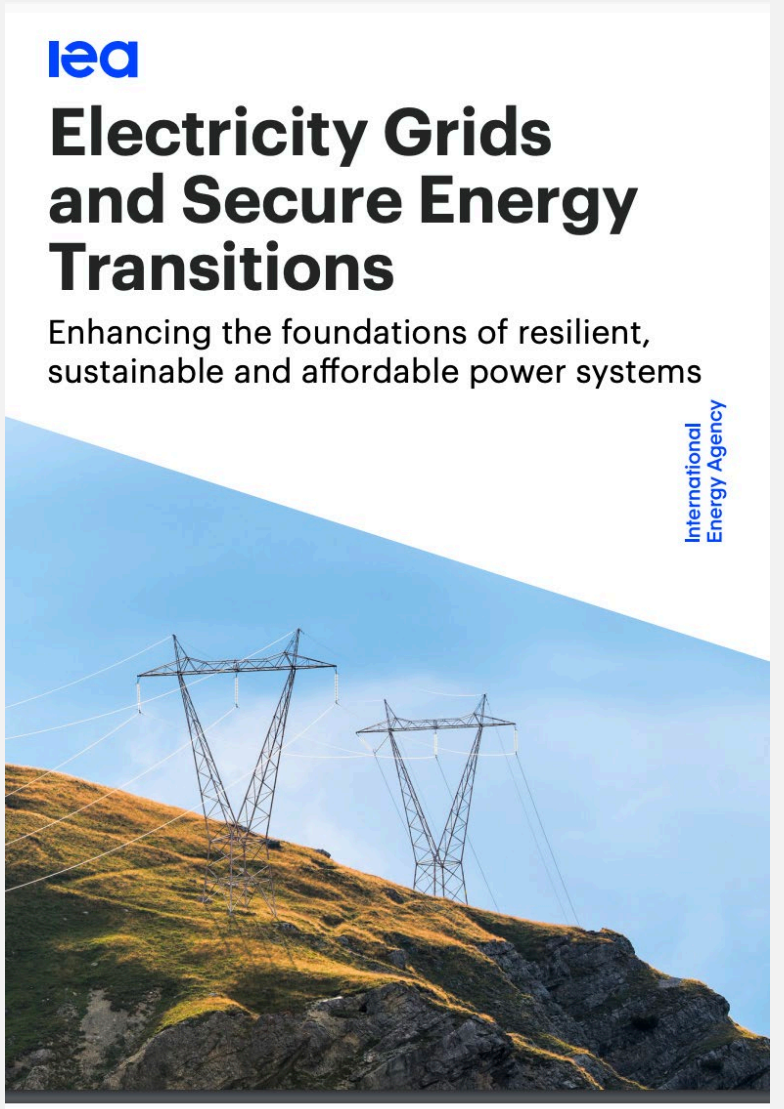
Lack of ambition and attention risks making electricity grids the weak link in clean energy transitions

Phases of grid infrastructure project development and potential causes of delay

	1 Scoping	2 Permitting	3 Construction
Main activities	• Identification of network needs • Feasibility studies • Stakeholder consultation process	• Permission process with public authority • Engineering activities	Physical construction of infrastructure
Potential causes of delay	Public opposition; changing legislation		• Supply chain constraints • Shortage of skilled trade • Difficult access to the site • Technical difficulties
	• Difficulties securing funds • Difficulties obtaining the land • Incompatibility with local conditions (soil, environment)	• Complex procedures and lack of personnel • Successful appeal against the project	

IEA. CC BY 4.0.

Source: IEA analysis, ENTSO-E, European Commission.

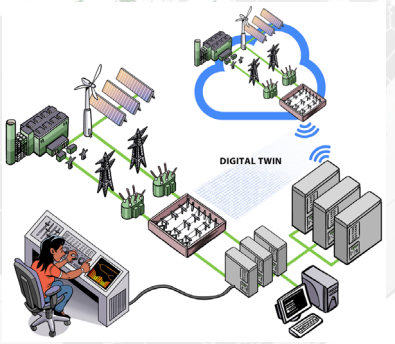


Space for Infrastructure Use Cases

Planning
Right of Way analysis
Enviromental assessments
GIS models
Load projections
Renewable siting

Monitoring – Diagnostics and Asset Management
Sensor data collection
Vegetation management
Distributed intelligence
Environmental monitoring

Monitoring – Security and Resilience
Storm forecasting and impacts
Wildfire detection and impacts
Restoration coordination
Intrusion detection
Cyber security - communications



Digital Twins - Operations
GIS model verification
Communications – remote locations
Real time conditions
Enable AI and diagnostics

Opportunities for Collaboration

Discussion of Use Cases

Ricardo Almeida Henriques
EU Policy Specialist and Project Manager at E-REDES (PT)

DSOs at the center of energy transition...

Challenges

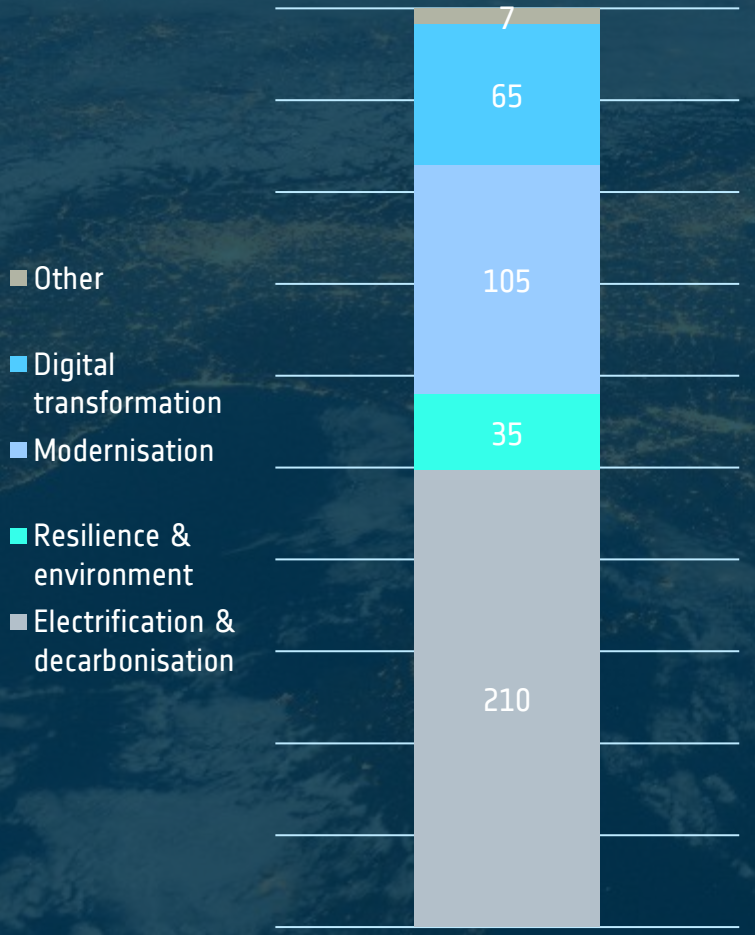
42.5%
RES integration by 2030 [1]

>70%
Of RES will be connected to distribution networks[2]

~1.8%
Electricity demand growth per year until 2030 [2]

50%
Of electricity grid assets will be +40 years by 2030 [2]

Total Investment Needs Estimation Until 2030 (B€)[3]

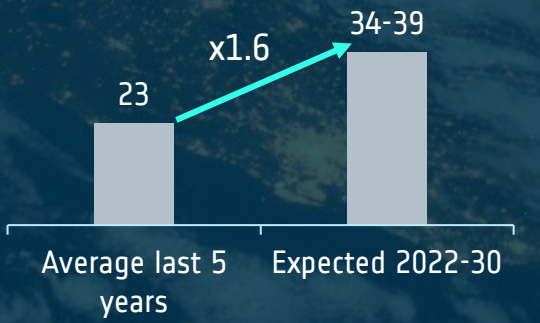


Needs

+40GW
Of flexibility needs by 2030, EU Flexibility potential should be +200 GW[4]

Digitalise
Supervise, Flex., Plan, Operate, Data Exchange[3]

Annual EU-27+UK Distribution Grid Investment[3] (B€)



Sources: 1 – RED; 2 – Monitor Deloitte; 3 – EU Action Plan Digitalise Energy System; 4 – IEA;

Space for Infrastructure – Energy

Members of ESA's Energy Task Force have identified the following 3 focus areas in which space can provide value in providing the next generation of solutions for Energy Infrastructure:

1. **Monitoring of Existing Infrastructure**
- With the threat of climate change and global warming along with other challenges such as the build-up of urban areas, monitoring of infrastructure is becoming ever more prevalent for the DSOs

2. **Provision of a Digital Twin of European Electricity Networks**
- In 2022, ENTSO-E and EU DSO Entity have led to signing a declaration of intent in which it aims to develop jointly a Digital Twin of the EU Electricity Grid

3. **Grid Operation and Planning**

Energy Use Cases - Monitoring of Existing Infrastructure (I)

1. Monitoring of the near-Environment for Overhead Cables
   - The impact of vegetation and other obstacles cause a problem for DSOs, possibly causing disruption to the network. For example, for E-REDES, >80% of the grid is overhead and requires inspection for encroaching vegetation or obstacles.
   - EO can be used to check on the presence of nearby obstacles and corrective actions can be automatically activated such that the risk is removed. The integration of time-series data would be of interest to provide AI-generated predictions (over a period of 1-5 years).
2. Increasing the Observability of the Grid
   - To increase the awareness of grid operators to changes in grid condition, an increase in observability of the grid is needed. This can be achieved through the roll-out of internet of things (IoT) devices so that measurements can be made on a granular level.
   - IoT devices when used in tandem with satellite communications, can be used to solve this technical challenge. In addition, using GNSS signals allows the asset to be geo-located, and also allows for the time verification of data.

Energy Use Cases - Monitoring of Existing Infrastructure (II)

3. Real-time monitoring of Renewable Energy Infrastructure

- To provide accurate measurements for the generation of renewable energy due to the increase in proportion of energy generated from renewable sources, monitoring of energy generation is required to enable DSOs to properly load and manage the grid.

- By integrating sensors and data from renewable energy assets (e.g. energy production, thermal and vibration sensors) information can be provided to both the DSO and asset operator to ensure that the asset is performing optimally. In addition to the real-time monitoring, this data can be used in conjunction with technologies such as AI/ML for the prediction of maintenance, thus saving asset operators time and money in the maintenance of their assets.

- Typically, renewable energy assets are in remote locations where access to terrestrial, cellular networks are limited. Satellite communications can be used to mitigate this problem by using low-latency LEO-based satellite networks. Therefore, real-time diagnostic information can be supplied to a central data center from which asset operators or DSOs can make strategic decisions based on the asset's condition

Energy Use Cases - Digital Twin of the EU Electricity Network

1. Load Management and Prediction

As electrification is ever increasing in Europe, load management and prediction are becoming more prevalent in DSO needs. Specifically, the following features are needed:

- Real-time monitoring of existing assets to predict future load/utilisation.
- Forecasting of the optimisation of power flows.

To achieve this, it is envisaged that through using a network of IoT devices will be needed. As the energy distribution system can be remote in places, communication to the IoT devices may prove difficult. By using satellite communications, low-latency connectivity can be achieved. In addition to using satellite communications, using GNSS signals allows the asset to be geo-located, and also allows for the time verification of data.

2. Digital Twin Partial Model Verification

With the digital twin model being currently developed, the verification of the model in terms of confirming the location and number physical assets will be important.

To solve this challenge, it is expected that Earth Observation will play a role in developing a new solution in which EO imagery will be used to cross-reference the model to the physical assets on the ground.

Energy Use Cases - Grid Operation and Planning

1. Energy Security and Detection of Anomalies

With the creation of accurate digital models of the energy infrastructure, the detection of anomalies within the network using AI/ML should be achievable. By integrating external IoT sensor anomalies within the system should be detected quickly and then actioned to the maintenance team.

For this to be achieved, using satellite communications to communicate with maintenance teams in a secure way is needed along with the ubiquitous connectivity when cellular networks are not available. In addition, GNSS technology can be used to geo-locate an asset but can also be used to provide geo-fencing and applications in the areas of data validation.

Example: Maintenance system in which a fault is discovered in the energy grid through a IoT sensor network. This then actions a drone to fly over the faulty area to survey the grid for any problems (i.e. a overhead cable failure) so that maintenance teams can quickly respond to faulty situations.

2. Response in Emergency Situations

In the case of emergency situations (e.g. natural disasters, security breaches, wildfires, etc...) clear communications and continuous connectivity to the distribution assets must be available to ensure a close-to-continuous distribution service as possible. This use case also applies to supporting the response personnel on the ground handling the situation.

Key Space Assets: Satellite Communications & GNSS

Space for Infrastructure: ENERGY

E.ON invites you to apply with your solution for two grid use-cases

Sebastian Schäfer - Senior Innovation Manager Startup Partnerships - E.ON Innovation
October 2023

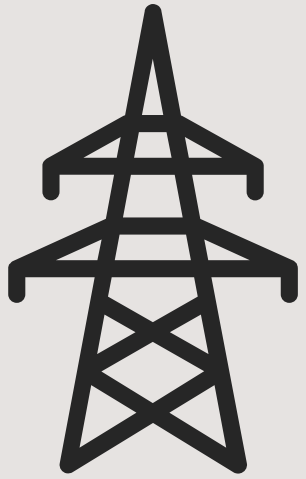
We Connect Everyone To Good Energy

Energy Networks
We operate the largest energy distribution grid in Europe being the backbone of the green energy transition and the most critical infrastructure for society

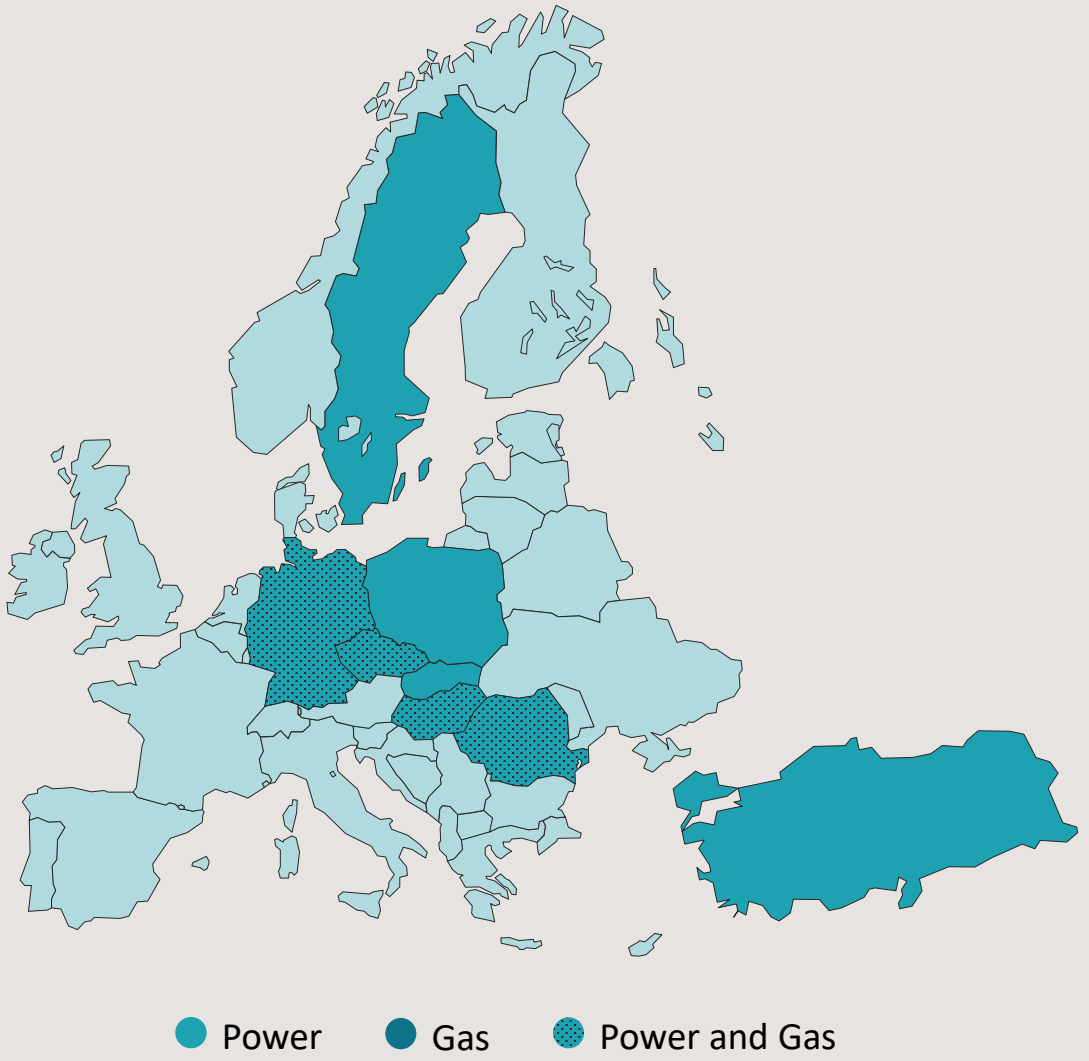
Energy Infrastructure Solutions
Urbanization and sustainability are key drivers to a decentral energy world. We are the change agent to decarbonize cities and industries

Energy Retail
We are helping millions of private households and enterprises on their individual green pathway to a net-zero future

E.ON Energy Networks



E.ON Energy Networks



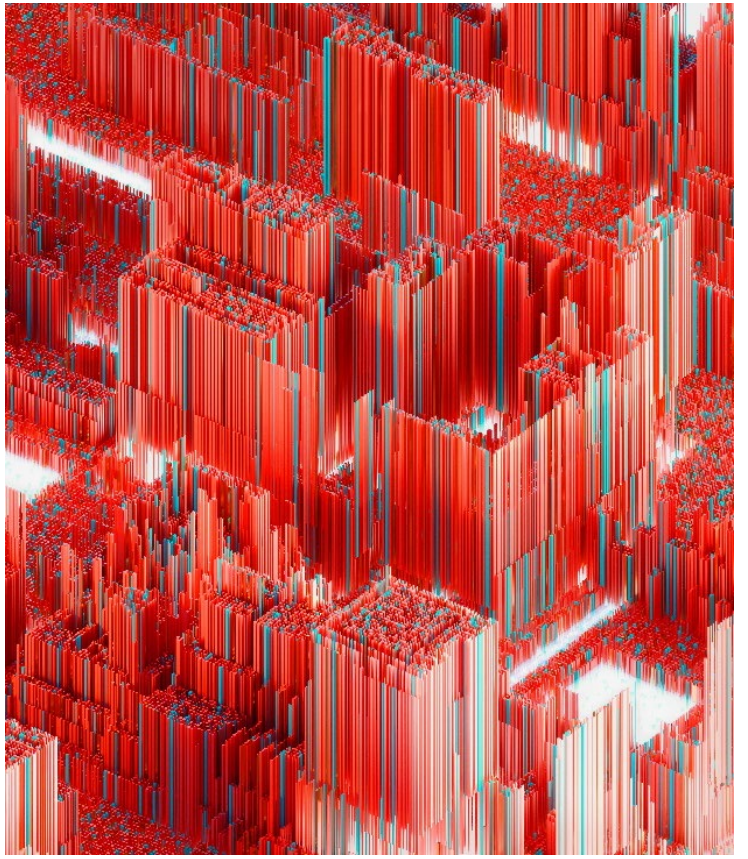
~ 1.6 Mio. km Grid length
for power and gas transport

> 1 Mio. Renewables connected

> 37 Mio. People supplied
in the network area

~ 600 TWh Electricity and Gas
wheeling volume

We already use satellite, drone as well as AI solutions and believe that these technologies are a gamer-changer for grid operations



E.ON invites you to apply with your solution for two grid use-cases

Rising extreme weather events are a challenge for continuous grid operations: How to make grid operations more resilient?

- We are looking for solutions that **automatically detect and display acute damage caused by vegetation**.
- Ideally, **detection should take place within 24 hours of the damage occurring**, but within 48 hours at the most.
- The solution should be **easy to use and mobile for on-site staff**.
- The **accuracy** should be in the **range of 10 – 20 m or visibility of the employees.**

1,6 Mio. km grid lines require constant and up to date monitoring: How to prevent critical third-party interventions?

- We are looking for solutions that **automatically detect construction sites close to grid infrastructure.**
- If risks are detected, **a warning should be issued automatically.**
- The **evaluation should take place in a fixed defined cycle** (e.g., every 14 days).
- A **pilot project has already been carried out,** but with **too many false alarms** (e.g., due to parked cars).
- The **accuracy** should be in the **range of 1 – 5 m.**

Together we can solve real world problems through innovation and collaboration

Apply and test your solution in the energy industry

E.ON Innovation launched 10+ demonstration projects and pilots with international startups this year

Get real industry insights of grid experts and customer feedback

E.ON Innovation operates in close collaboration with 16 E.ON grid business units

We believe in open innovation and collaboration

E.ON Innovation has 4 diverse startup programs running right now

Deliver a successful pilot and explore scaling opportunities

Get access to E.ON Energy Networks in 9 countries

Looking forward to your submissions

Scan to connect on LinkedIn

Sebastian Schäfer
Senior Innovation Manager Startup Partnerships, E.ON Innovation

How to Apply

Energy Infrastructure Opening Dates:

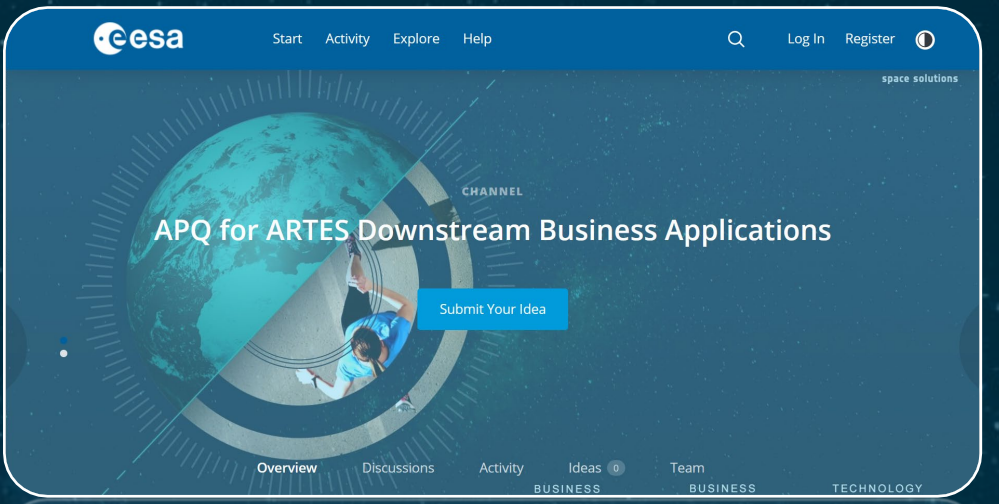
30th October 2023 – 31st December 2023

If you wish for the deadline to be extended, please get in touch!

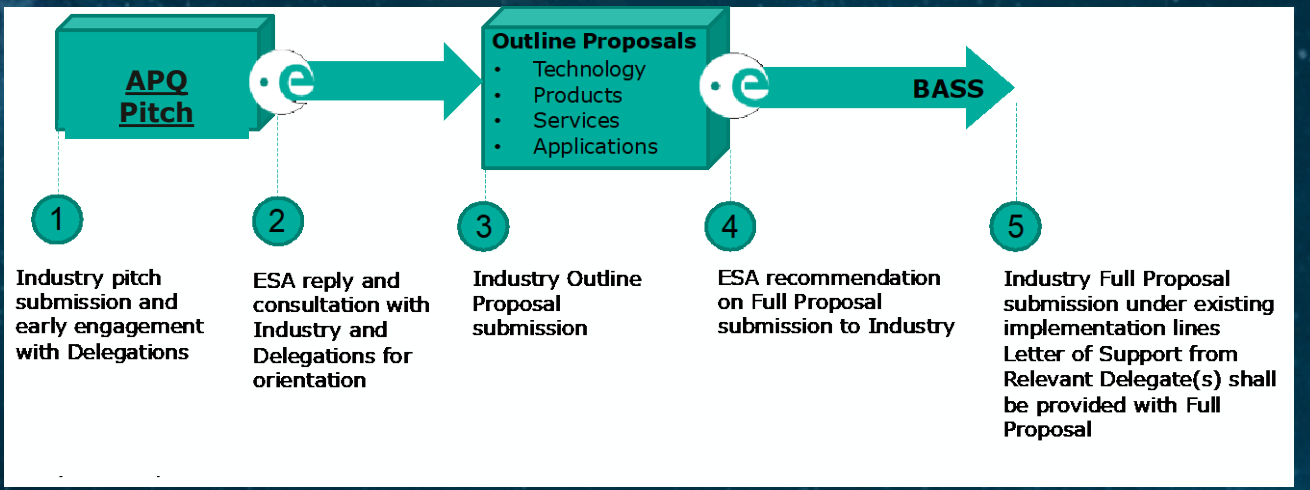
Things you will need to do:

- Submit your APQ pitch via ESA's Open Space innovation platform in the "APQ for ARTES Downstream Business Applications". Making it clear you are applying as part of the "Space for Infrastructure Thematic Call".
- If successful, you will be asked to submit an outline proposal and then (if acceptable) a final proposal (and dependent on national delegation support).

Please do not wait until the end of the opening period to apply! We will be reviewing proposals regularly throughout the opening period.



https://ideas.esa.int/



Funding Details

	Feasibility Study	Demonstration Project
Activity Cost	Max. 500 000€ (limited to acceptable cost)	Case by Case Assessment (limited to acceptable cost)
ESA Co-Funding		
Baseline	Max. 50% of company's cost	Max. 50% of company's cost
Micro, Small and Medium- Enterprises	Max. 80% of enterprise's cost	Max. 80% of enterprise's cost
Universities and Research Institutes with no commercial interest in the product/service	Max. 100% of institute's cost And Max. 30% of activity cost	Max. 80% of institute's cost And Max. 30% of activity cost
Industry Co-funding	Remaining part of the cost to carry out the activity	

- Activities in Direct Negotiation, streamlined process with ESA guidance.
- ESA will bear up to 50% (non-SME) or 80% (SME) of the eligible cost **pending support from the National Delegation**, and the remainder must be financed by the tenderer and/or other partners.
- IPRs (Intellectual Property Rights) will **remain with the company**.

Who can participate?

PARTICIPATING MEMBER STATES

- Austria
- Belgium
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Hungary
- Ireland
- Italy
- Lithuania
- Luxembourg
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Slovenia
- Sweden
- United Kingdom
- Switzerland

Where to find the Details

For more information see: business.esa.int

- Scroll down to the "Featured Opportunities" section to see all activities open or under preparation.
- Look for "Thematic Call for 'Space for Infrastructure': Energy"

https://business.esa.int/funding/call-for-proposals-non-competitive/thematic-call-for-space-for-infrastructure-energy

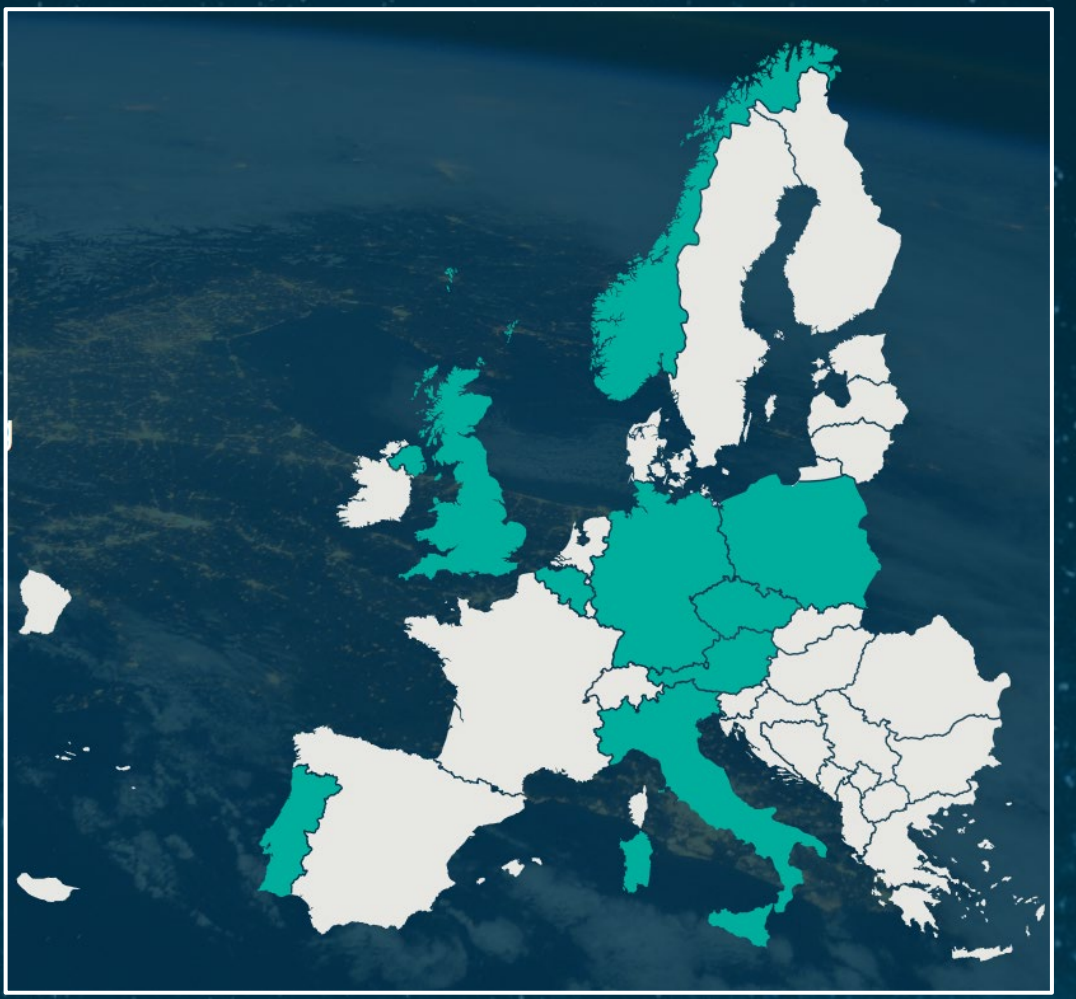
A tool at your disposal – The Ambassador Network

Ambassadors are present in 9 countries

They are your local interface for any questions related to the offering of ESA Space solutions.

They can advise you on:

- Preparation of the Activity Pitch Questionnaire (APQ)
- Give you an overview of ESA Space Solutions funding opportunities.



https://business.esa.int/ambassador-platforms

Q&A

For more information visit:

- https://business.esa.int/
- https://business.esa.int/funding/intended-tender/space-for-infrastructure
- Email: jonathan.crabb@esa.int